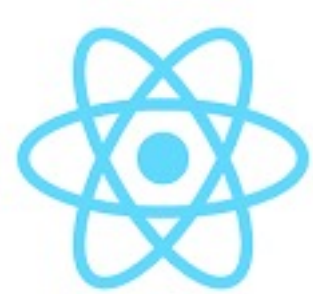


ReactJS (v18+).

Fundamentals

Agenda

- **Background.**
- **The V in MVC**
- **JSX (JavaScript Extension Syntax).**
- **Developer tools..**
- **React Component basics.**

ReactJS.

- **A Javascript framework for building dynamic Web** User Interfaces**.**
  - **A Single Page Apps technology.**
  - **Open-sourced in 2012.**

- **Client-side framework.**
  - **More a library than a framework.**

Before ReactJS.

- MVC pattern **– The convention for** app design. **Promoted by market leaders**, e.g. **AngularJS (1.x), EmberJS, BackboneJS.**
- **React is not MVC, just V.**
  - **It challenged established best practice (MVC).**
- Templating **– widespread use in the V layer.**
  - **React based on** components.

	Templates	**(React) Components**
Separation of concerns	Technology (JS, HTML)	Responsibility
Semantic	New concepts and micro-languages	HTML and Javascript
Expressiveness	Underpowered	Full power of Javascript

Components

- **Philosophy:** *Build components, not templates.*
- **All about the** User Interface **(UI).**
  - **Not about business logic or the data model (Mvc)**

- **Component - A unit comprised of:**

  UI description (HTML) + UI behavior (JS)
  - **Two aspects are tightly coupled and co-located.**
    - **Pre-React frameworks decoupled them.**
  - **Benefits:**
    1. **Improved Composition.**
    2. **Greater Reusability.**

Creating the UI description.

(Vanilla React)

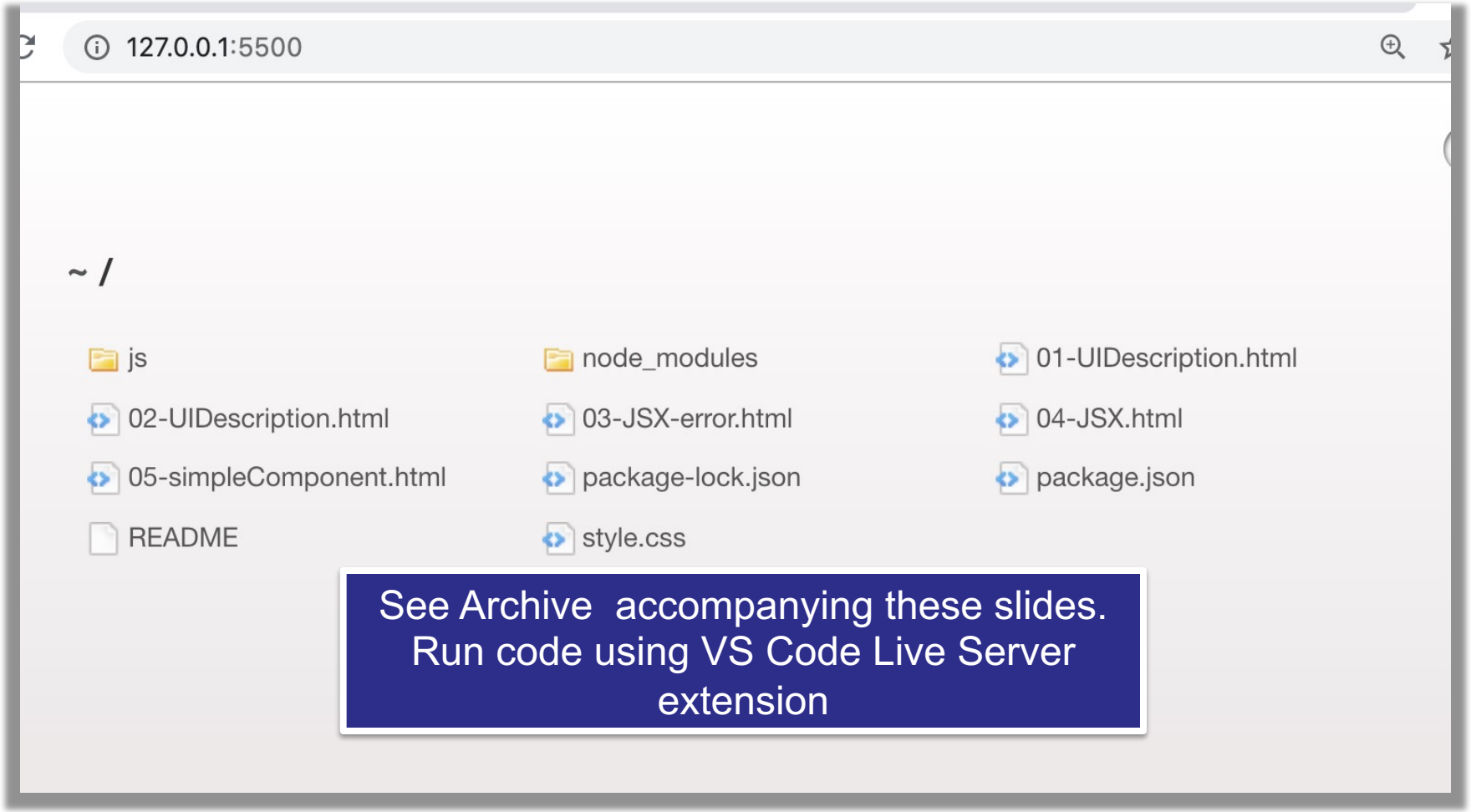
- React.createElement() **– create a HTML element.**
- ReactDOM.createRoot() – **which existing DOM node to attach the created element.**

- React.createElement() **arguments**:
  1. **type (h1, div, button etc).**
  2. **properties (style, event handler etc).**
  3. **children (0 -> M).**
  - **We never use** createElement**() directly – too cumbersome.**

- ReacrDOM.createRoot () **arguments:**
  1. **DOM node on which to** mount **a new element**.

Code Demos.

(See lecture archive)



UI description implementation

(the imperative way)

- **See the demos:**
  - **Ref.** 01-UIDescription.html.
  - **Nesting** createElement**() calls - Ref**. 02-UIDescription.html

---

Imperative programming *is a programming paradigm that uses statements that change a program's state*

Declarative programming *is a programming paradigm … that expresses the logic of a computation without describing its control flow.*

UI description implementation

(the declarative way)

- **JSX – JavaScript extension syntax.**

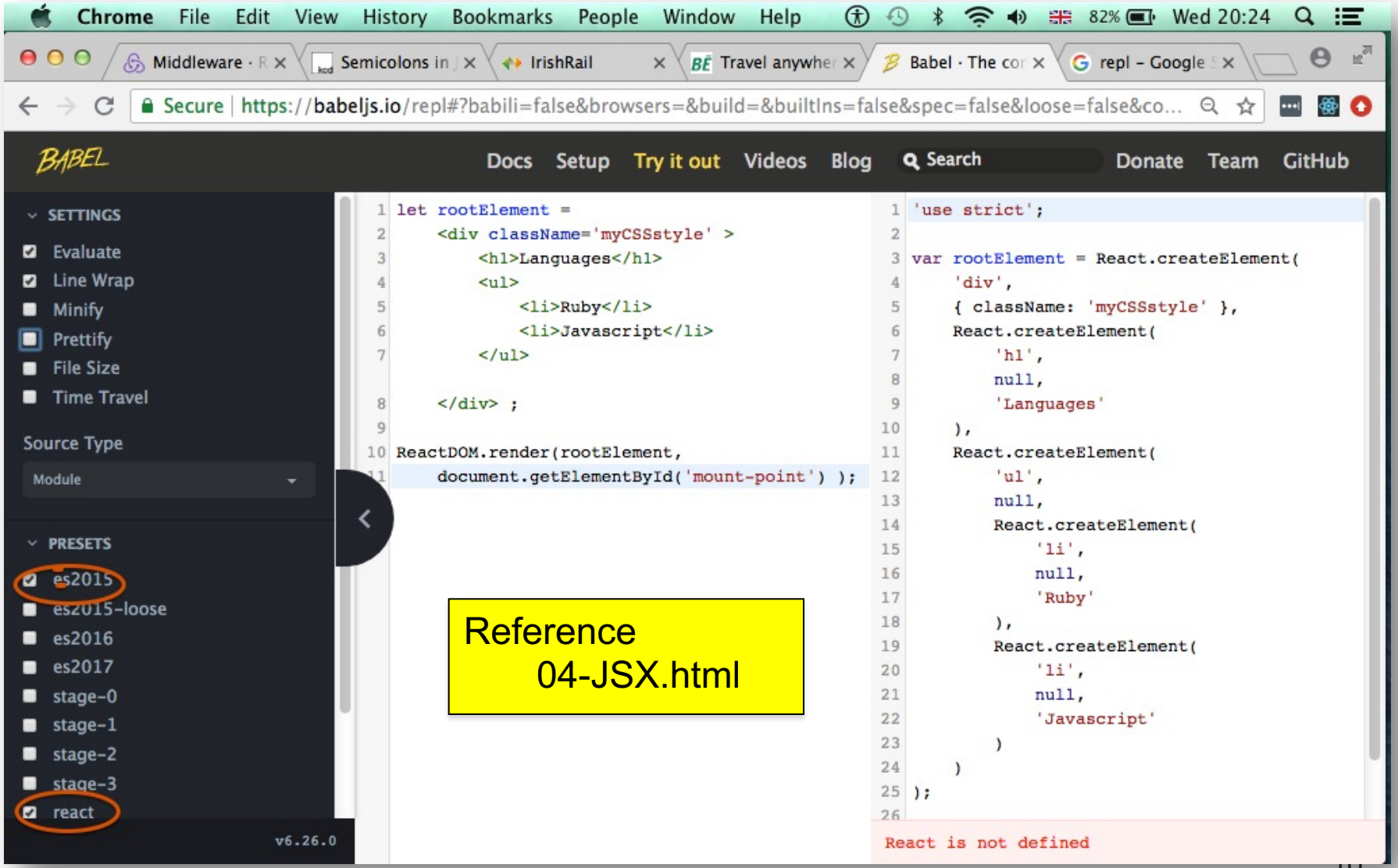
- **Declarative syntax for coding UI descriptions.**

- **Retains the full power of Javascript.**
- **Allows tight coupling between UI behavior and UI description.**

- **Must be transpiled before being sent to browser.**
  - **The Babel tool**

- **Reference** 03-JSX-error.html and 04-JSX.html

REPL (Read-Evaluate-Print-Loop) transpiler.



JSX.

- **HTML-like markup.**
  - **It's actually XML code.**
- **Some minor HTML tag attributes differences, e.g. className (class), htmlFor (for).**
- **Allows** UI description **to be coded in a** declarative style **and be inlined in JavaScript.**
- **Combines the ease-of-use of templates with the power of JS.**

Transpiling JSX.

- **What?**
  - **The Babel platform.**
  - **The Vite library.**

- **How?**
  1. **Manually, via REPL or command line.**
     - **When experimenting only.**
  2. **Using an instrumented web server – Vite library instrumentation.**
     - **Ideal for development.**
  3. **Using** bundler **tools as part of the build process – Vite again.**
     - **Production standard.**

React Components.

- **We develop COMPONENTS.**
  - **A** JS function **that returns a** UI description, i.e. JSX**.**

- **We reference a component like a HTML tag.**

  e.g.

```
const rootElement =
    ReactDOM.createRoot(document.getElementById("mount-point"));
rootElement.render( <DynamicLanguages/> );
```

- **Reference** 05-simpleComponent.html

React Developer tools.

- Vite **- Features:**
  - **Scaffolding/Generator.**
  - **Development web server: auto-transpilation on file change + live reloading (HMR – Hot Module Replacement).**
  - **Builder: build production standard version of app, i.e. minification, bundling.**

- Storybook - **Features:**
  - **A** development environment **for React components.**
  - **Allows components be developed in isolation.**
  - **Promotes more reusable, testable components.**
  - **Quicker development – ignore app-specific dependencies.**

- **Installation:**

  $ npm install @storybook/react

- **The tool has two aspects:**

  1. **A web server.**

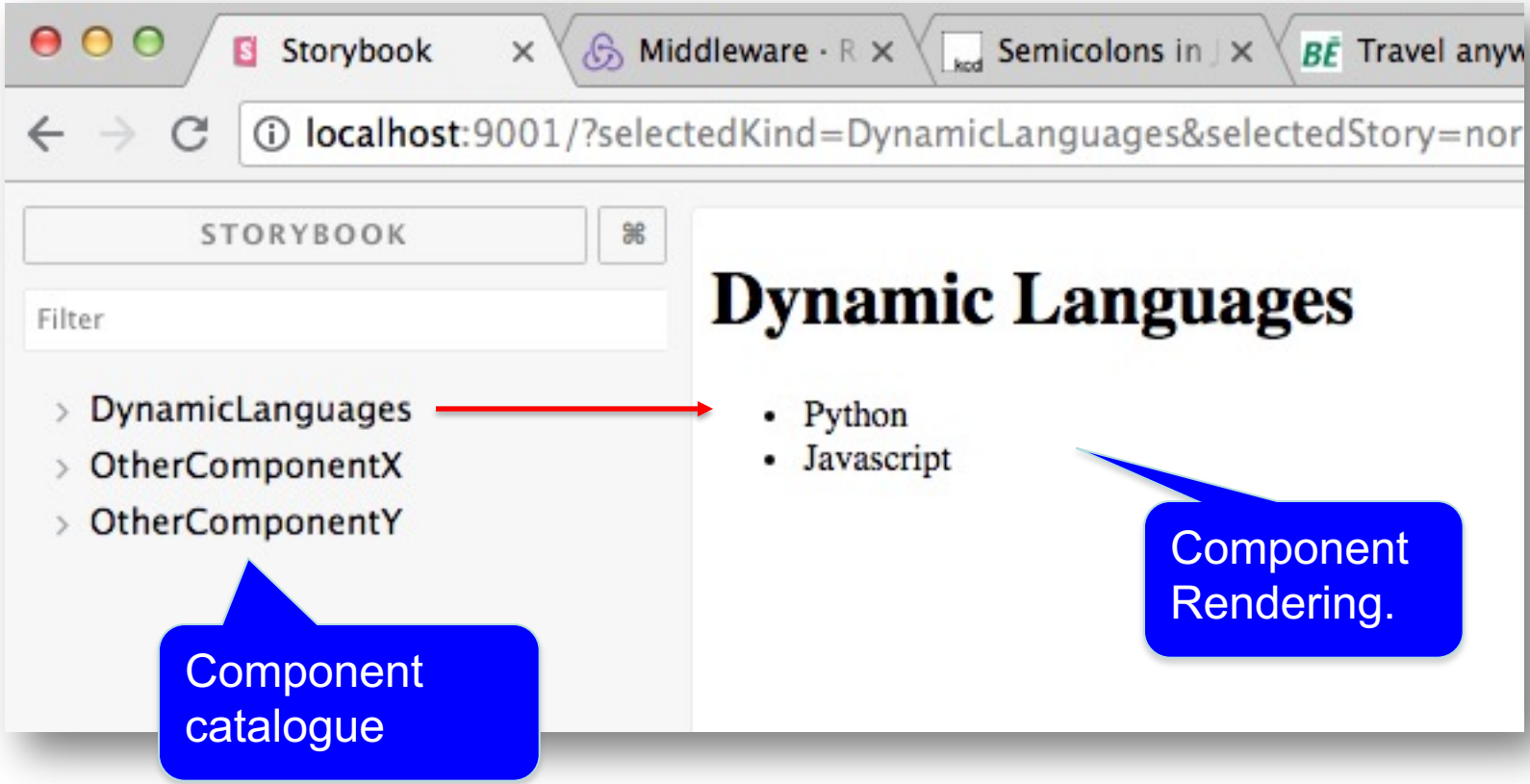
     $ ./node_modules/.bin/***start-storybook -p 6006 -c ./.storybo***ok

     • **Performs live re-transpilation and re-loading.**

  2. **Web browser user interface.**

STORYBOOK

- **Storybook User interface.**



STORYBOOK

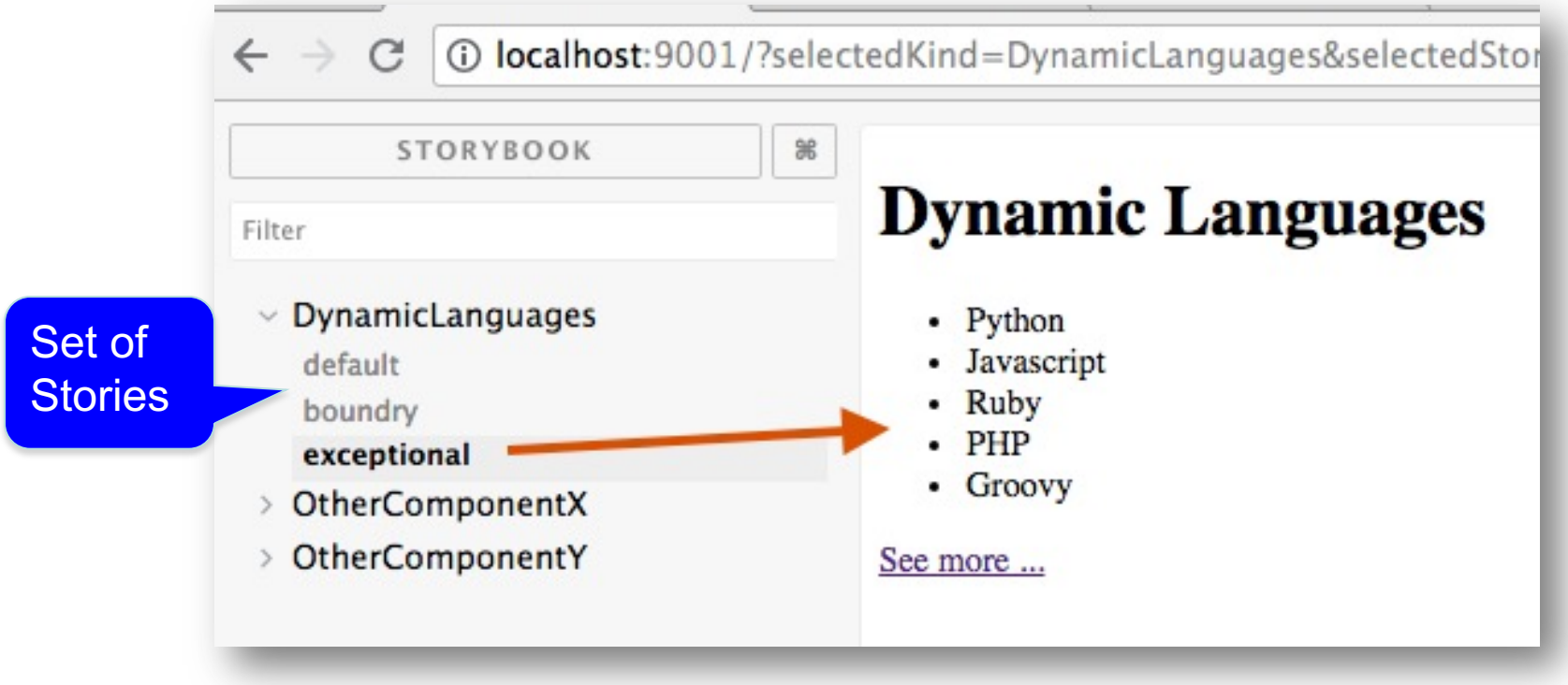
- **What is a Story?**

- **A component may have several STATES → State affects how it renders.**
  - **Each state case termed a STORY.**
  - **Stories are a design consideration.**

- EX.: DynamicLanguages **component.**
  - **States might be:**
    - Default **– 5 or less languages → Render full list**
    - Boundary **– empty list → Render 'No languages' message**
    - Exceptional **– More than 5 languages → Render first 5 and a 'See More…' link to display next 5.**

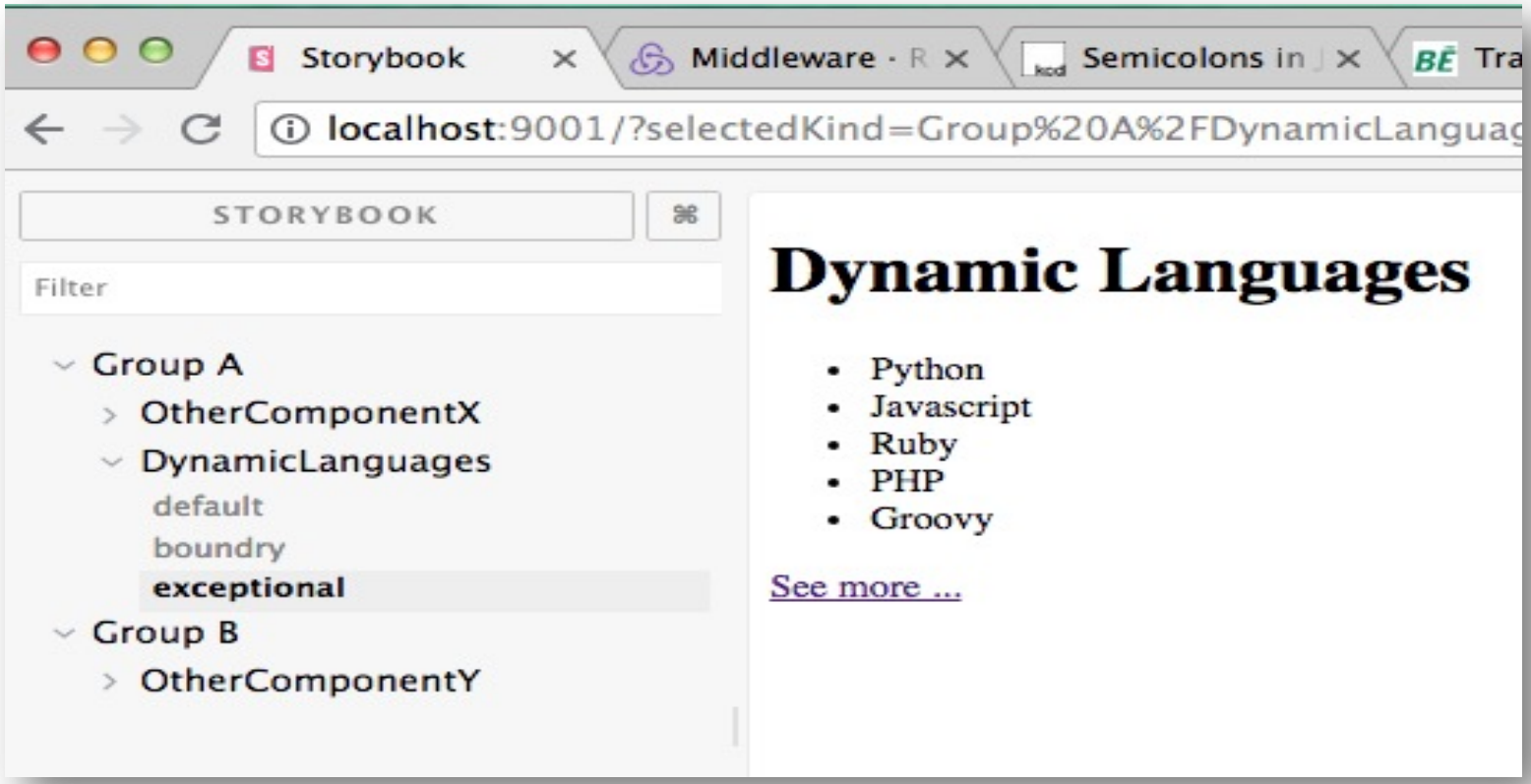
STORYBOOK

- **List a component's states/stories under its name:**



STORYBOOK

- **Define component** groups when **component catalogue is large.**
  - **helps others team members with searching**.



Aside – JS Modularity.

- **Split application code into multiple files, termed modules.**
- **Reusability - make modules available to other modules..**
- **Pre-ES6 provided module system via separate library;**
- **ES6 modules built into language.**
  - **Two main options: Default exports; Named exports.**
    - **Also Mixed exports.**

```
29  // lib.js
30  export default function() {
31    ...
32  }
33  // ------------------------
34  // bar.js
35  import myFunc from './lib';
36  myFunc();
37
```

```
// lib,js  (Named exports)
export let myStr = 'important string';
export const pi = 3.14159526;
export function myFunc() {
  ...
}
export class myClass {
  ...
}
// ------------------------
// bar.js
import {myFunc, myStr} from './lib';
myFunc() ;
console.log(myStr)
```

Writing stories

- .stories.js **file extension (convention)**
- **1 Stories file per coponent**

```
import React from "react";
import DynamicLanguages from "../components/dynamicLanguages";

export default {
  title: "Dynamic Languages",
  component: DynamicLanguages,
};

export const Default  = () => {
    const list = ["Javascript", "Python", "Java", "C#"];
    return <DynamicLanguages languages={list}  />;
};

export const Exceptional  = () => {
  ..........................
};

export const Error  = () => {
  ..........................
};
```

default export; Metadata; How Storybook lists components.

- Story implemented as a function.
- Named exports.
- UpperCamelCase
- 3 stories for this component

Grouping stories.

- **Use directory pathname symbol (/) to indicate component grouping (i.e.** group*/subgroup/….).*

```
export default {
  title: "Group A/ Component 1",
  component: Component1,
};

... stories ...
```

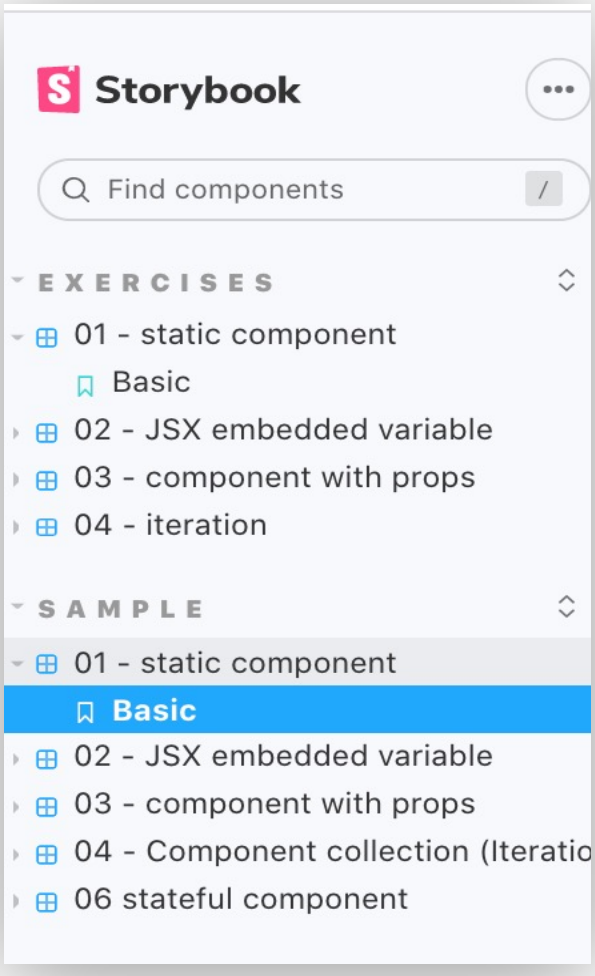
```
export default {
  title: "Group A/ Component 2",
  component: Component2,
};

... stories ...
```

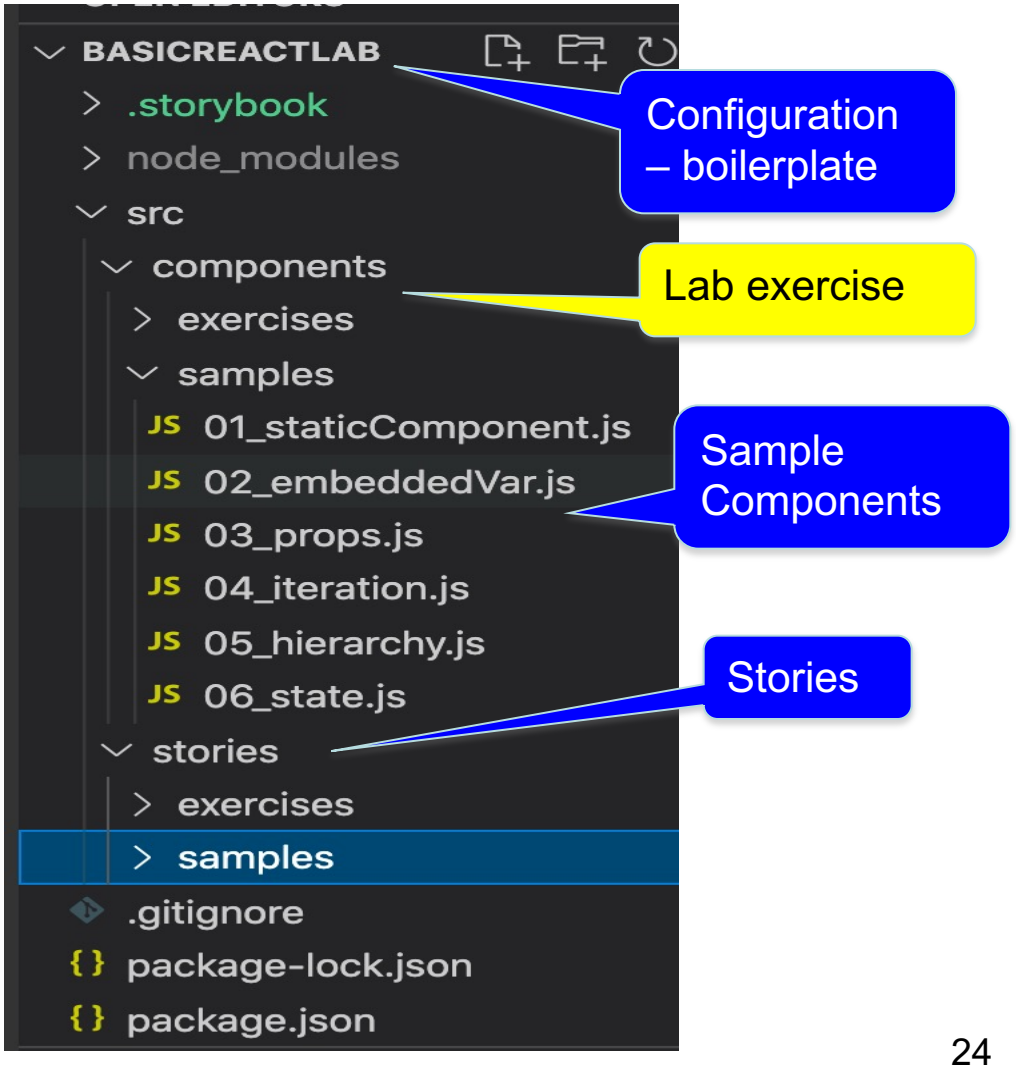
```
export default {
  title: "Group B/ Component X",
  component: Component1,
};

... stories ...
```

… back to components . . .

Demo Samples

(See lab exercise)





JSX - embedded variables.

- **Use { } to dereference variable embedded in JSX.**
  - **Curly braces can contain any valid JS expression.**
- **Reference** src/components/samples/02_embeddedVariables.js

JS 02_embeddedVar.js

components > samples > JS 02_embeddedVar.js > ...

```
1   import React from "react";
2
3   const Demo = () => {
4     const languages = ["Go", "Julia", "Kotlin"];
5     const header = "Modern";
6     return (
7       <div>
8         <h1>{`${header} Languages`}</h1>
9         <ul>
10          <li>{languages[0]}</li>
11          <li>{languages[1]} </li>
12          <li>{languages[2]} </li>
13        </ul>
14      </div>
15    );
16  };
17
18  export default Demo
```

Reusability.

- **We achieve reusability through** parameterization**.**
- props **– Component properties / attribute / parameters.**
  1. **Passing props to a component:**

     <CompName prop1Name={value} prop2Name={value} . . . . />
  2. **Access inside component via** props **object:**

     const ComponentName = (props) => {

         const p1 = props.prop1Name

         . . . . . .
  3. **Props are** Immutable**.**
  4. **Part of a component's design.**
- **Reference** src/components/samples/03_props.js **(and related story).**

Aside.

- **We can assign a** single **JSX element to a variable.**

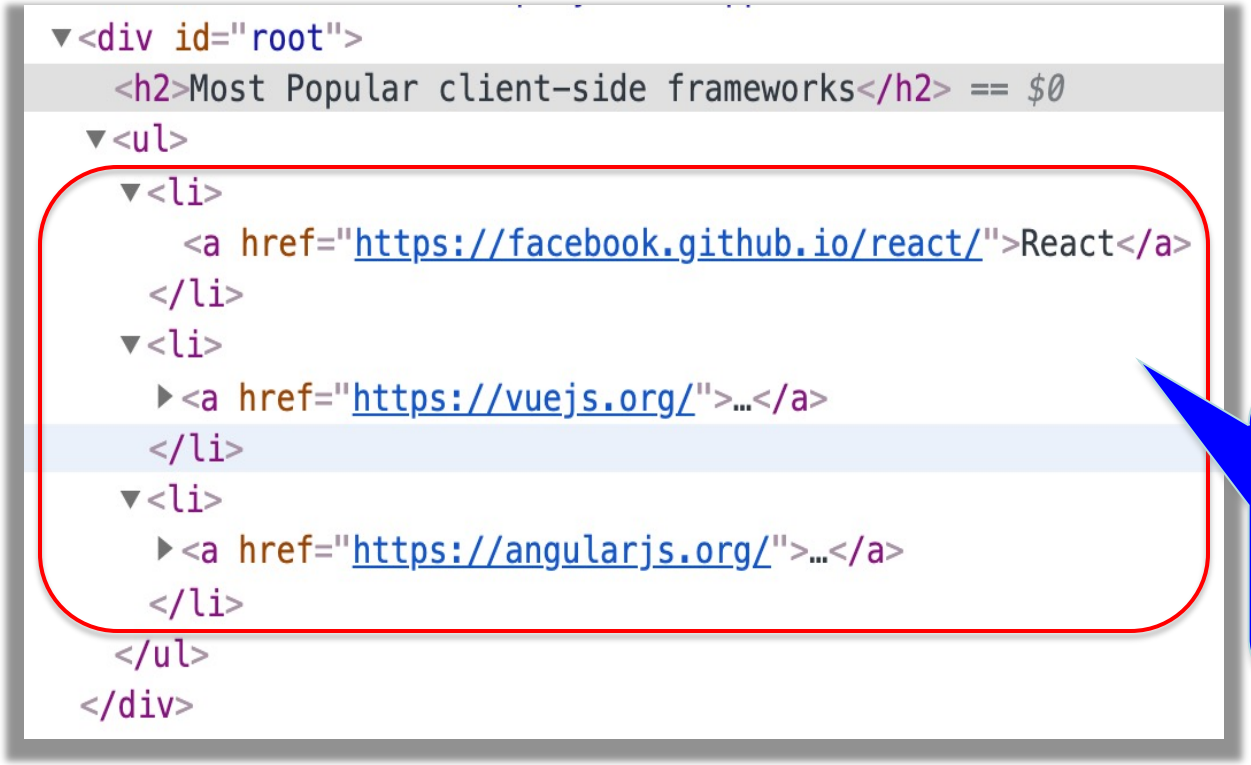
```
const demo = <div>
                <h1>Something</h1>
                <h2>Something else</h2>
             </div> ;
```

- **Why?**

```
const demo = React.createElement(
  "div",
  null,
  React.createElement("h1", null, "Something"),
  React.createElement("p", null, "Some text ...")
);
```

Component collection - Iteration

- **Use case: Generate an array of (similar) component from a data array.**
- **Reference** src/components/samples/04_iteration.js



Component return value.

- **Examples:**;
  1. return <MyComponent prop1={…..} prop2={……} /> ;
  2. return (

```
<div>
  <h1>{this.props.type}</h1>
  <MyComponent prop1={…..} prop2={……} />
  <p>
     . . . . . .
  </p>
</div>
```

) ;

  – **Must enclose in ( ) when multiline.**

Component return value.

- **Must return only ONE element.**
- **Error Examples:**
  - return (

```
<h1>{this.props.type}</h1>
<MyComponent prop1={…..} prop2={……} />
<p>
    . . . . . .
</p>
```

) ;
  - **Error** – ‘Adjacent JSX elements must be wrapped in an enclosing tag’
  - **Solution: Wrap elements in a tag.**

Component return value.

- **Old solution:**

```
return (
    <div>
        <h1> ……</h1>
        <MyComponent …… />
        <p> …….. </p>
     </div>
    ) ;
```

- **Adds unnecessary depth to DOM → affects performance.**

- **Alternative solution:**

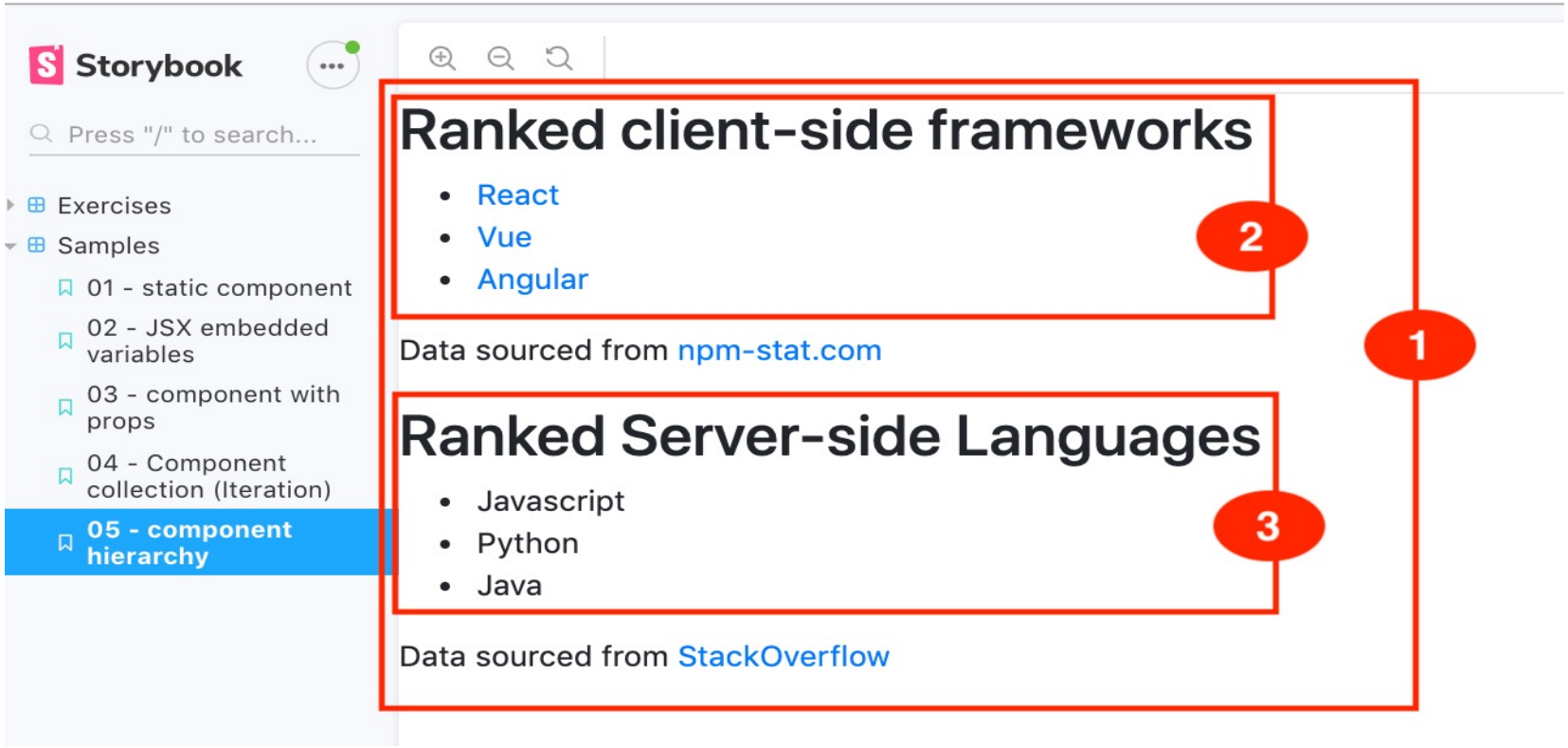
```
return (
    <>
        <h1> ……</h1>
        <MyComponent …… />
        <p> …….. </p>
     </>
    ) ;
```

- **<> </> – special React element, termed** Fragment**.**
  - **No DOM presence.**

Component ***Hierarchy***.

All React application are designed as a hierarchy of components.

- **Components have** children **– nesting.**
- **Ref.** src/components/samples/05_hierarchy.js.



React version 18

- **Released March 2022.**
- One significant breaking change.

```
You, 1 second ago | 1 author (You)
1  import React from 'react'
2  import ReactDOM from 'react-dom'
3  import App from './App'
4       You, 5 months ago • Completed app but using Bootstrap
5  ReactDOM.render(<App />, document.getElementById('root'));
```

```
You, 1 second ago | 1 author (You)
1  import React from 'react'
2  import { createRoot } from 'react-dom/client'
3  import App from './App'
4       You, 3 weeks ago • Initialize project using Create React App
5  const rootEleeent = createRoot( document.getElementById('root' ))
6  rootEleeent.render(<App /> );
```

React 18

Summary.

- **JSX.**
  - **UI** description **and** behaviour **tightly coupled.**
  - **Can embed variables/expressions with braces.**
- **All about components.**
  - **A function that takes a props argument and returns a single JSX element .**
  - **Components can be nested.**
- **Storybook tool.**
  - **Develop components in isolation.**
  - **Story – the state (data values) of a component can effect its rendering (and behaviour).**