

# ReactJS.

## Fundamentals

# Agenda

- **Background.**
- **JSX (JavaScript Extension Syntax).**
- **Developer tools.**
  - **Storybook.**
- **Component basics.**

# ReactJS.

- A Javascript framework for building dynamic Web User Interfaces.
  - 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

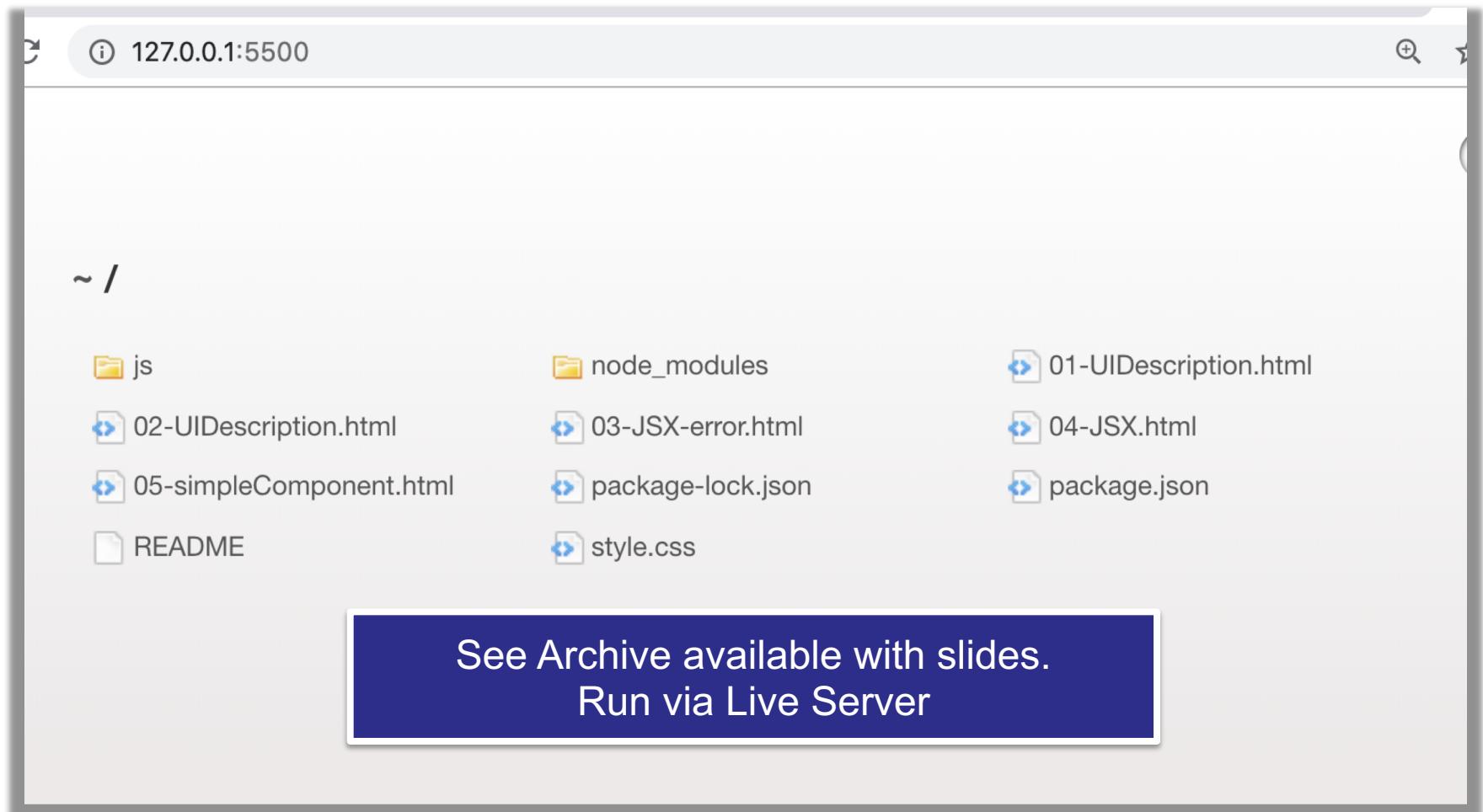
# ReactJS

- **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.**
    - **Other frameworks decoupled them.**
  - **Benefits:**
    - 1. Improved Composition.**
    - 2. Greater Reusability.**
    - 3. Better Performance.**

# Creating the UI description

- React.createElement() – **create a HTML element.**
- ReactDOM.render() – **attach an element to the DOM.**
- createElement() arguments:
  1. **type (h1, div, span etc).**
  2. **properties (style, event handler etc).**
  3. **children (0 -> M).**
    - **We never use createElement() directly – far too cumbersome.**
- ReactDOM.render() arguments:
  1. **element to be displayed.**
  2. **DOM node on which to mount the element.**
- **Ref. 01-UIDescription.html.**
- **Nesting createElement() calls - Ref. 02-UIDescription.html**

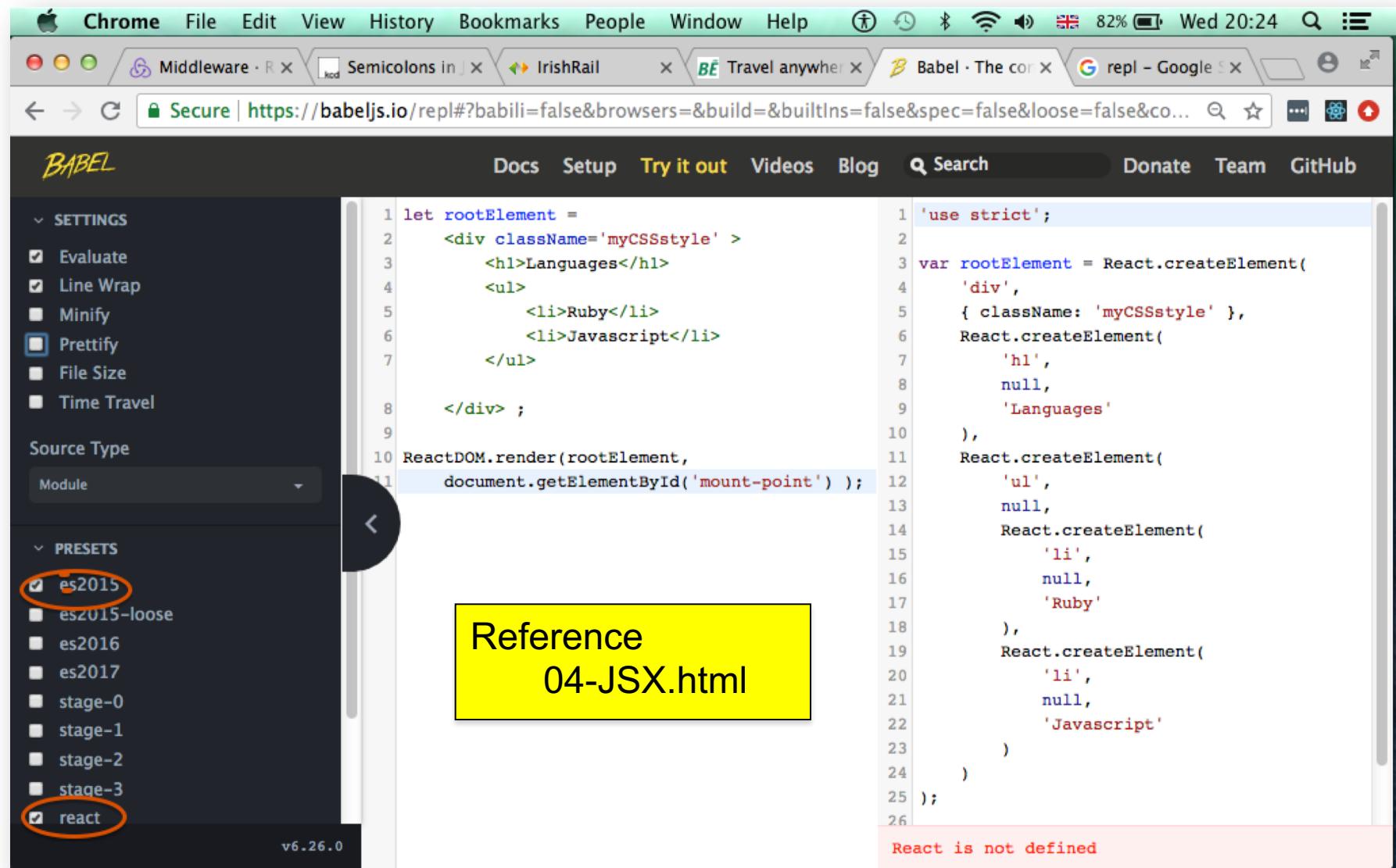
# Code Demos



# JSX.

- **JSX – JavaScript extension syntax.**
- **Declarative syntax for coding UI descriptions inside JS code**
- **Retains the full power of Javascript.**
- **Allows tight coupling between UI behavior and description.**
- **Must be transpiled (Babel) before being sent to browser.**
  - **Reference** 03-JSX-error.html
  - **Reference** 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 declarative description of the UI inlined in JavaScript.
- Combines the ease-of-use of templates with the power of JS.

# Transpiling JSX.

- **What?**
  - The Babel platform
- **How?**
  - 1. Manually, via REPL or command line.**
    - When experimenting only.
  - 2. During development by the web server (using special tooling, i.e. Webpack).**
  - 3. Before deployment as part of the build process for an app.**

# React Components.

- **We develop COMPONENTS.**
  - A JS function that **returns** a UI description, i.e. JSX.
- **Can reference a component like a HTML tag.**  
e.g. `ReactDOM.render(<ComponentName />, . . . )`
- **Reference** 05-simpleComponent.html

# React Developer tools.

- **create-react-app (CRA) - Features:**
  - **Scaffolding/Generator.**
  - **Development web server: auto-transpilation on file change + live reloading.**
  - **Builder: build production standard version of app, i.e. minification, bundling.**
- **Storybook - Features:**
  - **A development environment for UI components.**
  - **Develop component in isolation.**
  - **Leads to more reusable, testable components.**
  - **Quicker development – ignore app-specific dependencies.**



- **Storybook UI (User interface).**

A screenshot of a web browser window titled "Storybook". The address bar shows the URL "localhost:9001/?selectedKind=DynamicLanguages&selectedStory=none". The main content area is titled "Dynamic Languages". On the left, there's a sidebar with a "Filter" input field and a list of component names: "DynamicLanguages", "OtherComponentX", and "OtherComponentY". A red arrow points from the "DynamicLanguages" item in the sidebar to a bulleted list on the right containing "Python" and "Javascript". A blue callout bubble points from the "Component names/lanels" text in a blue box at the bottom left towards the "DynamicLanguages" item in the sidebar. Another blue callout bubble points from the "Component Rendering." text in a blue box at the bottom right towards the "Python" and "Javascript" items in the list.

STORYBOOK

Filter

> DynamicLanguages →

- Python
- Javascript

Component names/lanels

Component Rendering.



- **What is a Story?**
- **A component may have several STATES → State effects how it renders.**
  - **Each state case termed a STORY.**
  - **Stories are a design consideration**
- EX.: DynamicLanguages **component.**
  - **States might be:**
    - Default – **less than 5 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 UI indents stories inside the containing component:**

A screenshot of the Storybook UI interface. On the left, there's a sidebar titled "STORYBOOK" with a "Filter" input field. A blue callout bubble points to this sidebar with the text "Set of Stories". Below it is a tree view of components:

- DynamicLanguages
  - default
  - boundary
  - exceptional** (highlighted with a red arrow)
- OtherComponentX
- OtherComponentY

On the right, the "exceptional" story is expanded, showing the title "Dynamic Languages" and a list of five items:

- Python
- Javascript
- Ruby
- PHP
- Groovy

[See more ...](#)

The browser address bar at the top shows the URL: `localhost:9001/?selectedKind=DynamicLanguages&selectedStory=exceptional`.



- Can define component groups for large component libraries
  - helps others understand the catalogue.

The screenshot shows a web browser window titled "Storybook" displaying a component catalog. On the left, there's a sidebar with a "Filter" input field and a tree view of component groups:

- Group A
  - OtherComponentX
  - DynamicLanguages
    - default
    - boundary
    - exceptional** (highlighted in grey)
- Group B
  - OtherComponentY

The main content area has a title "Dynamic Languages" and a list of components:

- Python
- Javascript
- Ruby
- PHP
- Groovy

[See more ...](#)

# Writing stories

- Fluent-style syntax for writing stories.
  - Method chaining programming style.

```
1 import React from 'react';
2 import { storiesOf } from '@storybook/react';
3 import DynamicLanguages from '../components/dynamicLanguages';
4
5 storiesOf('DynamicLanguages', module)
6   .add('default',
7     () => {
8       let languages = ['Python', 'Javascript', 'Ruby']
9       return <DynamicLanguages list={languages} />
10    }
11  )
12  .add('boundary',
13    () => . . . . .
14  )
15  .add('exceptional',
16    () => . . . . .
17  )
18
19 storiesOf('OtherComponentX', module)
20   .add('state 1',
21     () => . . . . .
22  )
23  . . . . .
```

3 stories/states for DynamicLanguages component

- Story coded in callback argument of add() method.
- add() returns component instance.

# Grouping stories.

- **Use directory pathname pattern**, group/subgroup/.... e.g.  
storiesof('Group A/Component 1')  
.add('...'), () => {.....}  
.add('...'), () => {.....}  
storiesof('Group A/Component 2')  
.add('...'), () => {.....}  
.add('...'), () => {.....}  
storiesof('Group B/Component X')  
.add('...'), () => {.....}  
.add('...'), () => {.....}  
.add('...'), () => {.....}
- **Lots of flexibility with grouping approach.**

... back to components . . .

# Demo Samples

- Storybook server – performs live re-transpilation and re-loading.

The image shows a Storybook interface with a sidebar and a main content area. The sidebar on the left has a 'STORYBOOK' header, a 'Filter' input field, and two sections: 'Samples' and 'Exercises'. The 'Samples' section contains links to '01 - static component', '02 - JSX embedded variables', '03 - component with props', '04 - Component collection (Iteration)', and '05 - component composition'. The 'Exercises' section contains links to '01 - static component', '02 - JSX embedded variables', '03 - component with props', and '04 - iteration'. The main content area on the right shows a file tree for a 'BASICREACTLAB' project. The tree includes a '.storybook' folder, a 'components' folder containing 'exercises' and 'samples' subfolders, and a 'node\_modules' folder. Under 'samples', there are files named '01\_staticComponent.js', '02\_embeddedVar.js', '03\_props.js', '04\_iteration.js', and '05\_hierarchy.js'. Under 'stories', there are files named 'exercises.stories.js' and 'samples.stories.js'. There are also '.gitignore', 'package-lock.json', and 'package.json' files at the root level. Callouts with arrows point from the sidebar items to their corresponding files in the tree:

- A blue callout points from '01 - static component' to '01\_staticComponent.js'.
- A yellow callout points from '02 - JSX embedded variables' to '02\_embeddedVar.js'.
- A blue callout points from '03 - component with props' to '03\_props.js'.
- A blue callout points from '04 - Component collection (Iteration)' to '04\_iteration.js'.
- A blue callout points from '05 - component composition' to '05\_hierarchy.js'.
- A yellow callout points from '01 - static component' to 'exercises.stories.js'.
- A blue callout points from '02 - JSX embedded variables' to 'samples.stories.js'.
- A blue callout points from '03 - component with props' to 'samples.stories.js'.
- A blue callout points from '04 - iteration' to 'iteration'.

# JSX embedded variables.

- Dereference variable embedded in JSX using {} braces.
  - Braces can contain any valid JS expression.
- Reference 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.

- **Achieve reusability through parameterization.**
- **props – Component properties/attribute.**
  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 the component design process.**
- **Reference samples/03\_props.js and related story.**

# Aside – Some JS issues

- **Shorthand arrow function – many parts of the syntax is optional for single-parameter and single body statement cases.**
- **The Array map method – returns a new array based on applying the function argument to every element of the source array.**
- **We can assign a single JSX element to a variable.**

```
9
0  const demo = <div>
1      <h1>Something</h1>
2      <h2>Something else</h2>
3  </div> ;
```

# Component collection - Iteration

- **Use case:** Generate a collection of component/elements instances based on a prop array.
- **Reference** samples/04\_iteration.js

```
▼<div>
  <h1>JS client-side Web</h1>
  ▼<ul> = $0
    ▼<li>
      <a href="https://facebook.github.io/react/">React</a>
    </li>
    ▼<li>
      <a href="https://vuejs.org/">Vue</a>
    </li>
    ▼<li>
      <a href="https://angularjs.org/">Angular</a>
    </li>
  </ul>
</div>
```

Required Real DOM produced by component.  
(From Chrome Dev Tools)

# Component return value.

- **Examples:**
  1. `return <h1>Something</h1> ;`
  2. `return <MyComponent prop1={.....} prop2={.....} /> ;`
  3. `return (`  
    `<div>`  
    `<h1>{this.props.type}</h1>`  
    `<ul>`  
        `. . . . .`  
    `</ul>`  
    `</div>`  
    `) ;`
  - **Must enclose in ( ) when multiline.**

# Component return value.

- **Must return only ONE element.**
- **Error Examples:**
  - ```
return (
  <h1>{this.props.type}</h1>
  <ul>
    . . .
  </ul>
);
```
  - **Error** – ‘Adjacent JSX elements must be wrapped in an enclosing tag’
  - **Solution: Wrap elements in a <div> tag.**

# Component return value.

- **Old solution:**

```
return (  
  <div>  
    <h1>{this.props.type}</h1>  
    <ul>  
      .....  
    </ul>  
  </div>  
) ;
```

- **Added unnecessary depth to DOM → effected performance.**

- **New solution:**

```
return (  
  <>  
    <h1>{this.props.type}</h1>  
    <ul>  
      .....  
    </ul>  
  </>  
) ;
```

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

# Component *Hierarchy*.

*A React application is designed as a hierarchy of components.*

- Components have children – nesting.
- Ref. 05\_hierarchy.js.

The screenshot shows the Storybook interface with a sidebar on the left and a main content area on the right. The sidebar has a search bar and a navigation tree:

- Exercises
- Samples
  - 01 - static component
  - 02 - JSX embedded variables
  - 03 - component with props
  - 04 - Component collection (Iteration)
  - 05 - component hierarchy** (selected)

The main content area displays two sections:

- Ranked client-side frameworks**
  - React
  - Vue
  - Angular

Data sourced from [npm-stat.com](https://npm-stat.com)
- Ranked Server-side Languages**
  - Javascript
  - Python
  - Java

Data sourced from [StackOverflow](https://StackOverflow)

Red boxes and numbers are overlaid on the content to illustrate the component hierarchy:

- A red box encloses the "Ranked client-side frameworks" section, with a red circle containing the number **2** positioned to its right.
- A red box encloses the entire "Ranked client-side frameworks" and "Ranked Server-side Languages" sections, with a red circle containing the number **1** positioned to its right.
- A red box encloses the "Ranked Server-side Languages" section, with a red circle containing the number **3** positioned to its right.

# 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).**

