

NILS HARTMANN



RE-THINKING BEST PRACTICES –
MODERNE WEB-ANWENDUNGEN MIT

React 

The word "React" is written in a large, bold, dark teal sans-serif font. To its right is a small orange speech bubble containing the word "BED" in white, bold, sans-serif capital letters.

Slides: <http://bit.ly/bedcon-react>

NILS HARTMANN

Programmierer aus Hamburg

Java

JavaScript

Trainings und Workshops

@NILSHARTMANN

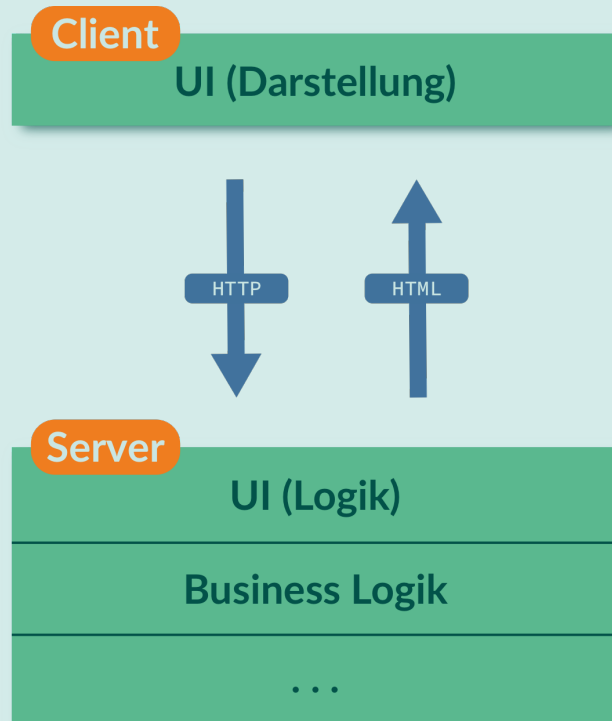
**"A JAVASCRIPT LIBRARY FOR
BUILDING USER INTERFACES"**

React

[HTTPS://FACEBOOK.GITHUB.IO/REACT/](https://facebook.github.io/react/)

SINGLE PAGE APPLICATIONS

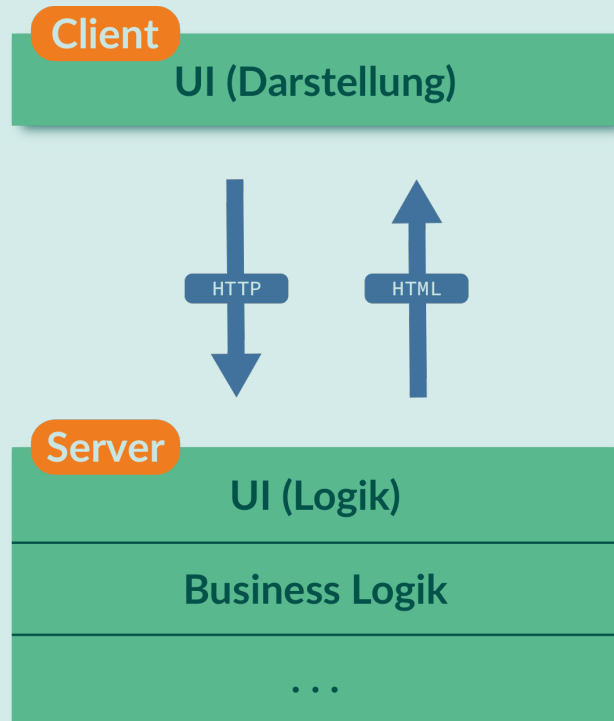
SINGLE PAGE APPLICATIONS



Klassische Webanwendung

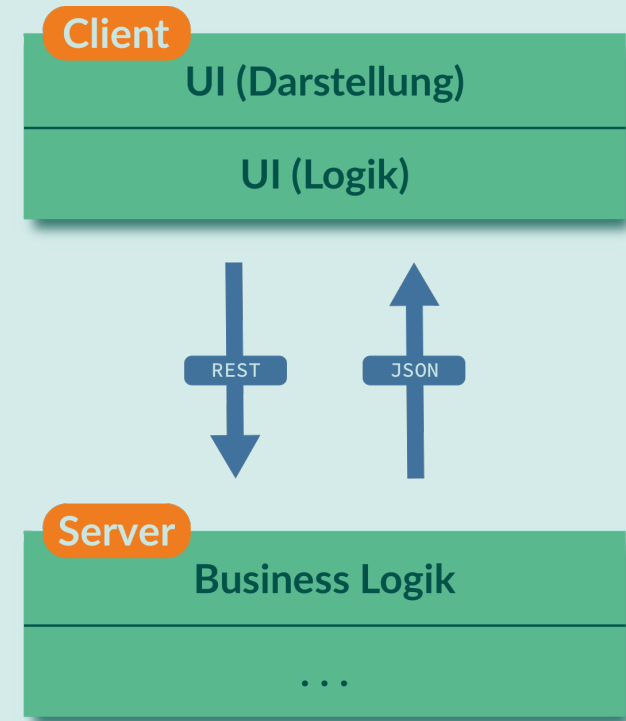
- JSP, Thymeleaf, JSF
- jQuery

SINGLE PAGE APPLICATION



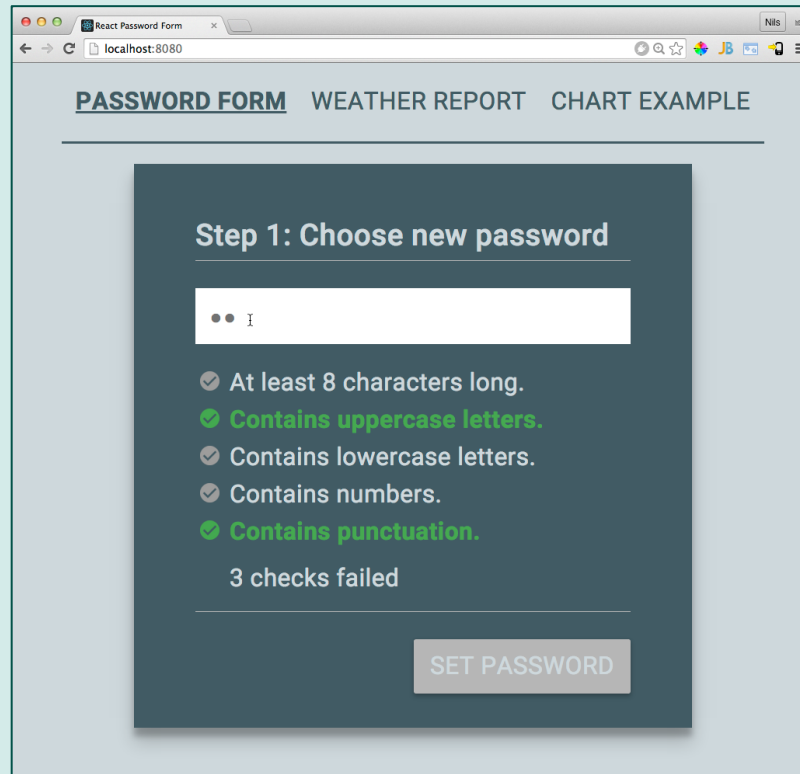
Klassische Webanwendung

- JSP, Thymeleaf, JSF
- jQuery



Single Page Application

- REST API
- React, Angular, Vue



Code: <https://github.com/nilshartmann/react-example-app>

Demo: <https://nilshartmann.github.io/react-example-app/>

BEISPIEL ANWENDUNG

Step 1: Choose new password

☐ At least 8 characters long.

☒ **Contains uppercase letters.**

☐ Contains lowercase letters.

☐ Contains numbers.

☐ Contains punctuation.

4 checks failed

SET PASSWORD

```
<PasswordView>
  <PasswordForm>
    <input />
    <CheckLabelList>
      <CheckLabel />
      <CheckLabel />
    </CheckLabelList>
    <Label />
    <Button />
  </PasswordForm>
</PasswordView>
```


PASSWORD FORM WEATHER REPORT CHART EXAMPLE

Step 1: Choose new password

R I

- ✓ At least 8 characters long.
- ✓ **Contains uppercase letters.**
- ✓ Contains lowercase letters.
- ✓ Contains numbers.
- ✓ Contains punctuation.

4 checks failed

SET PASSWORD

```
<Application>
  <Navigation />
  <ViewController>
    <PasswordView>
      . . .
      . . .
    </PasswordView>
  </ViewController>
</Application>
```

ANWENDUNGEN AUS KOMPONENTEN KOMPONIERT

RETHINKING BEST PRACTICES

Klassische Aufteilung

Logik, Model
(JS)



View
(HTML, Template)



Gestaltung
(CSS)



Grafik Inspiriert von: https://pbs.twimg.com/media/DCXJ_tjXoAAoBbu.jpg

SEPERATION OF CONCERNS

RETHINKING BEST PRACTICES

Klassische Aufteilung

Logik, Model
(JS)



View
(HTML, Template)



Gestaltung
(CSS)



Aufteilung in Komponenten



Button



Eingabefeld



Label

Grafik Inspiriert von: https://pbs.twimg.com/media/DCXJ_tjXoAAoBbu.jpg

SEPERATION OF CONCERNS

React-Komponenten

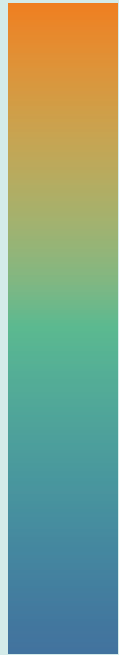
- bestehen aus Logik und UI
- keine Templatesprache
- werden deklarativ beschrieben
- werden immer komplett gerendert
- können auf dem Server gerendert werden („universal webapps“)



Button



Eingabefeld



Label

✓ At least 8 characters long.

✓ At least 8 characters long.

✓ Contains uppercase letters.

REACT!

✓ At least 8 characters long.

✓ Contains uppercase letters.

REACT SCHRITT FÜR SCHRITT

DIE JSX SPRACHERWEITERUNG

Anstatt einer Template Sprache: HTML in JavaScript integrieren

- Erlaubt Schreiben von HTML-artigen Ausdrücken im JavaScript-Code
- Wird zu regulärem JavaScript Code kompiliert (z.B. Babel, TypeScript)
- Optional

JSX

```
const name = 'Lemmy';  
const greeting = <h1>Hello, {name}</h1>;
```

Übersetztes JavaScript

```
var name = 'Lemmy';  
var greeting = React.createElement('h1', null, 'Hello, ', name);
```

EINE REACT KOMPONENTE: ALS FUNKTION

Komponente CheckLabel

✓ At least 8 characters long.

Komponentenfunktion

```
function CheckLabel() {  
  return <div  
    className="CheckLabel-unchecked">  
    At least 8 characters long.  
  </div>;  
}
```

JSX

KOMPONENTE EINBINDEN

✓ At least 8 characters long.

index.html

```
<html>
  <head>. . .</head>
  <body>
    <div id="mount"></div>
  </body>
  <script src="dist/dist.js"></script>
</html>
```


KOMPONENTE EINBINDEN

✓ At least 8 characters long.

app.js

```
import React from 'react';
import ReactDOM from 'react-dom';

import CheckLabel from './CheckLabel';

ReactDOM.render(
  <CheckLabel />,
  document.getElementById('mount')
);
```

KOMPONENTEN: PROPERTIES

✓ At least 8 characters long.

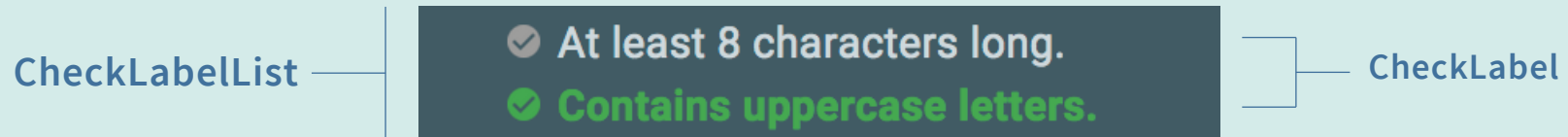
```
{  
  checked: false,  
  label: 'At least 8 characters long.'  
}
```



```
function CheckLabel(props) {  
  return <div  
    className=  
      {props.checked? 'CheckLabel-checked' : 'CheckLabel-unchecked'}>  
    {props.label}  
  </div>;  
}
```

KOMPONENTEN VERWENDEN

- Komponenten sind **zusammensetzbar**



```
function CheckLabelList() {  
  return <div>  
    <CheckLabel checked={false}  
      label='At least 8 characters long' />  
  
    <CheckLabel checked={true}  
      label='Contains uppercase letters.' />  
  </div>;  
}
```

BEISPIEL: KOMPONENTENLISTEN

✓ At least 8 characters long.

✓ Contains uppercase letters.

```
checks: [  
  { checked: false, label: 'At least 8 characters long.' },  
  { checked: true,  label: 'Contains uppercase letters' }  
]
```

```
function CheckLabelList(props) {  
  return <div>
```

```
    // . . .
```

```
  </div>;  
}
```

BEISPIEL: KOMPONENTENLISTEN

✓ At least 8 characters long.

✓ Contains uppercase letters.

```
checks: [  
  { checked: false, label: 'At least 8 characters long.' },  
  { checked: true,  label: 'Contains uppercase letters' }  
]
```

```
function CheckLabelList(props) {  
  return <div>  
    {props.checks.map(c => <CheckLabel  
                          label={c.label}  
                          checked={c.checked}  
                          key={c.label} />)}  
  </div>;  
}
```

KOMPONENTEN KLASSEN

ECMAScript 2015 Klasse

Properties über Konstruktor
(optional)

Lifecycle Methoden
(optional)

Render-Methode (pflicht)

Properties über **props** Objekt

```
class CheckLabelList extends React.Component {  
  constructor(props) {  
    super(props);  
  }  
  
  componentDidMount() { . . . }  
  componentWillReceiveProps() { . . . }  
  shouldComponentUpdate() { . . . }  
  
  render() {  
    return <div>  
      {this.props.checks.map(c => <CheckLabel . . . />)}  
    </div>;  
  }  
}
```

ZUSTAND VON KOMPONENTEN

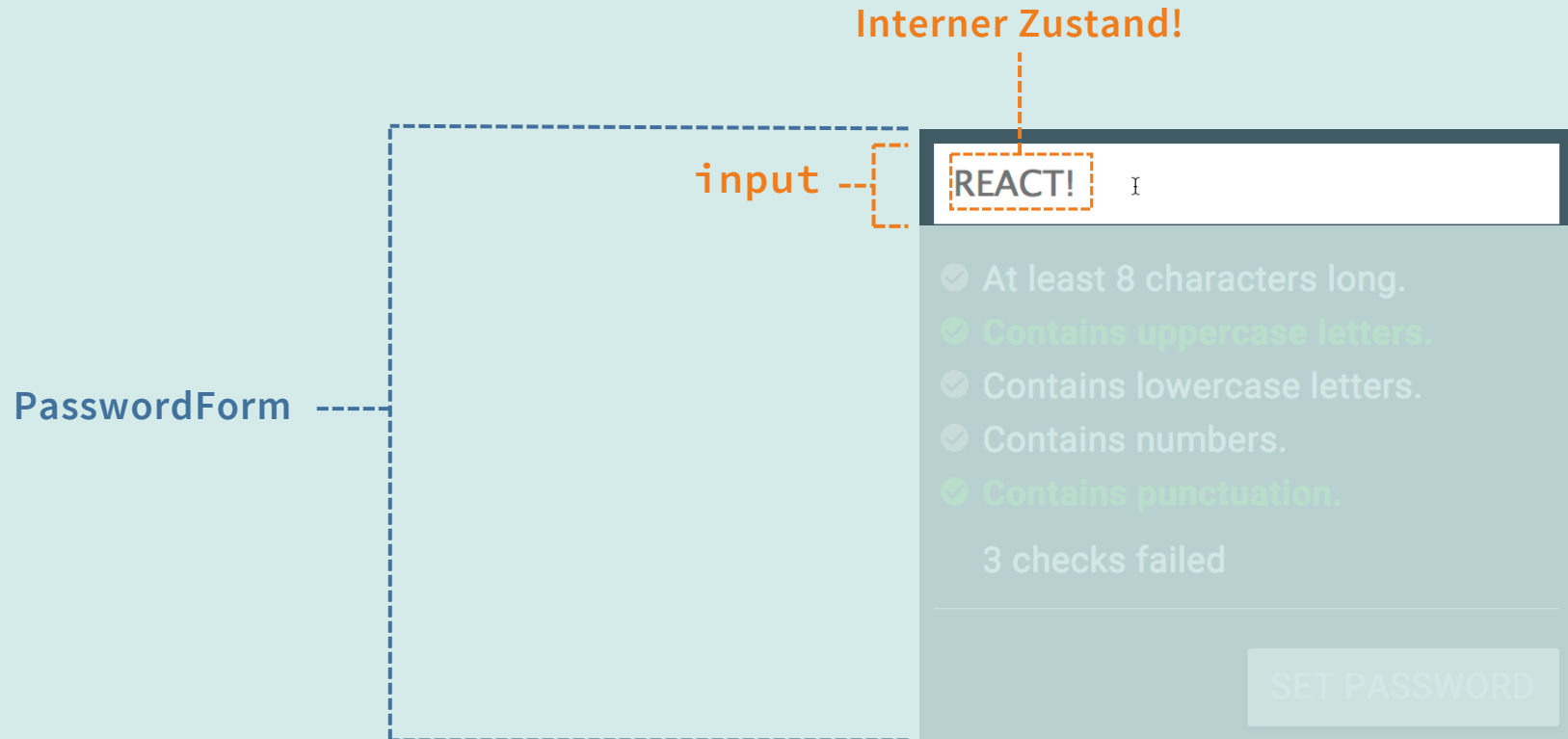
Zustand („state“): Komponenten-intern

- Beispiel: Inhalt von Eingabefeld, Antwort vom Server
- Objekt mit Key-Value-Paaren
- Zugriff über `this.state` / `this.setState()`
- Nur in Komponenten-Klassen verfügbar
- **`this.setState()` triggert erneutes Rendern**
 - auch alle Unterkomponenten
 - Kein 2-Wege-Databinding

Zum Vergleich: Properties

- Von außen übergeben
- Unveränderlich
- Zugriff über `this.props` (Key-Value-Paare)

BEISPIEL: EINGABEFELD



BEISPIEL: EINGABEFELD



```
class PasswordForm extends React.Component {  
  render() {  
    return <div>  
      <input  
        value={this.state.password}  
      />  
      . . .  
    </div>;  
  }  
}
```

1. Input mit Wert aus State befüllen

BEISPIEL: EINGABEFELD



```
class PasswordForm extends React.Component {  
  render() {  
    return <div>  
      <input  
        value={this.state.password}  
        onChange={e=>this.onPasswordChange(e.target.value)}  
      />  
      . . .  
    </div>;  
  }  
  
  onPasswordChange(newPassword) {  
  
  }  
}
```

1. Input mit Wert aus State befüllen

2a. Event Handler registrieren

2b. Event Handler

BEISPIEL: EINGABEFELD



```
class PasswordForm extends React.Component {  
  render() {  
    return <div>  
      <input  
        value={this.state.password}  
        onChange={e=>this.onPasswordChange(e.target.value)}  
      />  
      . . .  
    </div>;  
  }  
  
  onPasswordChange(newPassword) {  
    this.setState({password: newPassword});  
  }  
}
```

1. Input mit Wert aus State befüllen

2a. Event Handler registrieren

2b. Event Handler

3. Zustand neu setzen

ZUSTAND: EINGABEFELD



```
class PasswordForm extends React.Component {  
  render() {  
    return <div>  
      <input  
        value={this.state.password}  
        onChange={e=>this.onPasswordChange(e.target.value)}  
      />  
      . . .  
    </div>;  
  }  
  
  onPasswordChange(newPassword) {  
    this.setState({password: newPassword});  
  }  
}
```

1. Input mit Wert aus State befüllen

2a. Event Handler registrieren

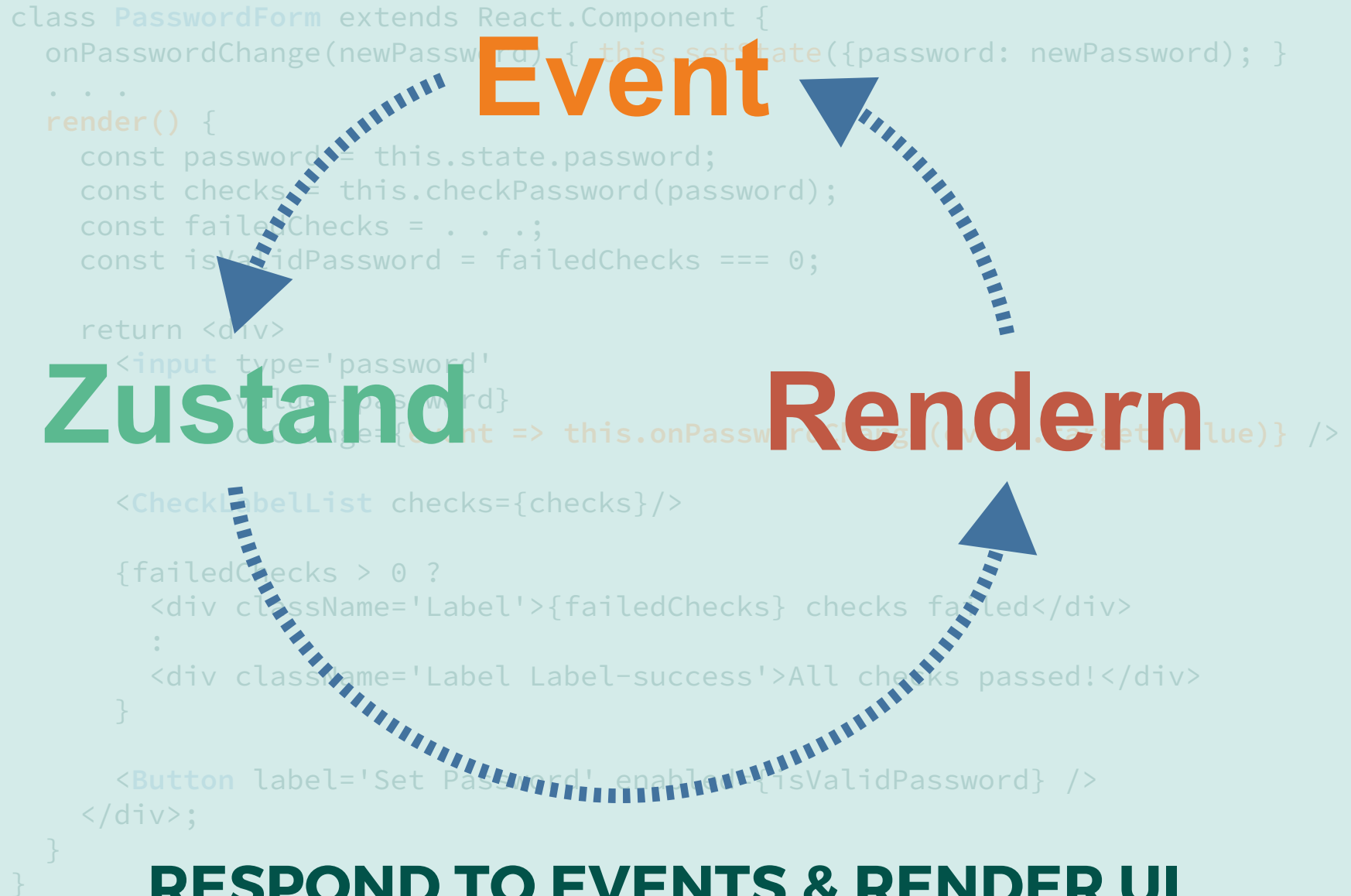
2b. Event Handler

3. Zustand neu setzen

Event

Neu rendern

REACT: UNI DIRECTIONAL DATAFLOW



KONSISTENTE UI

Beispiel: Password Formular

The diagram illustrates a password form with a text input field containing "REACT!". Below the input field is a list of validation rules, each preceded by a checkmark icon. The first rule, "At least 8 characters long.", is preceded by a grey checkmark. The second rule, "Contains uppercase letters.", is preceded by a green checkmark. The third rule, "Contains lowercase letters.", is preceded by a grey checkmark. The fourth rule, "Contains numbers.", is preceded by a grey checkmark. The fifth rule, "Contains punctuation.", is preceded by a green checkmark. Below the list of rules is the text "3 checks failed". At the bottom right of the form is a button labeled "SET PASSWORD". To the right of the form is a vertical line with seven horizontal arrows pointing left towards the form. The top arrow is labeled "beeinflusst".

REACT! |

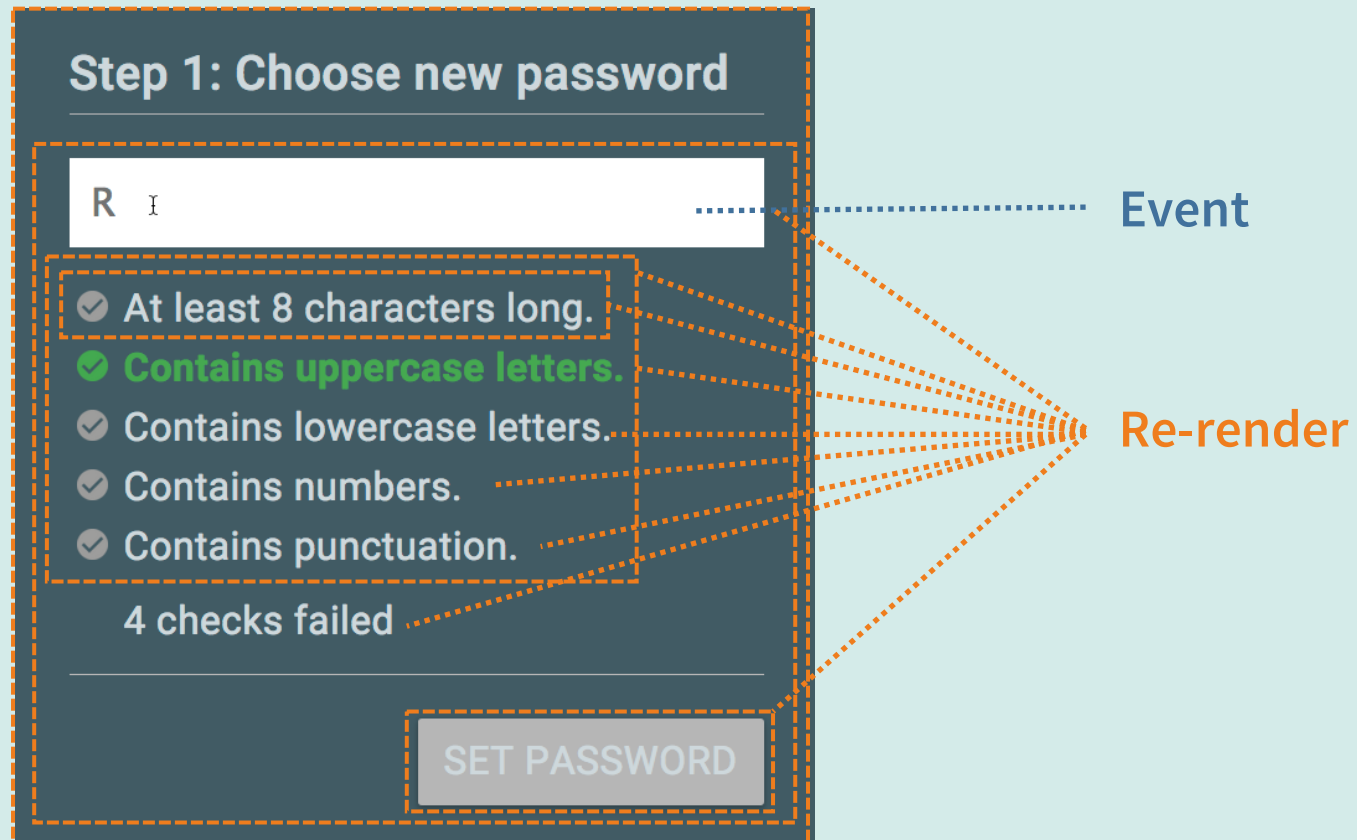
- ✓ At least 8 characters long.
- ✓ Contains uppercase letters.
- ✓ Contains lowercase letters.
- ✓ Contains numbers.
- ✓ Contains punctuation.

3 checks failed

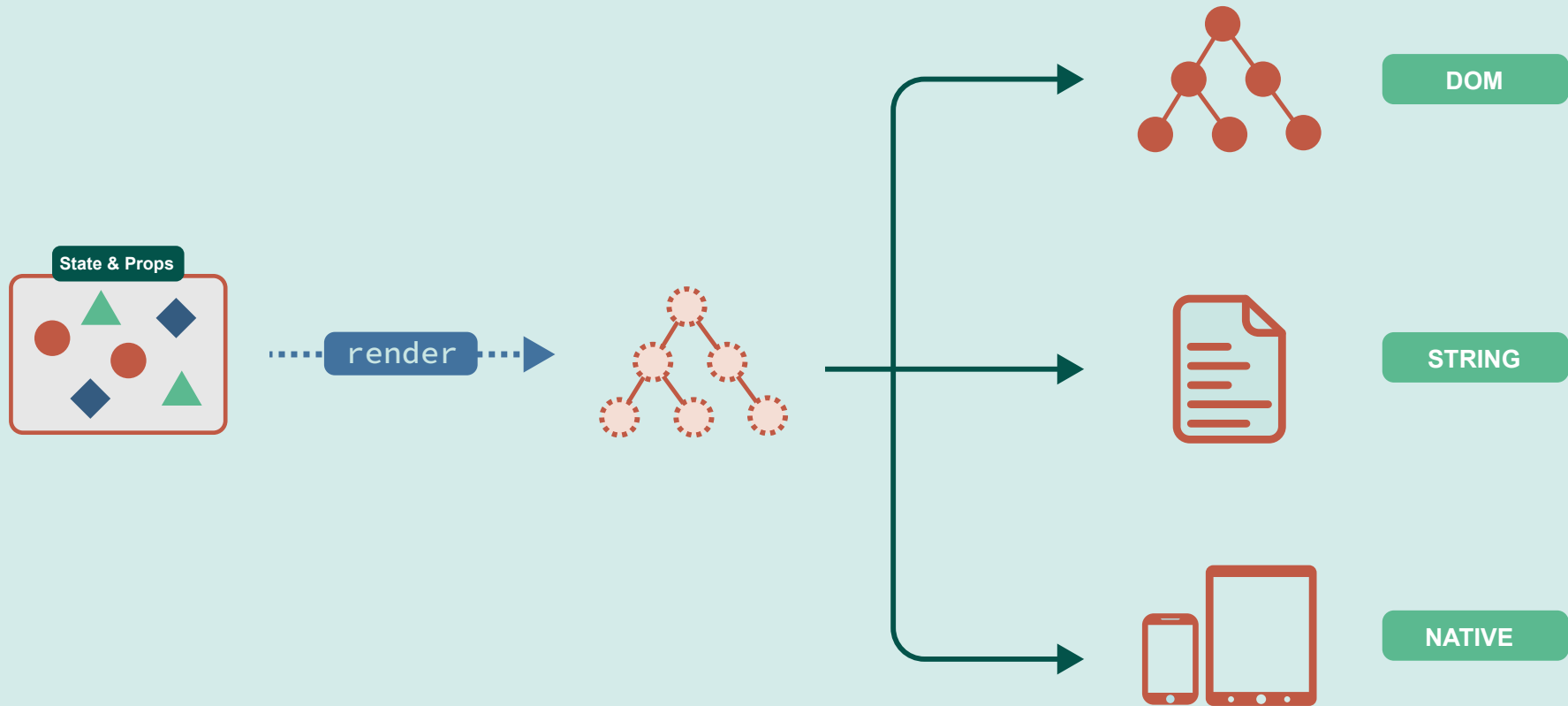
SET PASSWORD

beeinflusst

GANZ EINFACH: ALLES RENDERN

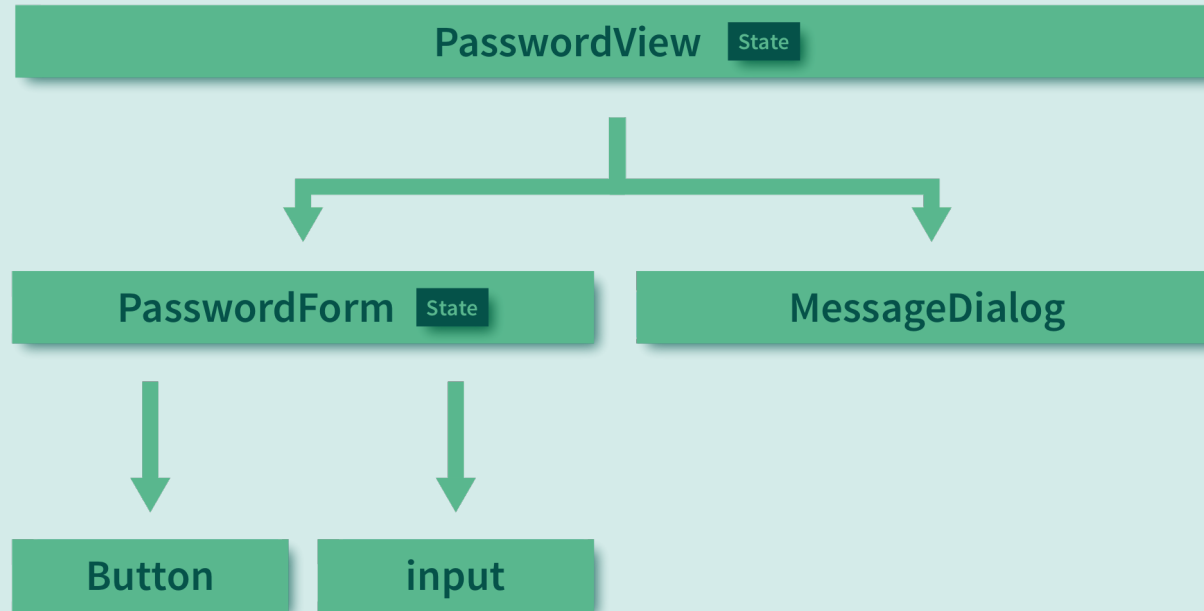


HINTERGRUND: VIRTUAL DOM



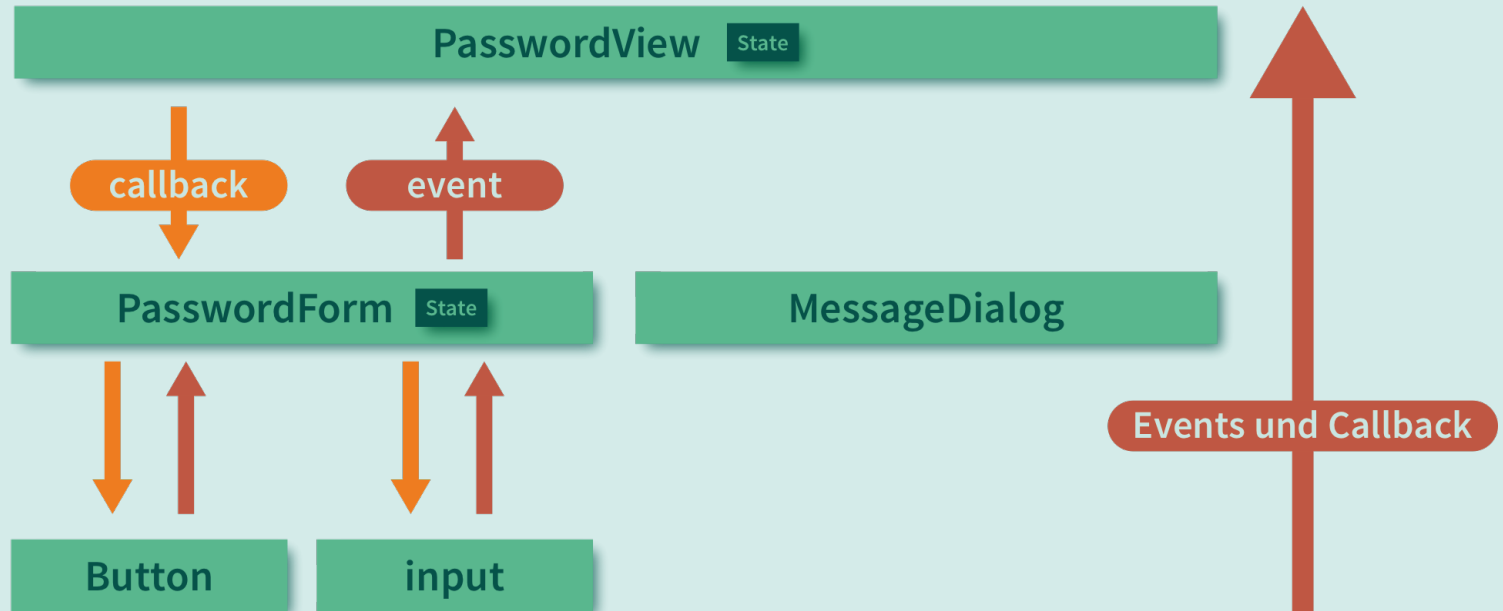
RENDERN IN VERSCHIEDENE FORMATE

KOMPONENTENHIERARCHIEN



Typische React Anwendungen: Hierarchisch aufgebaut

KOMMUNIKATION



Kommunikation zwischen Komponenten: Events und Callbacks

"JavaScript that scales"

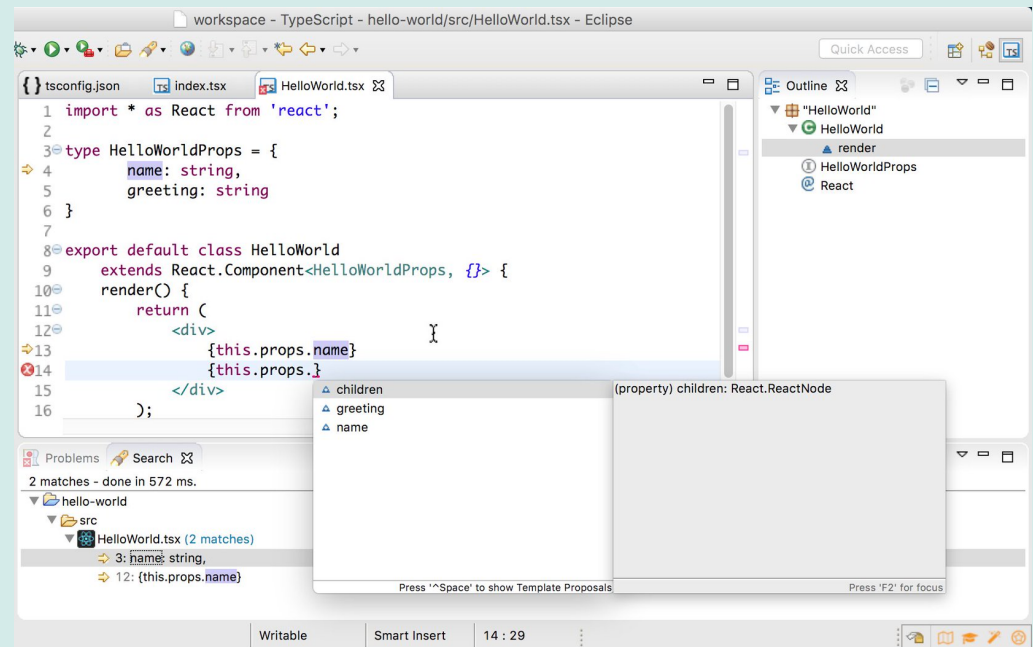
TypeScript

[HTTP://WWW.TYPESCRIPTLANG.ORG/](http://www.typescriptlang.org/)

HINTERGRUND: TYPESCRIPT

TypeScript: Obermenge von JavaScript mit Typ-System

- Gültiger JavaScript-Code auch gültiger TypeScript-Code
- Compiler übersetzt TypeScript in JavaScript-Code
 - Unterstützt auch JSX
- Sehr guter IDE Support
 - z.B. IDEA, Eclipse, VS Code



TYPESCRIPT - SYNTAX

Typen verwenden

Variablen

```
let foo: string; // eingebaute Typen z.B: string, number, boolean
foo = "yo";
foo = 10; // Fehler: Type 'number' is not assignable to type 'string'
```

TYPESCRIPT - SYNTAX

Typen verwenden

Variablen

```
let foo: string; // eingebaute Typen z.B: string, number, boolean
```

Funktionen

```
function sayIt(what: string) {  
    return `Saying: ${what}`;  
}  
sayIt('Klaus'); // OK  
sayIt(10); // Fehler (10 is not a string)
```

TYPESCRIPT - SYNTAX

Typen verwenden

Variablen

```
let foo: string; // eingebaute Typen z.B: string, number, boolean
```

Funktionen

```
function sayIt(what: string) {  
    return `Saying: ${what}`;  
}
```

Angabe von Typen ist optional, Typen werden dann abgeleitet:

```
let result = 7; abgeleiteter Typ: number  
result = sayIt('Lars') // Fehler (abgeleiteter Typ von sayIt: string)
```

Eigene Typen definieren

```
type Person = {                                // Alternativ: interface
  firstName: string,
  lastName: string|null,                       // nullable Typ ("ein String oder null")
  age?: number                                 // optionaler Typ
}
```


TYPESCRIPT - SYNTAX

Eigene Typen definieren und verwenden

```
type Person = {                                // Alternativ: interface
  firstName: string,
  lastName: string|null,                       // nullable Typ ("ein String oder null")
  age?: number                                 // optionaler Typ
}

function sayHello(p: Person) {
  console.log(`Hello, ${p.lastName}`);
  p.lastName.toUpperCase(); // Fehler: Object is possibly null
}

sayHello({firstName: 'Klaus', lastName: null}); // OK
sayHello({firstName: 'Klaus', lastName: 777}); // Fehler: lastName kein String
sayHello({firstName: 'Klaus', lastName: 'Mueller', age: 32}); // OK
```

TYPESCRIPT - SYNTAX

Generics

```
type Person = { name: string };  
type Movie = { title: string };
```

```
let persons:Array<Person> = [];  
let movies:Array<Movie> = [];
```

```
persons.push({name: 'Klaus'});      // OK  
movies.push({title: 'Batman'});    // OK  
persons.push({title: 'Casablanca'}) // error ('title' not in Person)
```

TYPESCRIPT - SYNTAX

Generics

```
type Person = { name: string };
```

```
type Movie = { title: string };
```

```
let persons:Array<Person> = [];
```

```
let movies:Array<Movie> = [];
```

```
persons.push({name: 'Klaus'});      // OK
```

```
movies.push({title: 'Batman'});    // OK
```

```
persons.push({title: 'Casablanca'}) // error ('title' not in Person)
```

TypeScript

für React-Anwendungen

TYPESCRIPT UND REACT: PROPERTIES

Properties als Typen in TypeScript

✓ At least 8 characters long.

```
function CheckLabel(props: CheckLabelProps) {  
  . . .  
}
```

Typ definieren

```
type CheckLabelProps = {  
  label: string,  
  checked?: boolean  
};
```

Überprüfung zur
Compile-Zeit
(auch direkt in der IDE)

```
[ts]  
Type '{ checked: false; }' is not assignable to type 'IntrinsicAttributes & CheckLabelProps'.  
  Type '{ checked: false; }' is not assignable to type 'CheckLabelProps'.  
    Property 'label' is missing in type '{ checked: false; }'.
```

```
(JSX attribute) checked: boolean
```

```
<CheckLabel checked={false} />;
```

Komponenten-Klassen als Generics

- Typ für Properties und State

1. Typen definieren

```
type PasswordFormProps = {  
  restrictions: Restriction[];  
  onPasswordSet: (password: string) => void;  
};  
  
type PasswordFormState = {  
  password: string;  
};
```

Komponenten-Klassen als Generics

- Typ für Properties und State

1. Typen definieren

```
type PasswordFormProps = {  
  restrictions: Restriction[];  
  onPasswordSet: (password: string) => void;  
};
```

```
type PasswordFormState = {  
  password: string;  
};
```

2. Typen als Parameter angeben

```
class PasswordForm extends  
  Component<PasswordFormProps, PasswordFormState> {  
  . . .  
}
```

TYPESCRIPT UND REACT: PROPERTIES & STATE

Typische Fehler, die durch TypeScript aufgedeckt werden

Potentielle Fehler

```
// Properties sind read-only
this.props.restrictions = null;

// Nur bekannte Properties dürfen verwendet werden
const x = this.props.not_here;

// State muss vollständig initialisiert werden
this.state = {}; // password fehlt

// this.state darf nur im Konstruktor verwendet werden
this.state.password = null; // außerhalb des Cstr

// Elemente im State müssen korrekten Typ haben
this.setState({password: 7}); // 7 is not a string

// Unbekannte Elemente dürfen nicht in den State
gesetzt werden
this.setState({notHere: 'invalid'});
```


Vielen Dank!

<http://bit.ly/bedcon-react>

Fragen?

[HTTPS://NILSHARTMANN.NET](https://nilshartmann.net) | @NILSHARTMANN