

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**

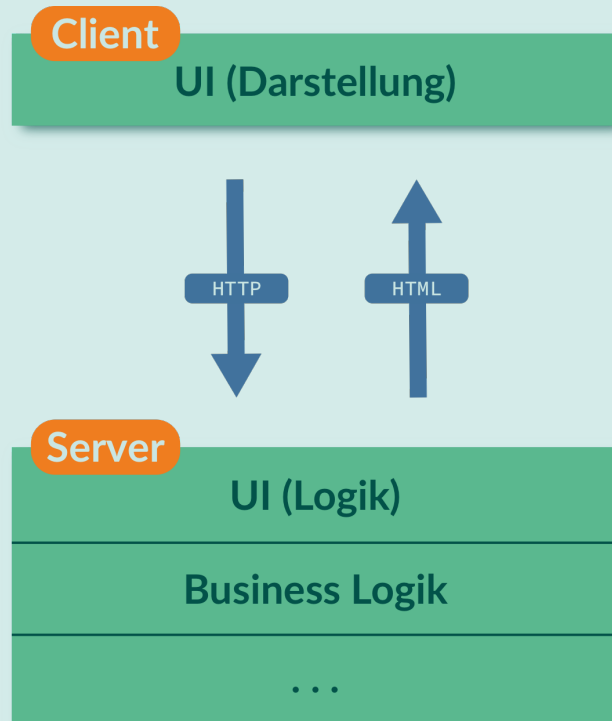
"A JAVASCRIPT LIBRARY FOR  
BUILDING USER INTERFACES"

# React

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

# SINGLE PAGE APPLICATIONS

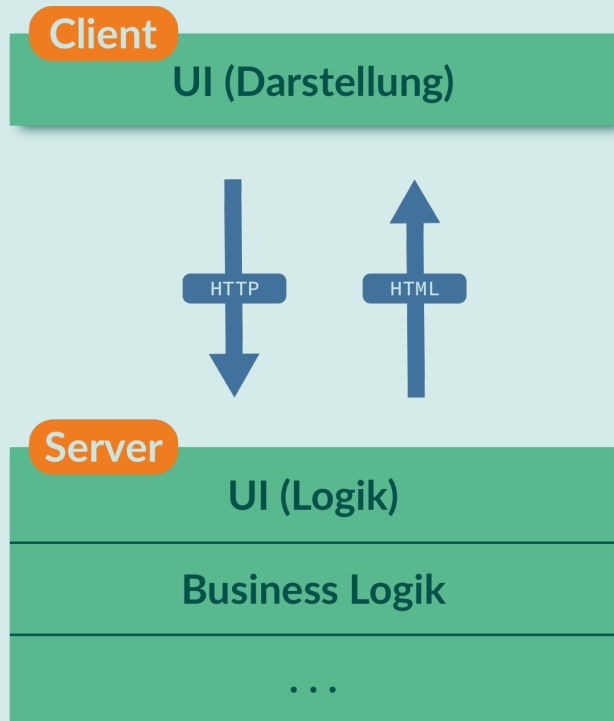
# SINGLE PAGE APPLICATIONS



## Klassische Webanwendung

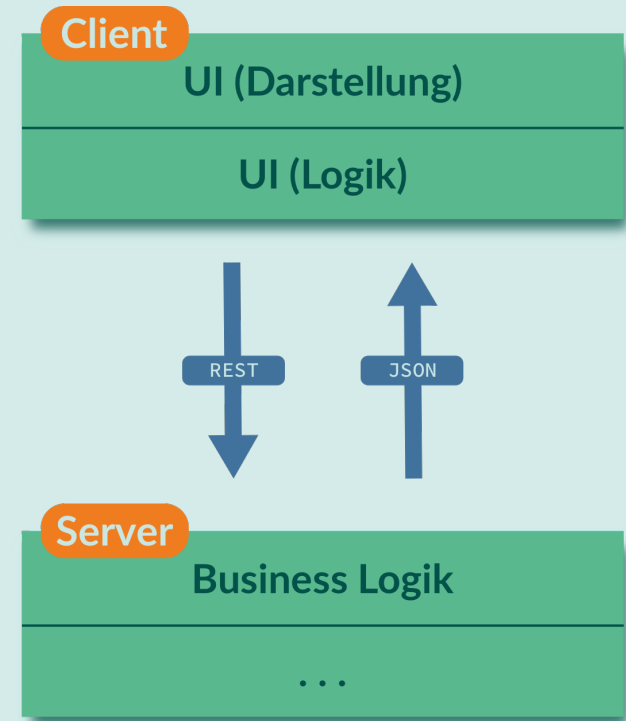
- JSP, Thymeleaf, JSF
- jQuery

# SINGLE PAGE APPLICATION



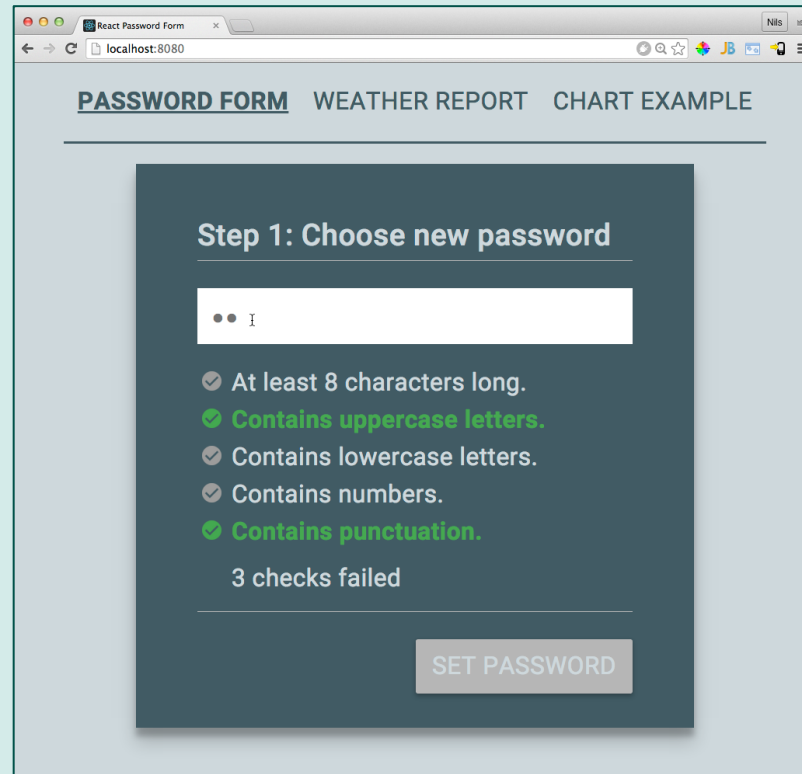
## Klassische Webanwendung

- 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](https://pbs.twimg.com/media/DCXJ_tjXoAAoBbu.jpg)

## SEPARATION 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](https://pbs.twimg.com/media/DCXJ_tjXoAAoBbu.jpg)

## SEPARATION OF CONCERNS

# React-Komponenten

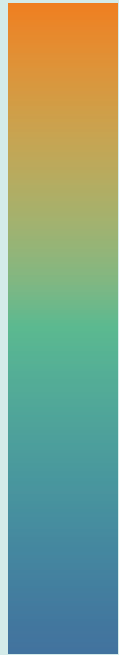
- bestehen aus Logik und UI
  - keine Templatesprache
  - werden deklarativ beschrieben
  - werden immer komplett gerendert
- 
- können auf dem Server gerendert werden („universal webapps“)



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

# 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.

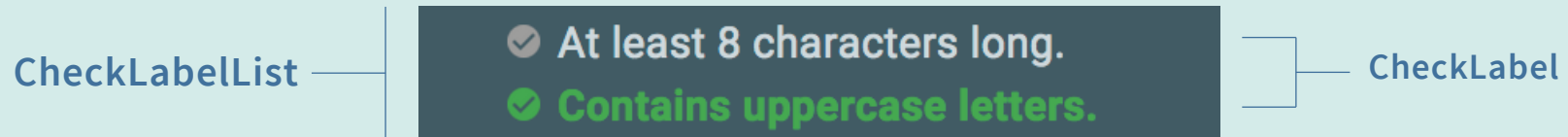
```
{  
  checked: false,  
  label: 'At least 8 characters long.'  
}
```



```
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

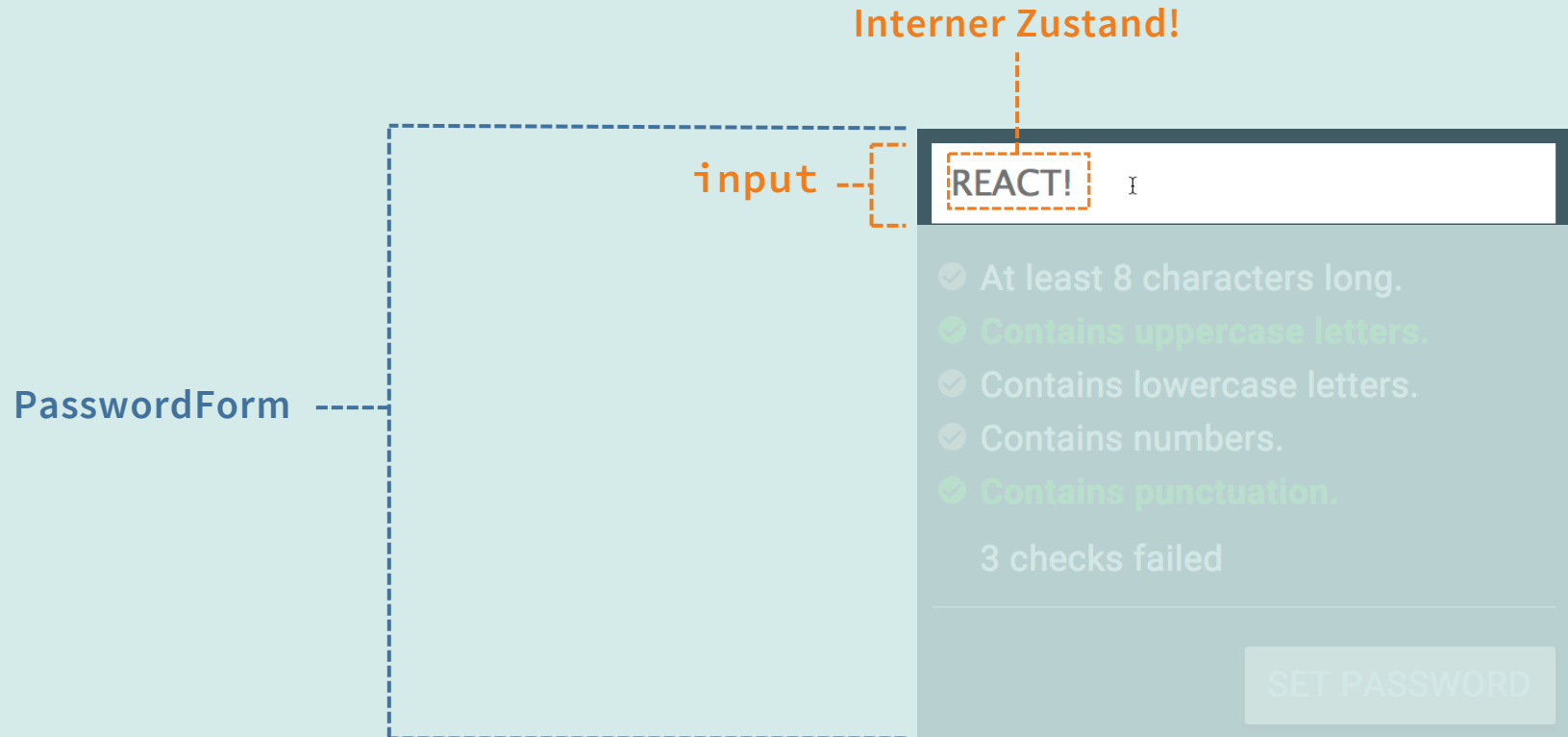
## Zustand („state“): Komponenten-intern

- 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>;  
  }  
}
```

1. Input mit Wert aus State befüllen

2a. Event Handler registrieren

2b. Event Handler

```
onPasswordChange(newPassword) {  
  
}  
}
```

# 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

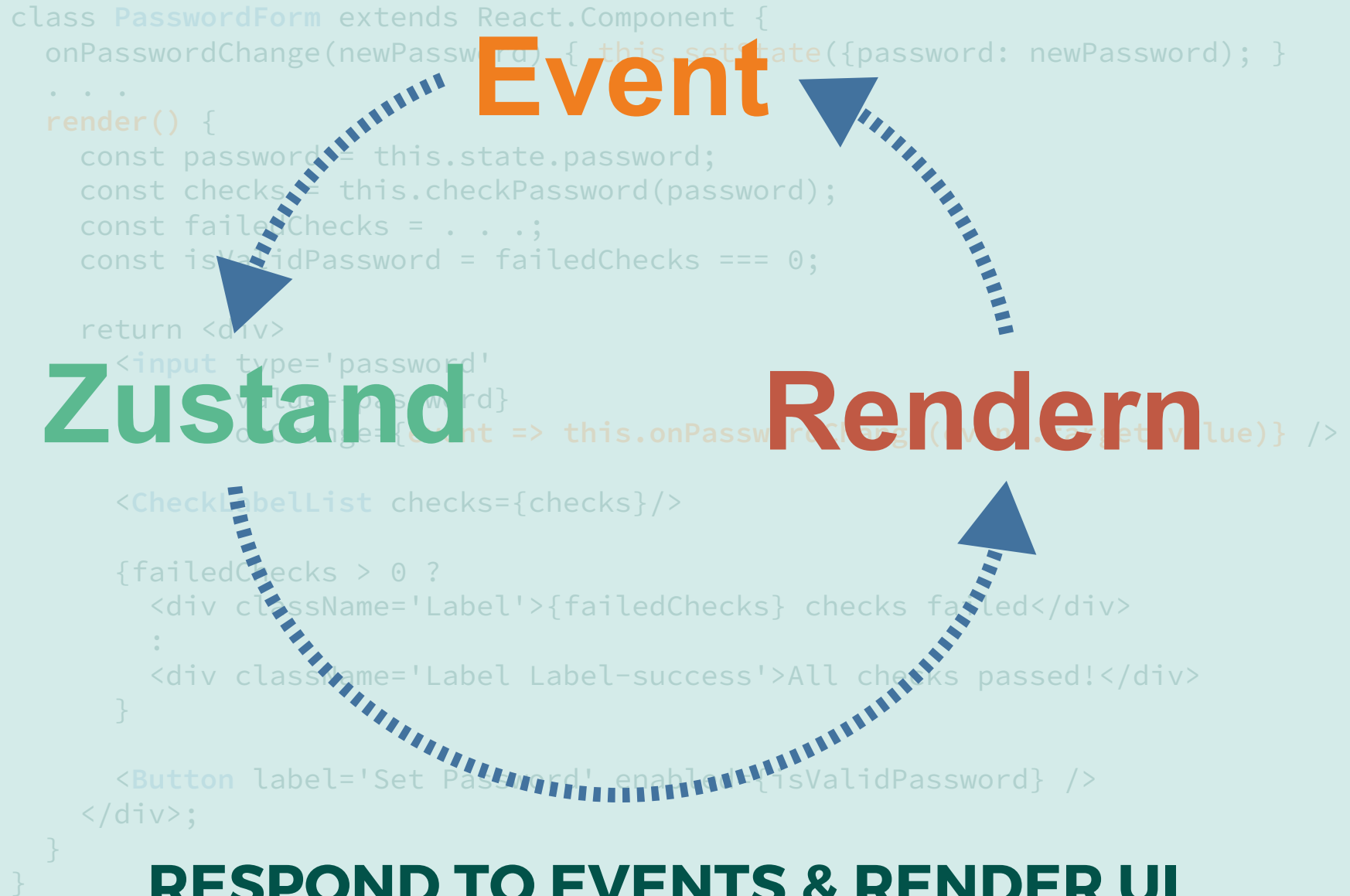
2b. Event Handler

3. Zustand neu setzen

Neu rendern

Event

# 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 five validation rules, each preceded by a checkmark icon. The first rule, "At least 8 characters long.", has a grey checkmark. The second rule, "Contains uppercase letters.", has a green checkmark. The third rule, "Contains lowercase letters.", has a grey checkmark. The fourth rule, "Contains numbers.", has a grey checkmark. The fifth rule, "Contains punctuation.", has 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, a vertical line labeled "beeinflusst" (influences) has seven horizontal arrows pointing left towards the form. The arrows point to the input field, the first rule, the second rule, the third rule, the fourth rule, the fifth rule, and the "SET PASSWORD" button.

REACT! |

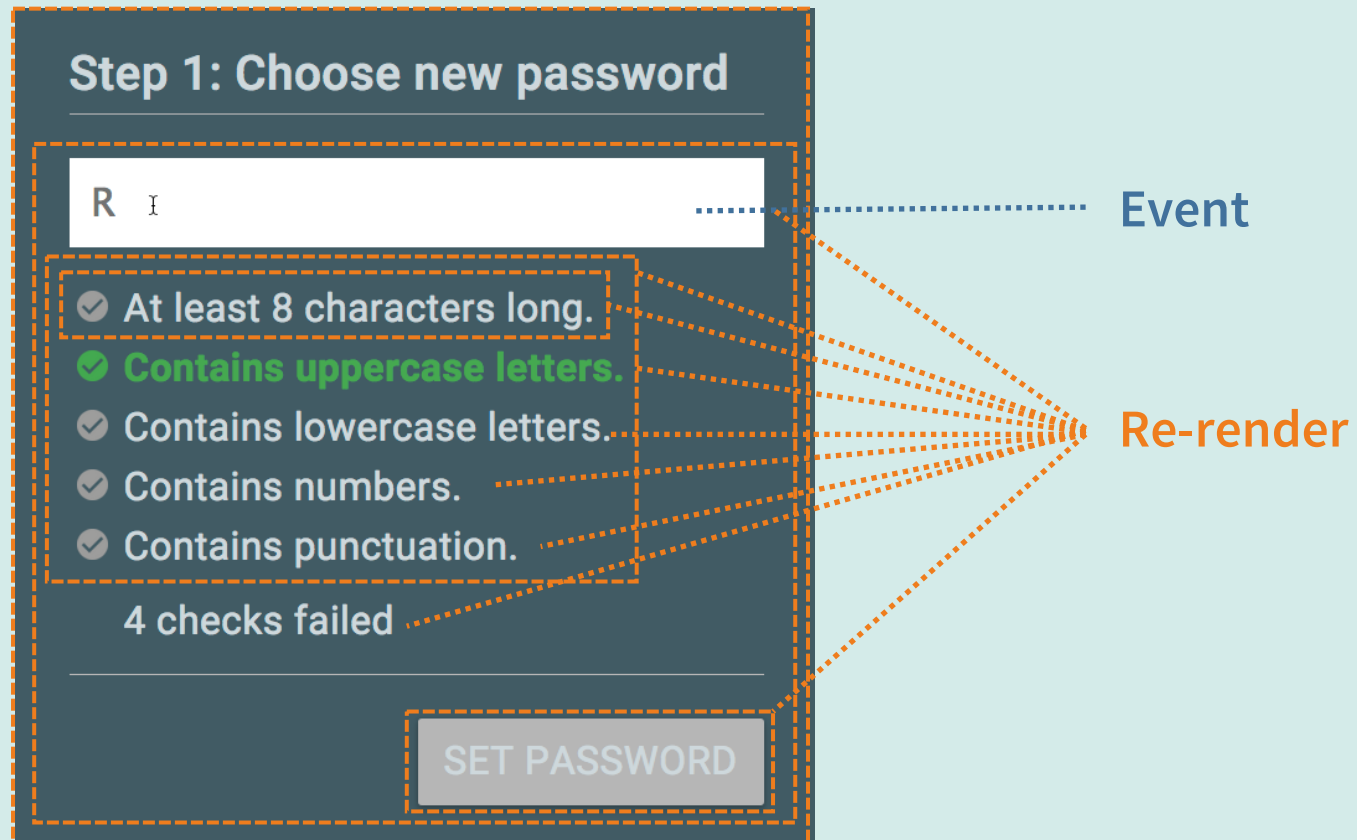
- ✓ At least 8 characters long.
- ✓ Contains uppercase letters.
- ✓ Contains lowercase letters.
- ✓ Contains numbers.
- ✓ Contains punctuation.

3 checks failed

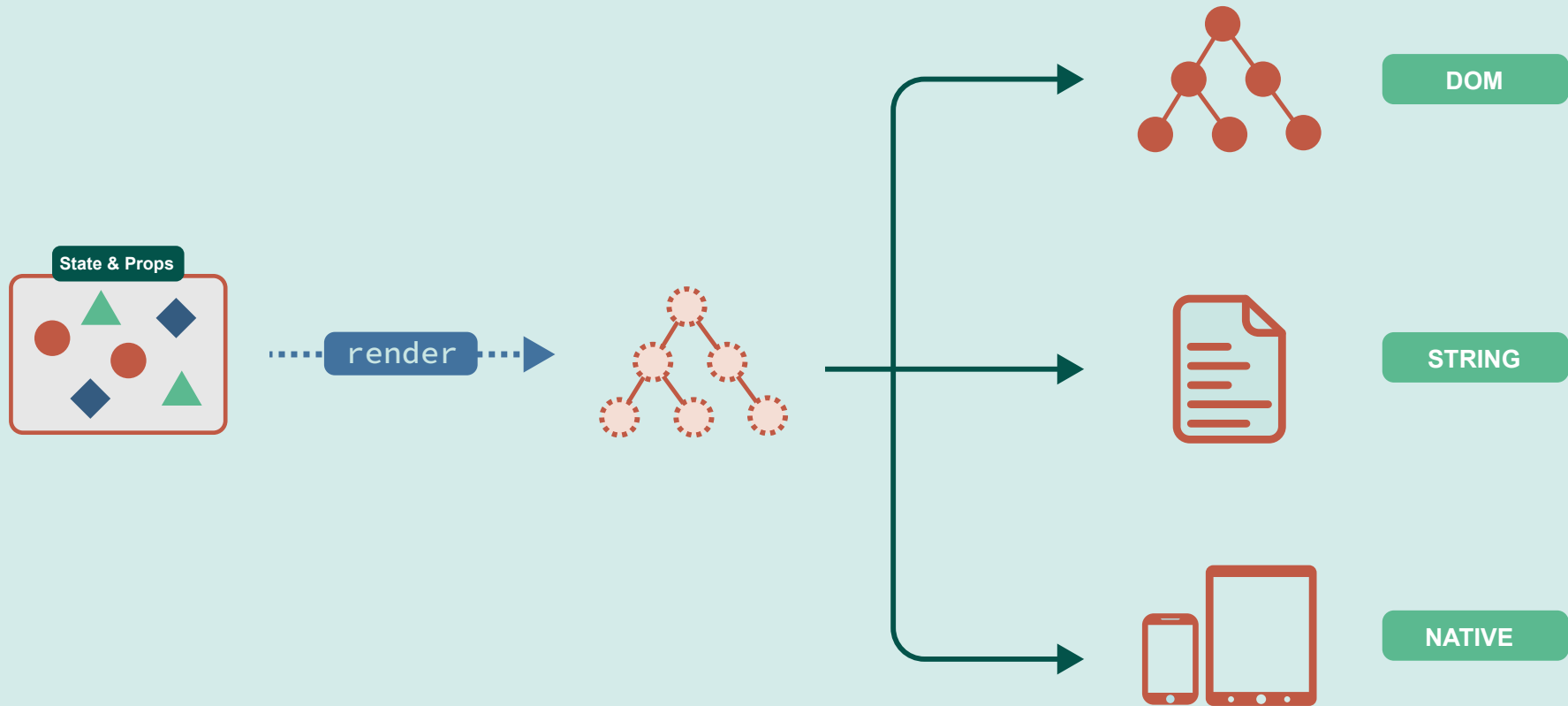
SET PASSWORD

beeinflusst

# GANZ EINFACH: ALLES RENDERN



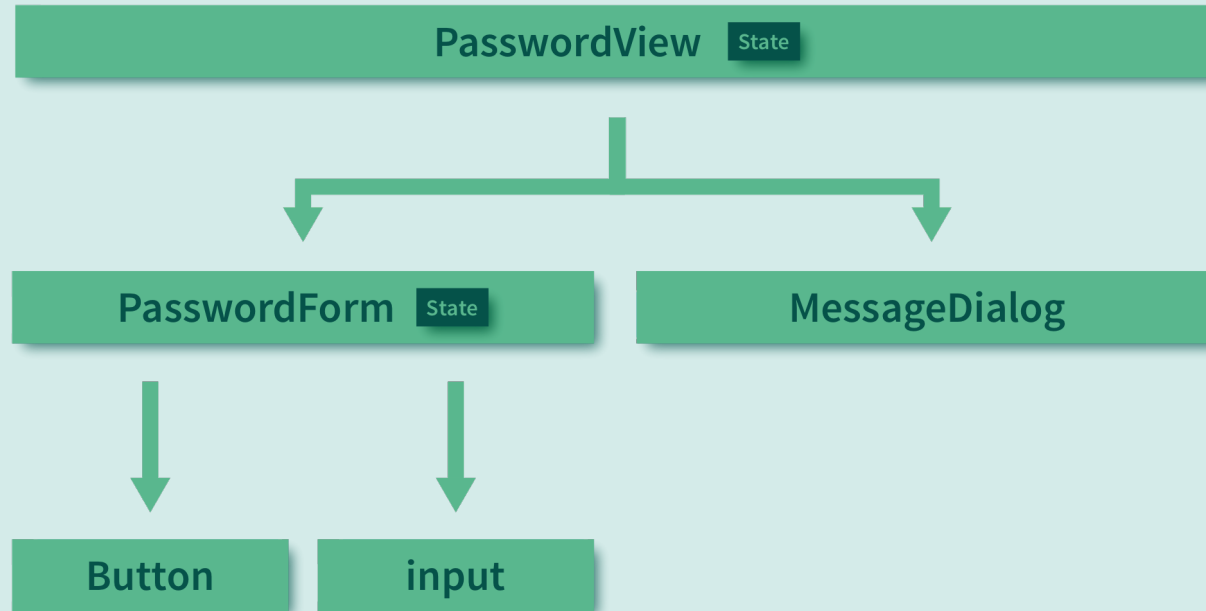
# HINTERGRUND: VIRTUAL DOM



## RENDERN IN VERSCHIEDENE FORMATE

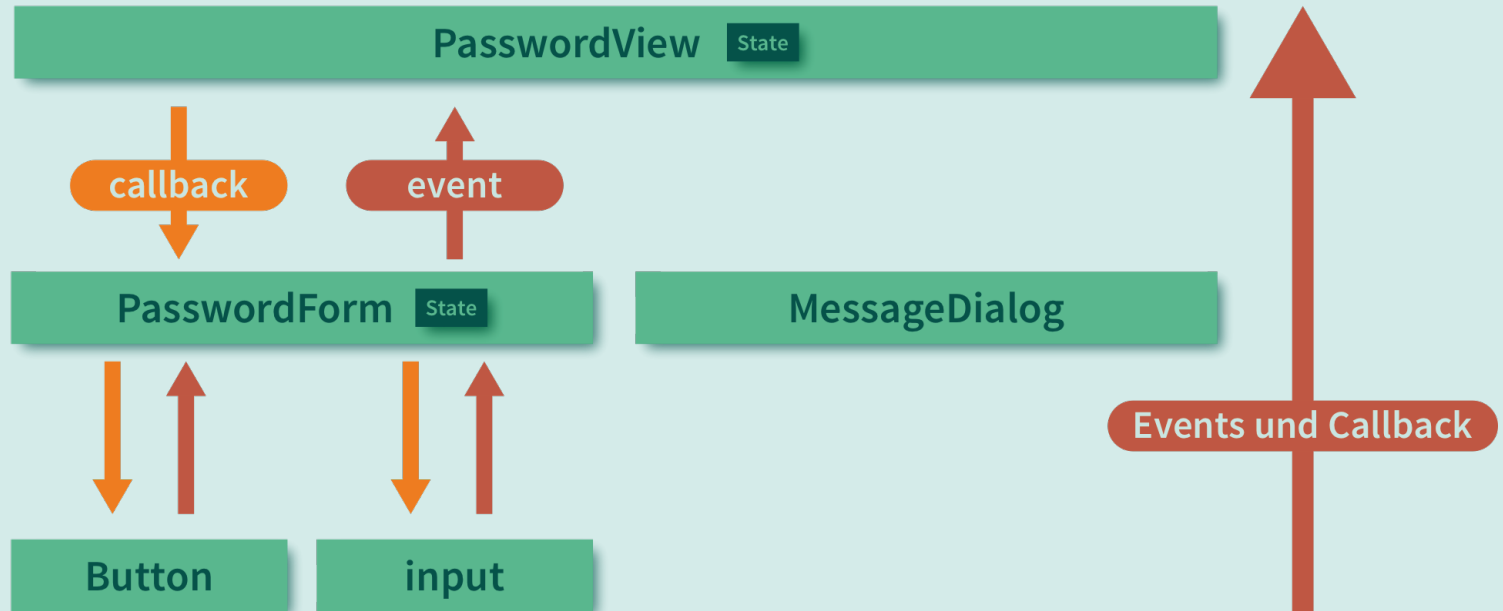


# KOMPONENTENHIERARCHIEN



**Typische React Anwendungen:** Hierarchisch aufgebaut

# KOMMUNIKATION



**Kommunikation zwischen Komponenten:** Events und Callbacks

"JavaScript that scales"

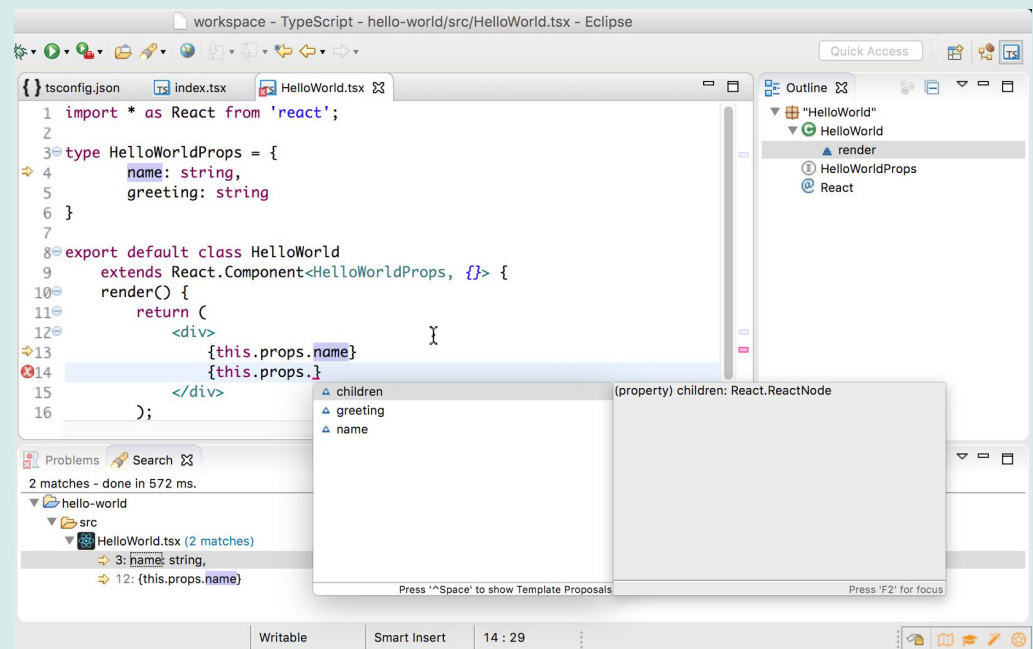
# TypeScript

[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

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



# TYPESCRIPT - SYNTAX

## Eigene Typen definieren und verwenden

```
interface Person {                // Alternativ: type
  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

für React-Anwendungen

# TYPESCRIPT UND REACT: PROPERTIES

## Properties als Typen in TypeScript

✓ At least 8 characters long.

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

Typ definieren

```
interface 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

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

## Komponenten-Klassen als Generics

- Typ für Properties und State

### 1. Typen definieren

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

```
interface 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