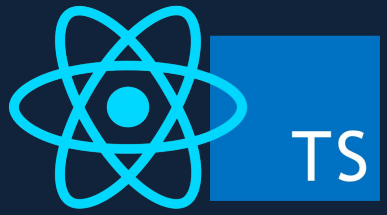



# Workshop

# Testing in React

# Hint for trainers

- Report each change or addition to the **trainers'** Discord-Channel.
- Tell which Slide is affected, why the change is important and what benefit your change provides.
- Use the code-highlighting-app if you work with code-snippets.
- Use the following slide if you want to repeat certain topics of the workshop.

# unit vs. integration vs. e2e testing

# Unit Testing

- code level
- every component can be unit tested (!)
- isolated testing
- Every dependency will be mocked and stubbed

# Integration Testing

- code level
- Testing a component with its dependencies
- Takes sometimes a lot of effort to implement
- If isolated unit test doesn’t make sense

# E2E Testing

- User level (Browser)
- Browser robot
- Assertions against the document

# Testing in React

- **Unit** tests (Jest)
- **Component** Testing
  - **Component** tests (with `@testing-library/react`)
    - Components (unit test)
    - Screens (integration test)
  - **Snapshot** tests
- End-to-end tests (Cypress)

# Unit Tests with Jest

**Jest** is a JavaScript test runner

# Why / What you'll learn

- Fast with parallel tests
- Zero-Configuration
- Everything you need built-in (e.g. code coverage, mocks, snapshot tests, …)

# Jest

<code>

Test method names should be sentences:

```
describe("BookListItem",() => {
  test("renders a book from a book prop", () => {
    // ...
  });
});

// ✓ BookListItem renders a book from a book prop
```

# Jest

<code>

Test method names should be sentences:

```
test("whether it will rain today", () => {
  expect(isRaining("today")).toBe(true);
});
```

# Jest Basics

Jest in comparison to “classic tests”:

| | | |
|---|---|---|
| Test Suite: | `describe()` | Test Suites can be nested! |
| Test Case: | `it()` or `test()` | |
| Setup: | `beforeEach()` | |
| Tear Down: | `afterEach()` | |
| Assert: | `expect()` | |

# Jest Matchers

**Matchers** replace "assert_equal", "assert_..."

- `toBe()`
- `toEqual()`
- `toContain()`
- `toBeUndefined()`
- `toBeTruthy()`
- `toThrow()`

→ `toBeGreaterThan()`

→ `toBeLessThan()`

→ `toBeCloseTo()`

**You can also create your own matchers.**

# Code coverage

- ***statement coverage***: how many of the statements in the script have been executed.
  - 100% statement coverage implies 100% line coverage
- ***branch coverage***: how many of the branches of control structures (e.g. if statements) have been executed.
- ***function coverage***: how many of the functions defined have been called.
- ***line coverage***: how many of lines of source code in the script have been tested.

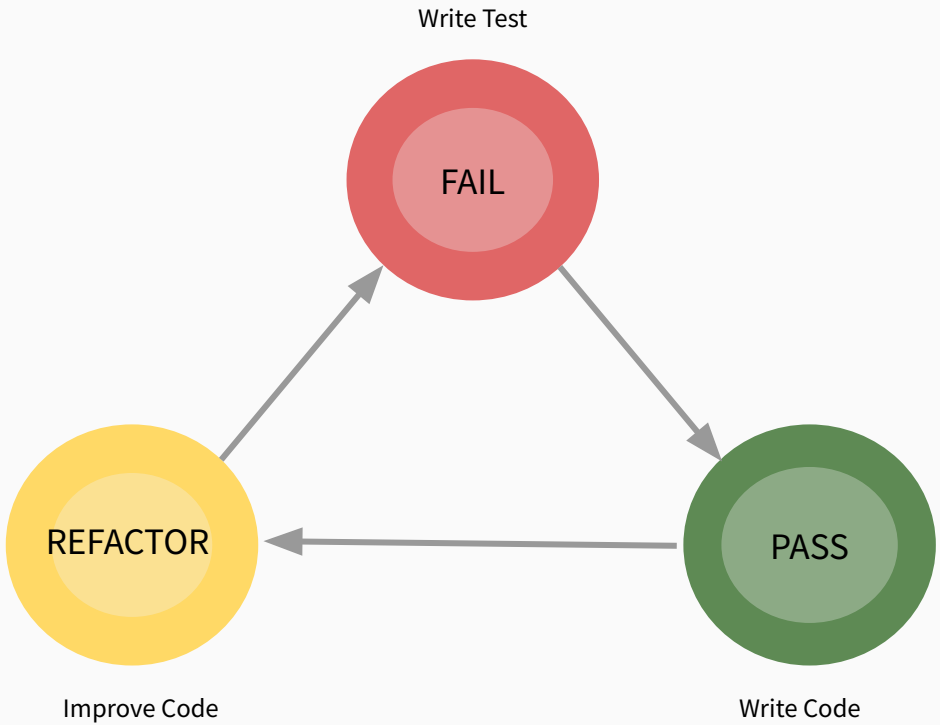
# Code coverage

Example output

code coverage comes in colors **green**, **yellow** and **red** as a quick visual feedback.

| File | % Stmts | % Branch | % Funcs | % Lines | Uncovered Line #s |
|---|---|---|---|---|---|
| All files | 91.67 | 100 | 81.82 | 90.91 | |
| common/util | 100 | 100 | 100 | 100 | |
| leapYear.ts | 100 | 100 | 100 | 100 | |
| test-utils.tsx | 100 | 100 | 100 | 100 | |
| components/BookList | 100 | 100 | 100 | 100 | |
| index.tsx | 100 | 100 | 100 | 100 | |
| components/BookListItem | 100 | 100 | 100 | 100 | |
| index.tsx | 100 | 100 | 100 | 100 | |
| components/Counter | 75 | 100 | 60 | 75 | |
| index.tsx | 75 | 100 | 60 | 75 | 14-16 |

# Test Driven Development (TDD)



# Test Driven Development (TDD)

1. Write a test case and make sure it fails. (red)
2. Satisfy the test case with minimal effort. (green)
3. Improve/refactor your code…
    a. Meet general code guidelines.
    b. Make it readable and comprehensible.
    c. Remove redundant code.
4. Verify that the test case is still passing. (green)

# Task

## TDD (Test driven development) with Jest

# Testing React - Component Tests

# Component tests

- Tests of individual React (Native) components
- *“Unit tests for Components”*
- You can create an instance of the component, pass it props, interact with it.

**react-testing-library** contains simple and complete React DOM testing utilities that encourage good testing practices.

# `render`



Render into a container which is appended to `document.body`

```
import {render} from '@testing-library/react'

render(<div />)
```

# Queries

Queries are the methods that Testing Library gives you to find elements on the page

- `getBy...`
- `queryBy...`
- `findBy...`
- `getAllBy...`
- `queryAllBy...`
- `findAllBy...`

# Queries

They behave differently if they can't find one or multiple elements

| | | | |
|---|---|---|---|
| • `getBy...` | `throw error` | | • `getAllBy...` |
| • `queryBy...` | `return null` | `return []` | • `queryAllBy...` |
| • `findBy...` | `throw error` | | • `findAllBy...` |

query* return `null` when no matching element is found -> allow negative assertions

find* also retries asynchronously

# `getBy...` Queries



Query argument can be either a string, regex, or a function which returns `true` for a match and `false` for a mismatch.

```
// Matching a string:
screen.getByText('Hello World') // full string match
screen.getByText('llo Worl', {exact: false}) // substring match
screen.getByText('hello world', {exact: false}) // ignore case

// Matching a regex:
screen.getByText(/World/) // substring match
screen.getByText(/world/i) // substring match, ignore case
screen.getByText(/^hello world$/i) // full string match, ignore case
screen.getByText(/Hello W?oRlD/i) // substring match, ignore case, searches for "hello world" or
"hello orld"

// Matching with a custom function:
screen.getByText((content, element) => content.startsWith('Hello'))
```

# Other `getBy...` query methods



Examples of queries with different query methods

```
import { render, screen } from '@testing-library/react'

// ByText
render(<MyComponent />)
const aboutNode = screen.getByText(/about/i)

// ByLabelText
render(<MyForm />)
const nameInputNode = screen.getByLabelText('name')
// ByPlaceholderText
const ageInputNode = screen.getByPlaceholderText('age')
```

# `findBy...` Queries



These queries are used for asynchronous actions or when you need to wait for an element to appear **asynchronously**. Example:

```
import { render, screen } from '@testing-library/react';
import userEvent from '@testing-library/user-event';
import { fetchPosts } from './api';

test('renders a list of posts fetched asynchronously', async () => {
  render(<Posts />);
  const loadButton = screen.getByRole('button', { name: 'Load Posts' });
  userEvent.click(loadButton);

  const postElement = await screen.findByText('Sample Post');
  expect(postElement).toBeInTheDocument();
});
```

# Task

## Component Tests

# Testing React - Snapshots

**Snapshots** save the complete test

output into a file

# react-test-renderer

Renders React components to pure JavaScript objects, without dependencies on the DOM.

# react-test-renderer

- Not included in `create-react-app`
- Install it via npm

```
npm i react-test-renderer --save-dev
```

# react-test-renderer



Import the test renderer

```
import renderer from 'react-test-renderer';
```

# react-test-renderer



The result of the renderer is an object

```
const result = renderer.create(
  <Link page="https://workshops.de/">Workshops.de</Link>
).toJSON();

// => { type: 'a',
// =>   props: { href: 'https://workshops.de/' },
// =>   children: [ Workshops.de ] }
```

# Snapshots

Snapshots save the HTML of a rendered component into a file

# Why / What you'll learn

Don't spend more time writing a test than the component itself.

# Matcher for Snapshots

<code>

Snapshots use the matcher `.toMatchSnapshot()`

```
it('renders a book item correctly', () => {
  const book = { title: "React Advanced"}

  const tree = ReactTestRenderer.create(
    <BookListItem book={book} />
  ).toJSON();
  expect(tree).toMatchSnapshot();
});
```

**Matches the tree and the saved snapshot**

# Snapshots and `react-router-dom`

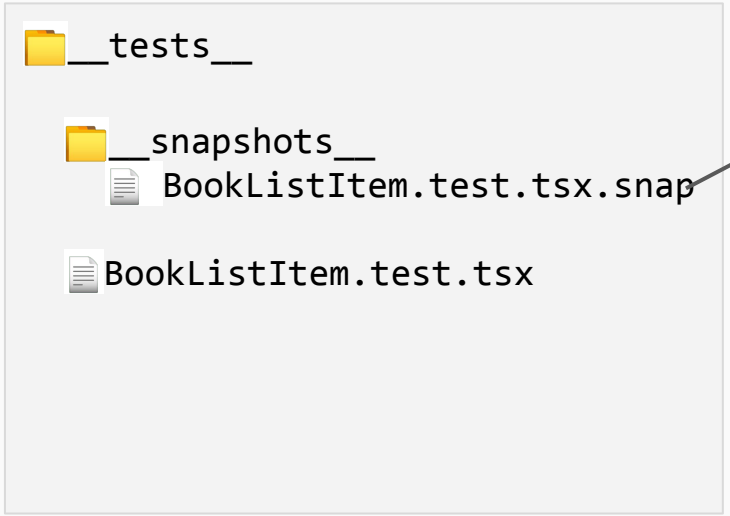
<code>

`MemoryRouter` may be used to provide routing context in tests

```
it(`renders a book item correctly`, () => {
  const tree = renderer
    .create(
      <MemoryRouter>
        <BookListItem book={book} />
      </MemoryRouter>
    )
    .toJSON();
  expect(tree).toMatchSnapshot();
});
```

# Snapshots

On first execution the html result is written to a file




```
exports[`components/BookListItem renders a
book item correctly`] = `
<a
  href="/books/undefined"
  onClick={[Function]}
>
  My first book
</a>
`;
```

# Snapshots - working with errors

- If something changes you get an error with a diff
- You can now either
  - Fix the bug
  - Update all snapshots with u in the console

    (or run `yarn test --updateSnapshot`)

```
Received value does not match stored snapshot 1.

- Snapshot
+ Received

@@ -1,3 +1,3 @@
 <span>
-  React Advanced
+  React Beginner
 </span>
```

# Snapshots - working with errors

- If something changes you get an error with a diff
- You can now either
  - Fix the bug
  - Update all snapshots with u in the console

    (or run `yarn test --updateSnapshot`)

# Task

## Snapshot Tests

# Testing Interactivity

# fireEvent

<code>

Fire DOM events via the built in utility.

```
import { fireEvent, screen } from "@testing-library/react";

// click event
fireEvent.click(screen.getByText("reset"));

// change event
fireEvent.change(screen.getByPlaceholderText(/email/i), {
  target: { value: "abc@def.gh" },
});
```

# `@testing-library/user-event`

- Companion library for Testing Library simulating user interactions.
- Closer to real interactions in a browser as when using `fireEvent`.
- Needs to be installed separately:

```
npm install --save-dev @testing-library/user-event
yarn add --dev @testing-library/user-event
```

# @testing-library/user-event



Fire DOM events via the built in utility.

```
import userEvent from "@testing-library/user-event";

it(`handles a click event`, async () => {
  const user = userEvent.setup()
  const mockOnSave = jest.fn()

  render(<BookForm onSave={mockOnSave} />)

  await user.click(screen.getByRole('button', {name: /save book/i}))
  expect(mockOnSave).toHaveBeenCalled()
});
```

# @testing-library/user-event



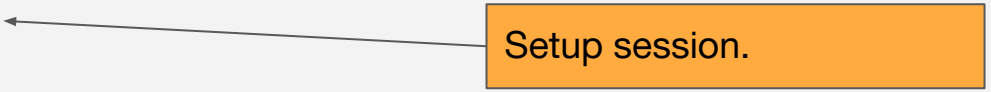
Fire DOM events via the built in utility.

```
import userEvent from "@testing-library/user-event";

it(`handles a click event`, async () => {
  const user = userEvent.setup()
  const mockOnSave = jest.fn()

  render(<BookForm onSave={mockOnSave} />)

  await user.click(screen.getByRole('button', {name: /save book/i}))
  expect(mockOnSave).toHaveBeenCalled()
});
```



# @testing-library/user-event



Fire DOM events via the built in utility.

```
import userEvent from "@testing-library/user-event";

it(`handles a click event`, async () => {
  const user = userEvent.setup()
  const mockOnSave = jest.fn()

  render(<BookForm onSave={mockOnSave} />)

  await user.click(screen.getByRole('button', {name: /save book/i}))
  expect(mockOnSave).toHaveBeenCalled()
});
```

Render our component with a mock event handler.

# @testing-library/user-event



Fire DOM events via the built in utility.

```
import userEvent from "@testing-library/user-event";

it(`handles a click event`, async () => {
  const user = userEvent.setup()
  const mockOnSave = jest.fn()

  render(<BookForm onSave={mockOnSave} />)

  await user.click(screen.getByRole('button', {name: /save book/i}))
  expect(mockOnSave).toHaveBeenCalled()
});
```

Perform a click on an element we select from the screen.

# @testing-library/user-event



Fire DOM events via the built in utility.

```
import userEvent from "@testing-library/user-event";

it(`handles a click event`, async () => {
  const user = userEvent.setup()
  const mockOnSave = jest.fn()

  render(<BookForm onSave={mockOnSave} />)

  await user.click(screen.getByRole('button', {name: /save book/i}))
  expect(mockOnSave).toHaveBeenCalled()
});
```

Assert our mock event handler was called.

# Task

## Component Tests with interactivity

# Advanced topics

# Jest: Setup and Teardown

<code>

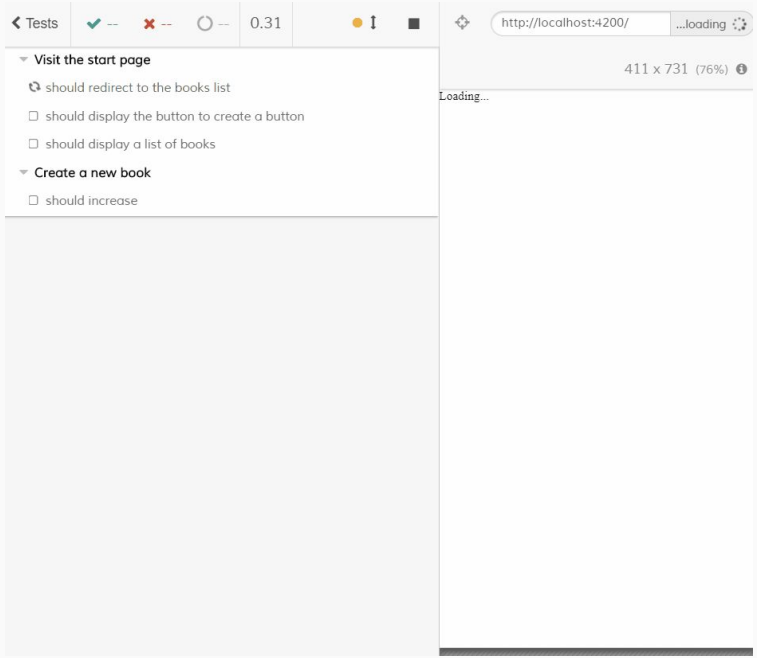
helper functions to setup work that needs to happen before tests run and finishing work that needs to happen after tests run.

```
beforeAll() // is run once before all the tests in a describe
afterAll() // is run once after all the tests in a describe

beforeEach() // is run before each test in a describe
afterEach() // is run after each test in a describe
```

# End-to-end tests with Cypress

# Cypress Test Runner



# We teach.

workshops.de