# ⚛⚛⚛⚛ REACT ⚛⚛⚛⚛

## Why react came in picture

## 🤔 First, Understand Two Styles of Programming

| Style | What it means | How it feels |
|---|---|---|
| Imperative | You tell the computer how to do things step-by-step. | Like giving cooking instructions. |
| Declarative | You tell the computer what you want, and it figures out the how. | Like saying "Make me a pizza"—you care about the result, not the steps. |

## 🔍 So Why Use React When We Have JS?

| Feature | JavaScript (DOM) | React |
|---|---|---|
| DOM updates | Manual | Automatic |
| Code style | Imperative | Declarative |
| State management | You do it yourself | `useState`, `useEffect` etc. |
| Reusability | Harder | Easy (Components) |
| Scaling apps | Difficult | Much easier |
| Performance | Okay | Fast with Virtual DOM |
| Maintainability | Can become messy | Cleaner structure |

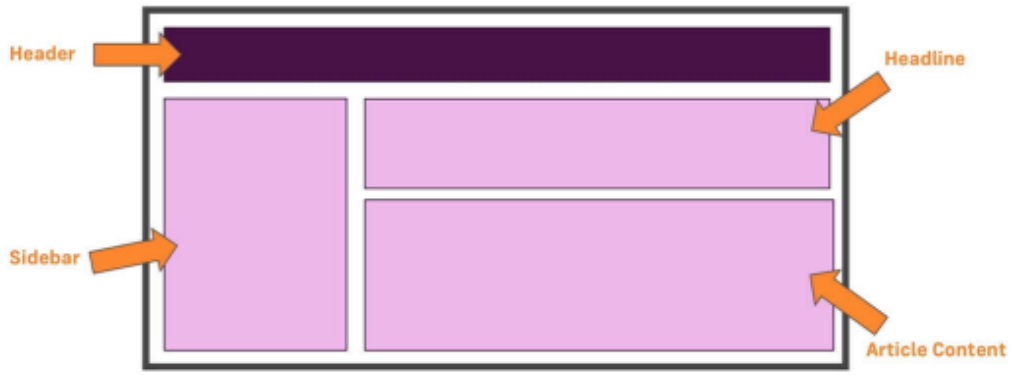
## 📜 JavaScript vs React (Summary Table)

| Feature | JavaScript (Imperative) | React (Declarative) |
|---|---|---|
| **Programming Style** | Imperative (step-by-step instructions) | Declarative (describe what UI should look like) |
| **DOM Manipulation** | Manual (e.g., `document.getElementById`) | Automatic via Virtual DOM |
| **UI Updates** | You handle state + DOM updates yourself | React handles re-rendering automatically |
| **Component Reuse** | Harder to structure and reuse | Easy with components |
| **State Management** | Manual (global vars, event listeners) | Built-in with `useState`, `useReducer`, etc. |
| **Code Maintenance** | Becomes complex as app grows | Cleaner and more manageable |
| **Learning Curve** | Lower initially | Slightly higher, but pays off in large apps |
| **Performance** | Depends on how you write code | Efficient updates with Virtual DOM |
| **Best For** | Small/simple scripts or legacy projects | Modern, scalable, dynamic web apps |

# React

## What is React?

- From the official React page : A JavaScript library for building user interfaces
- Its not a framework; React does only one thing – create awesome UI!
- React is used to build single page applications.
- React.js is a JavaScript library. It was developed by engineers at Facebook.
- React is a declarative, efficient, and flexible JavaScript library for building user interfaces.
- It lets you compose complex UIs from small and isolated pieces of code called “components”.

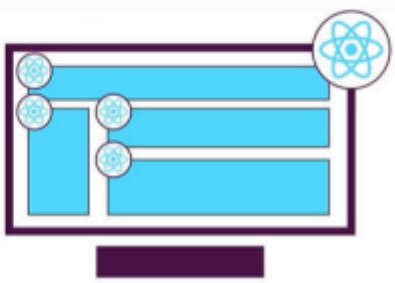



- It uses VirtualDOM instead of RealDOM considering that RealDOM manipulations are expensive.
- Supports server-side rendering.
- Follows Unidirectional data flow or data binding.
- Uses reusable/composable UI components to develop the view.

## Components

- A **Component** is one of the core building blocks of React.
- Its just a **custom HTML element**!

- Every application you will develop in React will be made up of pieces called components.
  - Components make the task of building UIs much easier. You can see a UI broken down into multiple individual pieces called components and work on them independently and merge them all in a parent component which will be your final UI.

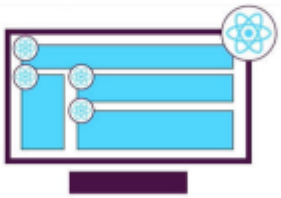


## Creating a functional component

- Components are the essential building blocks of any app created with React
  - A single app most often consists of many components.
- A component is in essence, a piece of the UI - splitting the user interface into reusable and independent parts, each of which can be processed separately.
  - Components are independent and reusable bits of code.
  - It's an encapsulated piece of logic.
  - They serve the same purpose as JavaScript functions, but work in isolation and return HTML via a render function.

```
function ExpenseItem(){
   return <h2>Expense Item</h2>
}
export default ExpenseItem;
```

```
const ExpenseItem = () => {
   return <h2>Expense Item</h2>
}
export default ExpenseItem;
```



## Components & JSX

- When creating components, you have the choice between two different ways:
- Functional components (also referred to as "presentational", "dumb" or "stateless" components)

```
const cmp = () => {
   return <div>some JSX</div>
}
```

*using ES6 arrow functions as shown here is recommended but optional*

- class-based components (also referred to as "containers", "smart" or "stateful" components)

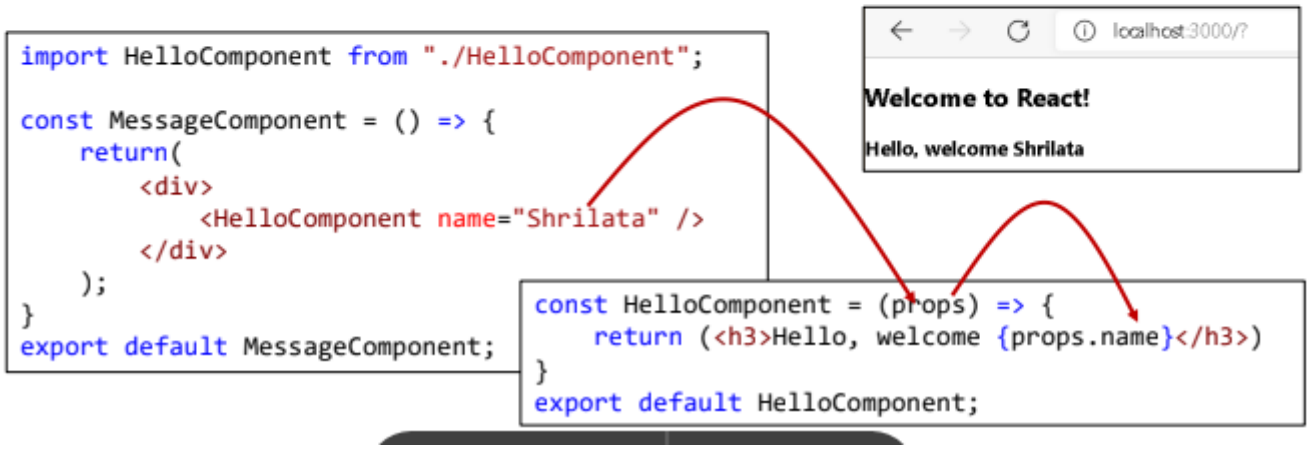
```
class Cmp extends Component {
   render () {
        return <div>some JSX</div>
   }
}
```

# PROPS

Props (short for "properties") are read-only inputs that you pass from a parent component to a child component in React.

# Passing data via 'Props'

- "Props" stands for properties.
  - It is a special keyword in React used for passing data from one component to another.
  - Props are arguments passed into React components.
  - props are read-only. So, the data coming from a parent component can't be changed by the child component.
  - Props are passed to components via HTML attributes.
  - Props can be used to pass any kind of data such as: String, Array, Integer, Boolean, Objects or, Functions




They allow components to be reusable and dynamic by giving them custom data.

💡 Key Points about Props

| Feature | Explanation |
|---|---|
| Read-only | Props cannot be changed inside the child component. |
| Passed down | Always flow from parent → child. |
| Reusable | Make components flexible with different data. |
| Destructuring | Common to use: `function Component({ title }) {}` |

🔒 Can I Modify Props?

- ❌ No — Props are immutable inside the component.
- If you need to change data, you should use state (useState) instead.

```jsx
function Menu() {
  return (
    <main className="menu">
      <h2>Our Menu</h2>
      <Pizza
        name="Pizza Funghi"
        ingredient="Tomato, mozarella, mushrooms, and onion"
        photoName="pizzas/funghi.jpg"
        price={100}
      />
      <Pizza
        name="Pizza Prosciutto"
        ingredient="Tomato, mozarella, ham, aragula, and burrata cheese"
        photoName="pizzas/prosciutto.jpg"
        price={180}
      />
    </main>
  );
}
```

```jsx
function Pizza(props) {
  console.log(props);
  return (
    <div className="pizza">
      <img src={props.photoName} alt={props.name} />
      <div>
        <h3>{props.name}</h3>
        <p>{props.ingredient}</p>
        <span>{props.price + 3}</span>
      </div>
    </div>
  );
}
```

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# Destructuring Props

Props destructuring in React is the practice of extracting specific properties from the props object directly, so you can access them without repeatedly writing props. in your component.

- Props destructuring makes React components more concise, readable, and maintainable by letting you directly extract needed values from the props object.

## ✅ Why We Need It:

We use props destructuring to:

1. **Write cleaner and shorter code**
   → Avoid repeating `props.name`, `props.age`, etc.
2. **Improve readability**
   → You see exactly which props the component uses — right in the function signature.
3. **Avoid clutter inside JSX**
   → Especially useful when there are multiple props.
4. **Make code more maintainable**
   → Easier to update, refactor, and debug.

## 🔁 Comparison Table

| Aspect | Without Destructuring | With Destructuring |
|---|---|---|
| Access syntax | `props.name`, `props.age` | `name`, `age` |
| Readability | 👎 Cluttered with `props.` prefix | 👍 Clear and focused |
| Code length | Longer | Shorter |
| Best in JSX? | No — looks noisy | Yes — looks clean |
| Common use? | Less common | ✅ Preferred in modern React |

## 🛠️ Without Destructuring

jsx Copy Edit

```jsx
function Welcome(props) {
  return (
    <h1>
      Hello {props.name}, you are {props.age} years old!
    </h1>
  );
}
```

- You access values with `props.name`, `props.age`, etc.
- Works fine — but becomes **verbose** with many props.

### ✨ With Destructuring

#### ✅ Inside the function body:

```jsx
function Welcome(props) {
  const { name, age } = props;

  return (
    <h1>
      Hello {name}, you are {age} years old!
    </h1>
  );
}
```

- You pull out `name` and `age` from `props` into their own variables.
- This makes the JSX cleaner.

#### ✅ Even Cleaner: Destructure in the parameter list

```jsx
function Welcome({ name, age }) {
  return (
    <h1>
      Hello {name}, you are {age} years old!
    </h1>
  );
}
```

- This is the **most common** and cleanest way.
- You skip `props` entirely and pull out only what you need.

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# LIST RENDERING

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### 📚 Rendering a List in React

To render a list of items in React, you typically:

1. Use the `.map()` function to loop over an array.
2. Return **JSX** for each item.
3. Provide a **unique** `key` **prop** to each list item.

Why Use a key Prop?

The key helps React identify which items changed, were added, or removed, which improves performance and avoids rendering bugs.

- 🔑 Key should be unique and stable.
- Avoid using index as key if the list can change.

## 🎯 Key Concepts Explained

### 1. `.map()`

- A JavaScript array method.
- Takes a callback and returns a new array.
- Used to convert an array of data → array of JSX.

```js
array.map(item => <JSX />)
```

### 2. `key` Prop

React needs a unique key to track each element:

```jsx
<li key={book.id}>...</li>
```

```jsx
function Menu() {
  return (
    <main className="menu">
      <h2>Our Menu</h2>
      <div>
        <ul className="pizzas">
          {pizzaData.map((pizza) => (
            <Pizza pizzaObject={pizza} key={pizza.name} />
          ))}
        </ul>
      </div>
    </main>
  );
}

function Pizza(props) {
  console.log(props);
  return (
    <li className="pizza">
      <img src={props.pizzaObject.photoName} alt={props.pizzaObject.name} />
      <div>
        <h3>{props.pizzaObject.name}</h3>
        <p>{props.pizzaObject.ingredients}</p>
        <span>{props.pizzaObject.price + 3}</span>
      </div>
    </li>
  );
}
```

## 🔁 `.map()` is **Pure**

### What does "pure" mean?

> A **pure function** is one that **does not change anything outside itself** and **always returns a new value** based only on its input.

### ✅ `.map()`:

- Takes an array.
- Processes each element.
- **Returns a new array** with the transformed results.
- **Does not change** the original array.
- **No side effects.**

### 🧠 Example:

js Copy Edit

```
const numbers = [1, 2, 3];
const doubled = numbers.map(n => n * 2);
console.log(doubled); // [2, 4, 6]
console.log(numbers); // [1, 2, 3] - original array unchanged
```

✔ This is **pure and declarative** — you declare what the new data should look like.

## 🔄 `.forEach()` is **Imperative**

### What does "imperative" mean?

> An **imperative function** tells the program **how to do something**, often involving **side effects** (modifying something outside the function).

### ❌ `.forEach()`:

- Loops over an array.
- **Does not return anything.**
- Meant for running side effects (e.g., logging, changing variables).
- Often used when you're **doing something**, not **producing a new result**.

### 🧠 Example:

```js
const numbers = [1, 2, 3];
const doubled = [];

numbers.forEach(n => {
  doubled.push(n * 2); // Side effect: modifying `doubled` array
});

console.log(doubled); // [2, 4, 6]
```

✔ This is **imperative** — you manually push items, m ge state, and give instructions.

## Why Use map() Instead of forEach() in React for Rendering Lists

Fundamental Difference

- `map()` returns a new array with transformed elements
- `forEach()` returns undefined and only executes a function for each element
- Always use map() when you need to render a list in JSX
- Use forEach only for side effects when you don't need the return value

## 🧠 Why Use `.map()` in React (Not `forEach`):

1. **React needs JSX to be returned**
   When you're rendering a list in React, you need to **return JSX elements** (like `<li>`, `<div>`, `<Card />`) so React knows what to display on the screen.
   - `.map()` creates and **returns a new array** of these elements.
   - `.forEach()` does **not return anything**. It just runs code for each item — which is useful for side effects, but not for rendering.

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2. `.map()` **fits naturally in JSX**
   You can use `.map()` **directly inside JSX**:

```jsx
{users.map(user => <li>{user}</li>)}
```

   But `.forEach()` doesn't return a value, so you **can't use it like this.**

3. **Cleaner, more concise code**
   `.map()` allows you to transform data into UI in a **single line.**
   With `.forEach()`, you'd need to:
   - create an empty array,
   - manually push items into it,
   - and then return it.

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4. **React community standard**
   Using `.map()` is the **standard and recommended** way to render lists in React. It's used in almost every React codebase and documentation, so it keeps your code **idiomatic and familiar** to other developers.

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## ✅ Summary (in one sentence):

> We use `.map()` in React to render lists because it returns an array of JSX elements, which React uses to display content — while `.forEach()` does not return anything useful for rendering.

## Conditional Rendering?

Conditional rendering means showing different UI / div / some portion based on a condition — like whether a user is logged in, or if a shop is open.

- React uses JavaScript logic (like if, ?:, &&) inside JSX to decide what to render.

**1) Ternary Operator condition ? trueUI : falseUI**

```
{isLoggedIn ? <p>Welcome back!</p> : <p>Please log in.</p>}
```

**2) Logical AND (&&) — render only if condition is true**

```
{isOpen && <p>The shop is open!</p>}
```

**3) if...else (outside JSX)**

- Use this if the condition is complex or the JSX is long.

```
let content;
if (isOpen) {
  content = <p>We are open</p>;
} else {
  content = <p>We are closed</p>;
}

return <div>{content}</div>;
```

**4) Early return (guard clause)**

```
if (!isOpen) return <p>Closed</p>;

return <p>We're open!</p>;
```

---

# What are React Fragments?

A React Fragment lets you group multiple elements without adding an extra node to the DOM.

**Why Use Fragments?**

Normally in React, components must return a single parent element. If you want to return multiple siblings, you usually wrap them in a `<div>` — but that adds unnecessary HTML to the DOM.

### 🚫 Without Fragment:

jsx Copy Edit

```jsx
return (
  <div>
    <h1>Hello</h1>
    <p>Welcome</p>
  </div>
);
```

This adds an **extra** `<div>` to the DOM.

### ✅ With Fragment:

jsx Copy Edit

```jsx
return (
  <>
    <h1>Hello</h1>
    <p>Welcome</p>
  </>
);
```

This adds **no extra HTML** — just the `<h1>` and `<p>`.

### 🔑 Where to Use Fragments?

1. Inside .map() when rendering a list of elements that don't need a wrapper

```jsx
const items = ["Pizza", "Pasta"];

return (
  <ul>
    {items.map((item, index) => (
      <React.Fragment key={index}>
        <li>{item}</li>
        <hr />
      </React.Fragment>
    ))}
  </ul>
);
```

2. Inside a component when returning multiple sibling elements.

```jsx
function Welcome() {
  return (
```

```
    <>
      <h1>Hi!</h1>
      <p>Welcome to our store.</p>
    </>
  );
}
```

3. In tables, where adding extra
   would break structure — instead use fragments to return and properly.

```
function Row() {
  return (
    <div>
      <tr>
        <td>Pizza</td>
        <td>$10</td>
      </tr>
    </div>
  );
}
```

---

# REACT STATE

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# React State

- The state is a built-in React object that is used to contain data or information about the component.
- A component's state can change over time; whenever it changes, the component re-renders.
  - The change in state can happen as a response to user action or system-generated events and these changes determine the behavior of the component and how it will render.
- A component with state is known as stateful component.

- State allows us to create components that are dynamic and interactive.
  - State is private, it must not be manipulated from the outside.
  - Also, it is important to know when to use 'state', it is generally used with data that is bound to change.

# React Hooks

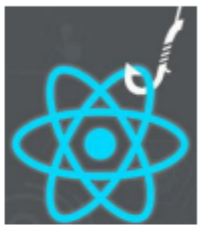
- Hooks allow us to "hook" into React features such as state and lifecycle methods
  - React Hooks are special functions provided by React to handle a specific functionality inside a React functional component.
  - Eg React provides *useState()* function to manage state in a functional component.
  - When a React functional component uses React Hooks, React Hooks attach itself into the component and provides additional functionality.

- You must import Hooks from react
  - Eg : import React, { useState } from "react"; Here - useState is a Hook to keep track of the application state.

- There are some rules for hooks:
  - Hooks can only be called inside React function components.
  - Hooks can only be called at the top level of a component.
  - Hooks cannot be conditional
  - Hooks will not work in React class components.
  - If you have stateful logic that needs to be reused in several components, you can build your own custom Hooks

# Working with “state” in functional component

- The React useState Hook allows us to track state in a function component.
- To use the useState Hook, we first need to import it into our component.
  - import { useState } from "react";
  - We initialize our state by calling useState in our function component.



```
import React, {useState} from 'react';

const UseStateComponent = () => {
    useState(); //hooks go here
}
```

  - useState accepts an initial state and returns two values:
  1. The current state.
  2. A function that updates the state.
  - Eg:

```
function FavoriteColor() {
    const [color, setColor] = useState("");
}
```

    - The first value, color, is our current state.
    - The second value, setColor, is the fuction that is used to update our state.
    - Lastly, we set the initial state to an empty string: useState("")

# Working with “state” in functional component

```
import React, {useState} from 'react';

const UseStateComponent = () => {
    const [counter, setCounter] = useState(0);  //hooks go here

    const btnHandler = () => {
        setCounter(counter+1);
        console.log(counter, "  button clicked")
     }
    return(
           <div>
              Counter : {counter}   
              <button onClick={btnHandler}>increment counter</button>
           </div>
        );
}
export default UseStateComponent;
```


# 📌 Props vs State

Props and State are core concepts in React. They are the only triggers that cause React to re-render components and potentially update the DOM in the browser

- Props : allow you to pass data from a parent (wrapping) component to a child component.
  - Eg : AllPosts Component : “title” is the custom property (prop) set up on the custom Post component.
  - Post Component: receives the props argument. React will pass one argument to your component function; an object, which contains all properties you set up on <Post ... /> .
  - {props.title} then dynamically outputs the title property of the props object - which is available since we set the title property inside AllPosts component

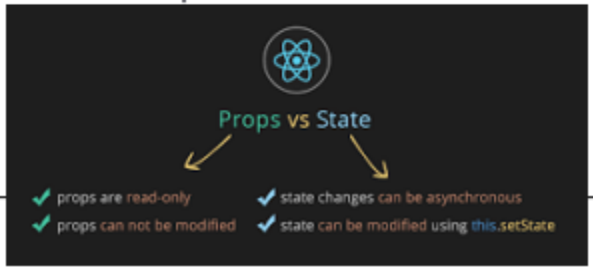
```
//AllPosts
const posts = () => {
    return (
        <div>
            <Post title="My first Post" />
            <Post title="My second Post" />
        </div>
    );
}
```

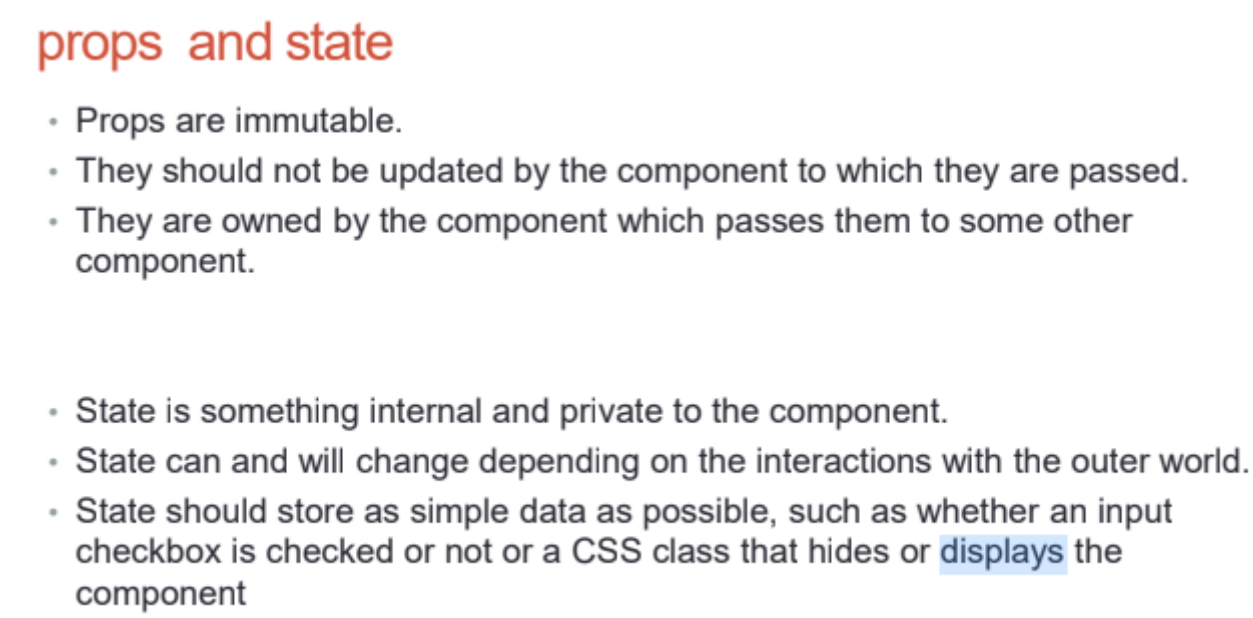
```
//Post
const post = (props) => {
    return (
        <div>
            <h1>{props.title}</h1>
        </div>
    );
}
```

- State : While props allow you to pass data down the component tree (and hence trigger an UI update), state is used to change the component’s, well, state from within.
  - Changes to state also trigger an UI update.
  - Example: NewPost Component: this component contains state . Only class-based components can define and use state . You can of course pass the state down to functional components, but these then can't directly edit it.

```
class NewPost extends Component { // state can only be accessed in class-based components!
    state = {
        counter: 1
    };

    render () { // Needs to be implemented in class-based components! Return some JSX!
        return (
            <div>{this.state.counter}</div>
        );
    }
}
```






## 🧩 Props vs 🧠 State

| Feature | Props | State |
|---|---|---|
| Mutability | Immutable – cannot be changed by the receiving component | Mutable – can be updated using `useState` or similar |
| Ownership | Owned by the **parent** component | Owned and managed by the **same** component |
| Purpose | Pass data and configuration to child components | Store dynamic data that may change during lifecycle |
| Usage | Passed via JSX: `<Component title="Hello" />` | Managed internally: `const [count, setCount] = useState(0)` |
| Example Use | Text, props like `title`, `id`, etc. | Form inputs, toggle states, visibility, active tabs, etc. |
| Modification | Cannot be modified by the child component | Can be updated by event handlers, API responses, etc. |