React Life Cycle

Making React Components Alive

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https://reactjs.org/docs/state-and-lifecycle.html

https://reactjs.org/docs/react-component.html

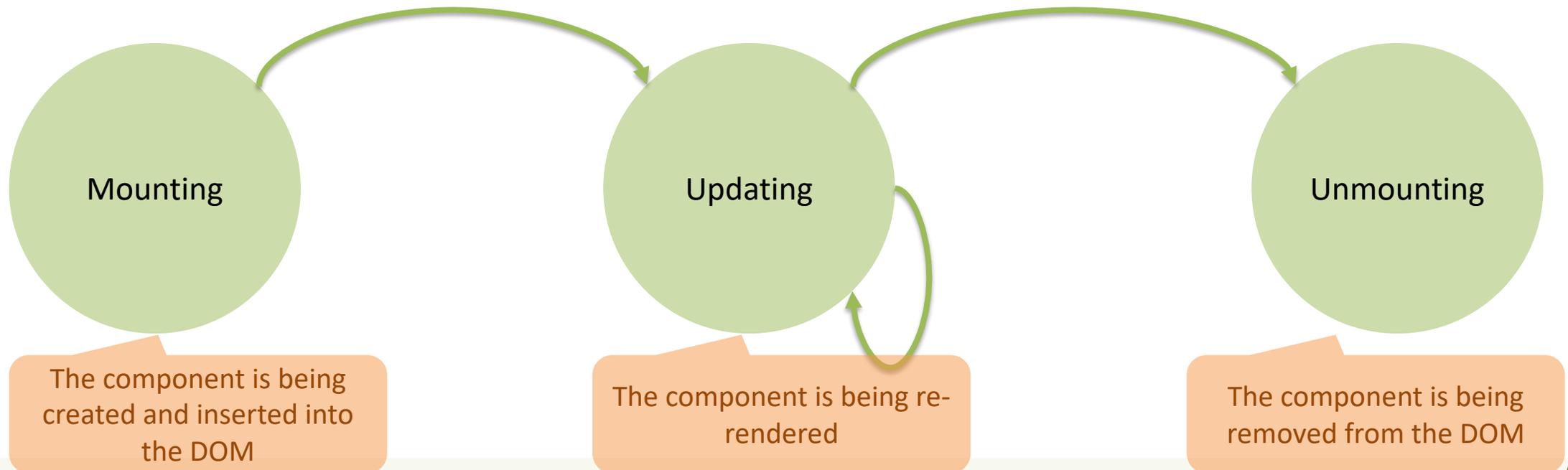https://github.com/Wavez/react-hooks-lifecycle
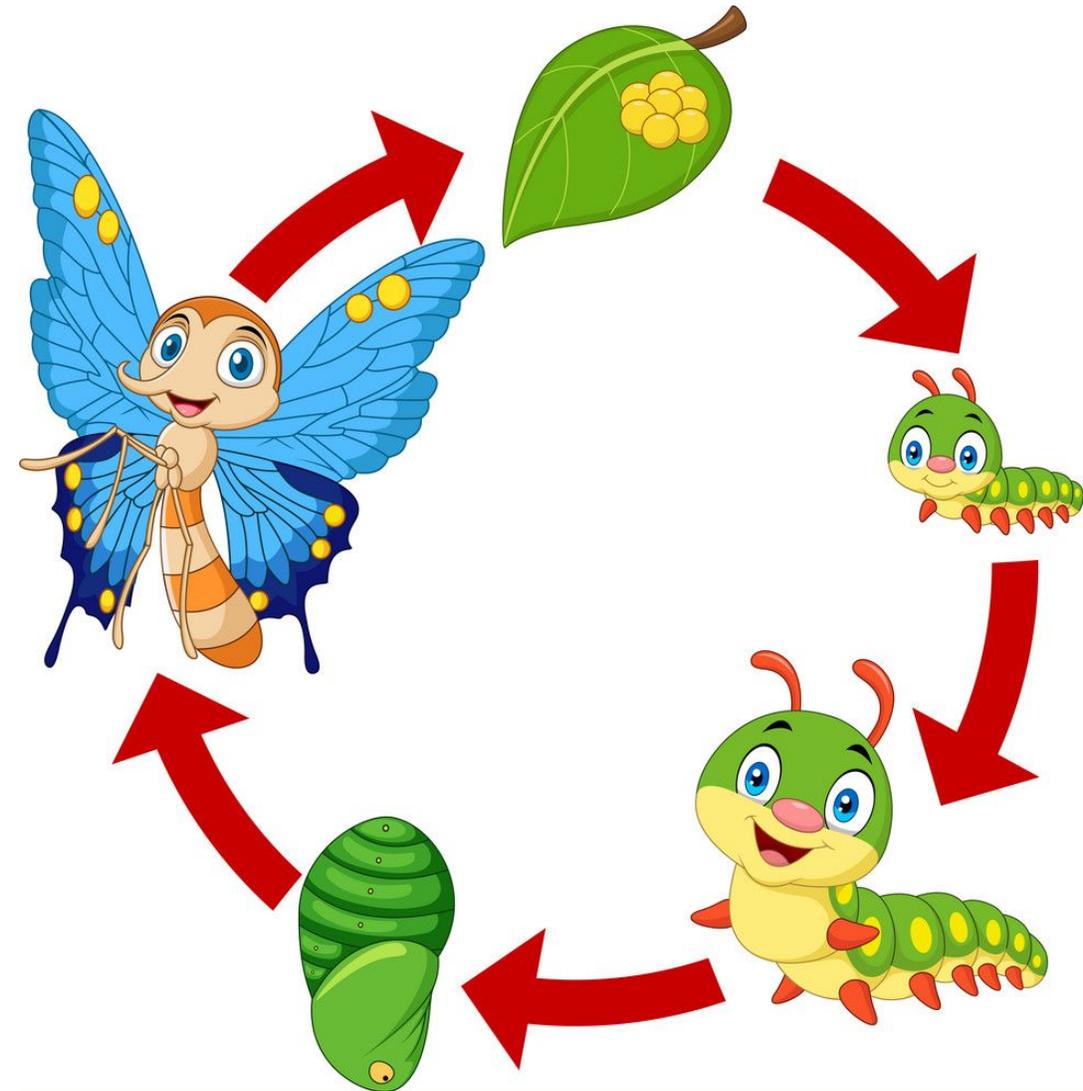
Full Stack React, Chapter "Advanced Component Configuration with props, state, and children"

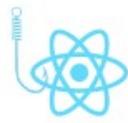There's life before and after `return<JSX>`
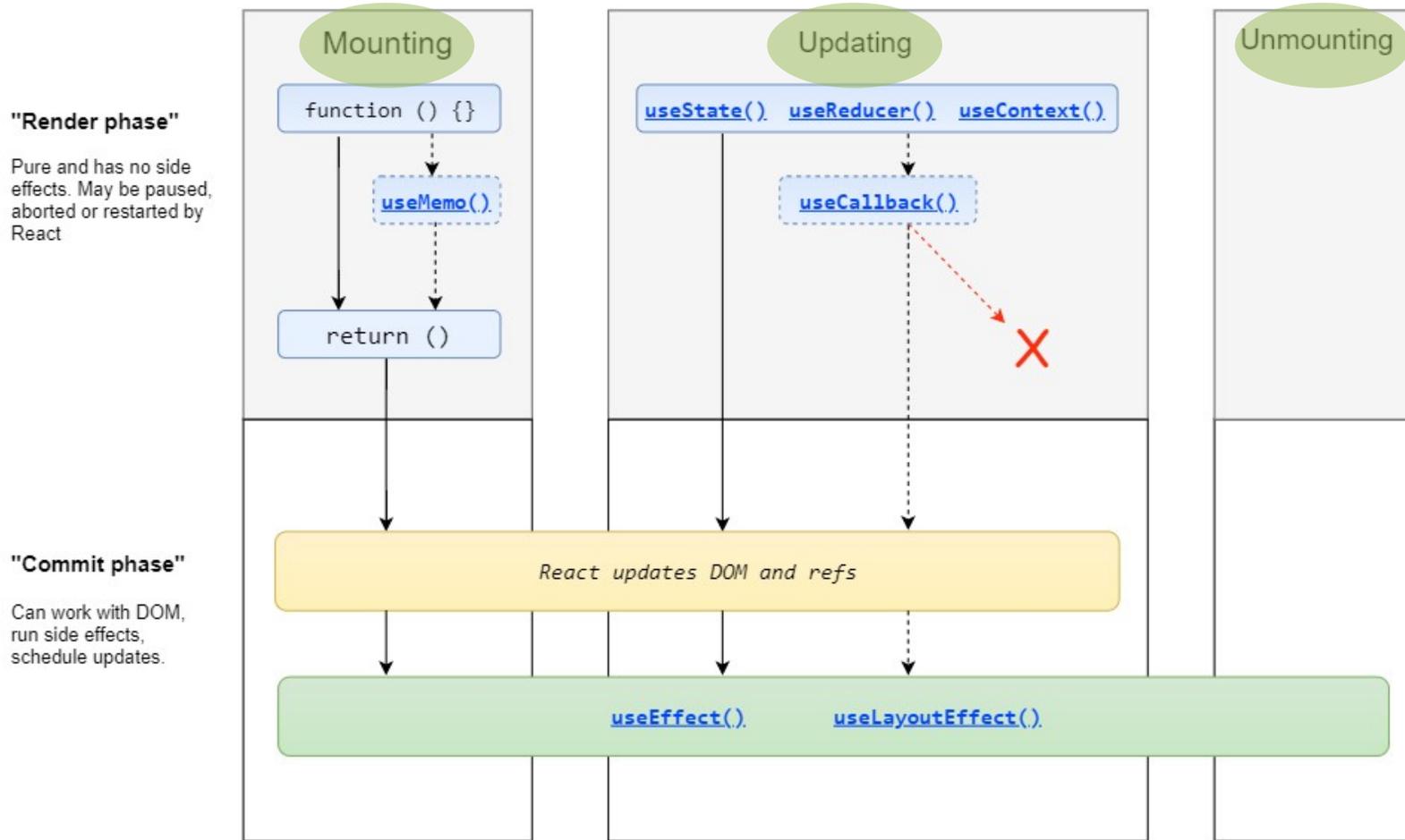
COMPONENTS' LIFECYCLE

Lifecycle Events

- The render action is the most important one for a component
- However, it is also useful to customize what happens at different moments in the evolution of the component

Mounting

Updating

Unmounting

The component is being created and inserted into the DOM

The component is being re-rendered

The component is being removed from the DOM

React Hooks Lifecycle

Mounting · **Updating** · **Unmounting**

"Render phase"

Pure and has no side effects. May be paused, aborted or restarted by React

- function () {}
- useMemo()
- return ()
- useState() useReducer() useContext()
- useCallback()

"Commit phase"

Can work with DOM, run side effects, schedule updates.

React updates DOM and refs

useEffect()   useLayoutEffect()

Made with 💓 by Gal Margalit. Feel free to contribute and share wavez/react-hooks-lifecycle

Side Effects in Function Components

- A functional React component uses props and state to calculate its output
- **Side effect**: any calculation that do not target the output values, anything that affects something *outside the scope of the function component* being executed
- Examples of side effects:
  - **Data fetching**
  - Log recording
  - Setting up a subscriptions (handlers, etc.), or removing them
  - Scheduling additional actions when some state values change
  - Manually changing the DOM in React components
 - Managing timeouts and interval timers
  - ...

Side Effects in Function Components

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  - **Data fetching**
  - Log recording
  - Setting up a subscriptions (handlers, etc.), or
  - Scheduling additional actions when some stat
  - Manually changing the DOM in React compon
  - Managing timeouts and interval timers
  - …

⚠️

The component rendering and side-effect logic are *independent*.

It would be a mistake to perform side-effects directly in the body of the component.
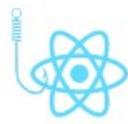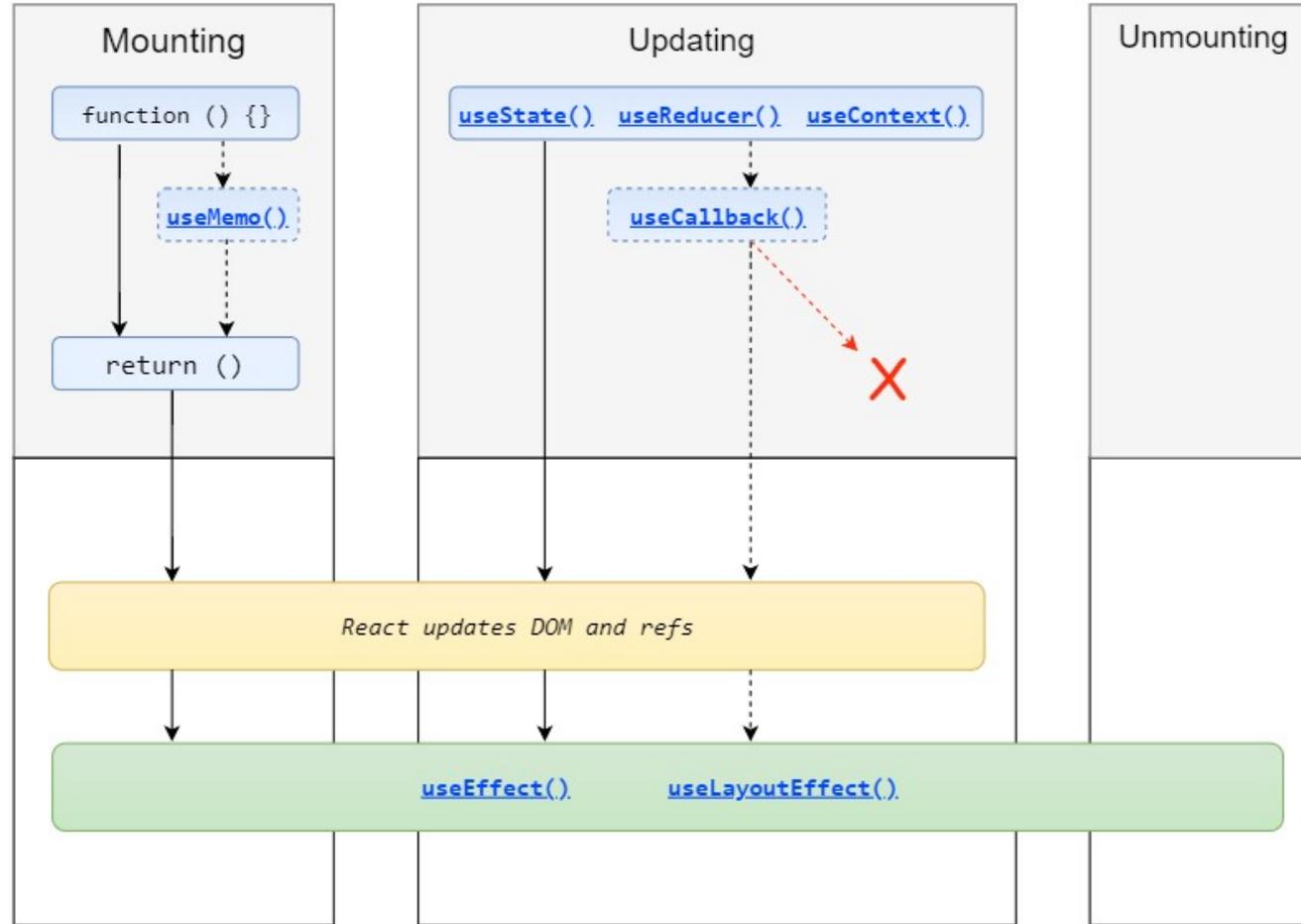
React Hooks Lifecycle

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Mounting

function () {}

useMemo()

return ()

Updating

useState() useReducer() useContext()

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✗

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No side effects
in the render phase

Side effects run after
rendering and DOM
updating

Full Stack React, "Appendix C: React Hooks"

React Handbook, chapter "Hooks"

https://reactjs.org/docs/hooks-effect.html
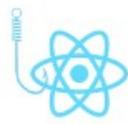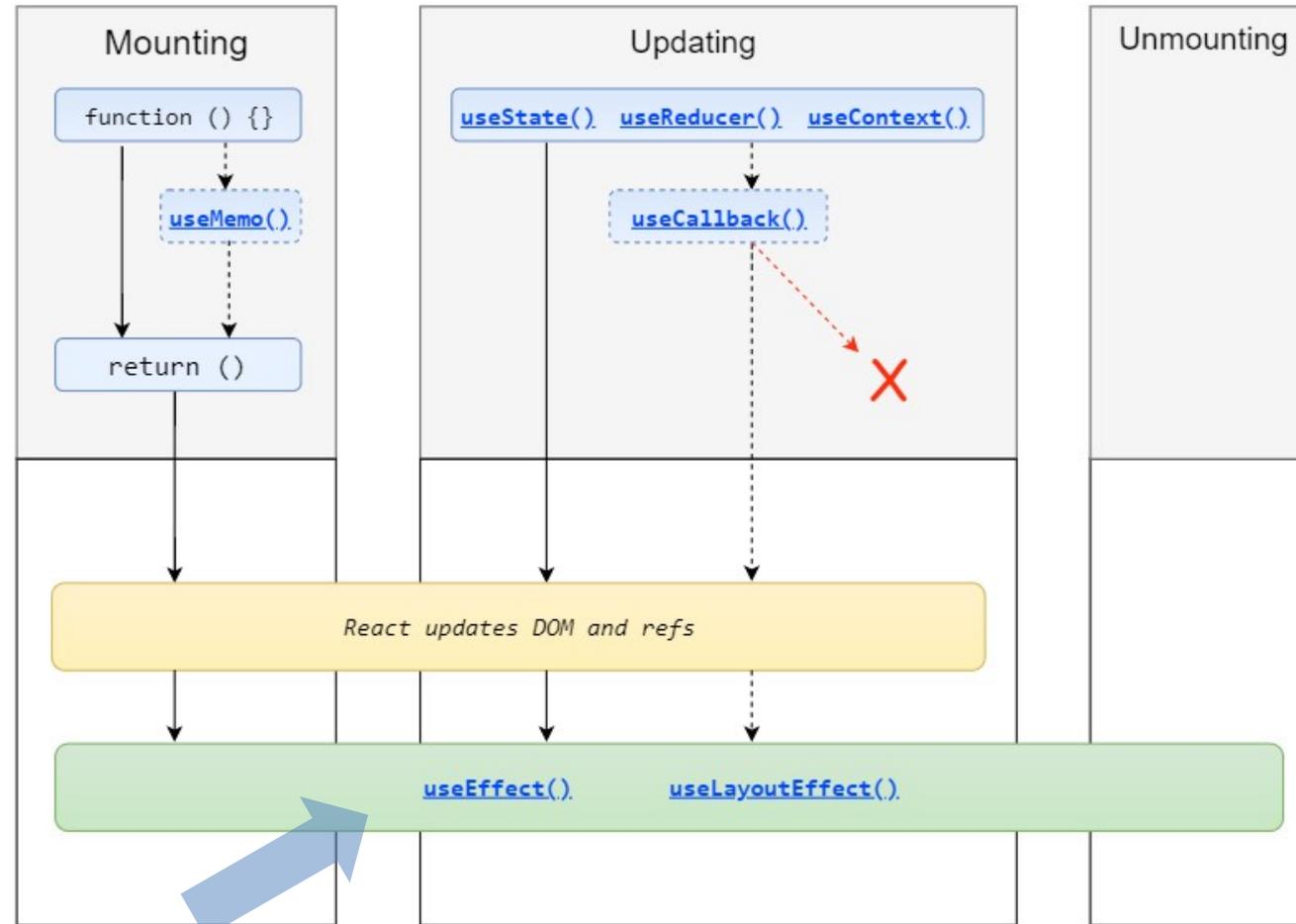
https://dmitripavlutin.com/react-useeffect-explanation/ (source for many examples)

Side-effects and Life Cycle in Functional Components

USEEFFECT HOOK

No Side Effects in Render Function

Side effects are confined within a useEffect hook.

The hook controls their execution

```
function GreetBAD(props) {
    const message = `Hello, ${props.name}!`;
    // Calculates output

    // Bad!
    console.log(`Greetings: ${message}`); // Side-effect!

    return <div>{message}</div>;      // Calculates output
}
```

```
import {useEffect} from "react";

function Greet(props) {
    const message = `Hello, ${props.name}!`;
    // Calculates output

    useEffect(() => {
        // Good!
        console.log(`Greetings: ${message}`); // Side-effect!
    }, []);

    return <div>{message}</div>;      // Calculates output
}
```

The side effect will be executed when React decides to [re-]render.

Never? Once? Twice? When?

Rendering is under React control

How To **useEffect**

Very "dense" API

- useEffect(callback, [dependencies])

What to execute

When to execute it

- – callback: function containing side-effect logic
- – useEffect executes the callback function after React has committed the changes to the screen

- – [dependencies]: an *optional* array of dependencies
- – useEffect executes callback only if at least one of the dependencies have changed between renderings

useEffect's Dependency Array

- **Not provided**: the side-effect runs after *every* rendering

- **An empty array** `[]`: the side-effect runs *once* after the initial rendering

- **Has props or state values** `[prop1, prop2, ..., state1, state2]`: the side-effect runs *once* after the initial rendering, then only *when any dependency value changes*

useEffect's Dependency Array

- **Not provided**: the side-effect runs after *every* rendering

- **An empty array** [ ]: the

```javascript
import { useEffect } from 'react';

function MyComponent() {
  useEffect(() => {
    // Runs after EVERY rendering
  });
}
```

- **Has props or state value** [... ,state2]: the side-effect runs only *when any dependency value changes*

useEffect's Dependency Array

- **Not provided**: the side-effect runs after *every* rendering

- **An empty array** [ ]: the side-effect runs *once* after the initial rendering

- **Has props or state v**
  state2]: the side-e   *ges*

```javascript
import { useEffect } from 'react';

function MyComponent() {
  useEffect(() => {
    // Runs ONCE after initial rendering
  }, []);
}
```

useEffect's Dependency Array

- **Not provided**: the side

- **An empty array** [ ]: th   g

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

function MyComponent({ prop }) {
  const [state, setState] = useState('');
  useEffect(() => {
    // Runs ONCE after initial rendering
    // and after every rendering ONLY IF `prop` or `state` changes
  }, [prop, state]);
}
```

- **Has props or state values** [prop1, prop2, ..., state1, state2]: the side-effect runs only *when any dependency value changes*

Side Effects At Mount Time / Update Time

```
<Count num={num}/> <button onClick={()=>setNum(i=>i+1)}>+</button>
```

```
function Count(props) {

    useEffect( ()=>{ console.log(`My static number is ${props.num}`)},  [] ) ;
    // run only once

    useEffect( ()=>{ console.log(`My dynamic number is ${props.num}`)},  [props.num] ) ;
    // run at every change

    return <div>{props.num}</div> ;
}
```

```
My static number is 3          Count.js:5
My dynamic number is 3         Count.js:8
My dynamic number is 4         Count.js:8
My dynamic number is 5         Count.js:8
My dynamic number is 6         Count.js:8
My dynamic number is 7         Count.js:8
My dynamic number is 8         Count.js:8
My dynamic number is 9         Count.js:8
My dynamic number is 10        Count.js:8
```

Only when the component is *mounted*.

Will print the *initial value* of the num, only.

At mount time, *plus* every time the num changes.

Will print all the values.

Side Effects At Mount Time / Update Time

```
<Count num={num}/> <button onClick={()=>setNum(i=>i+1)}>+</button>
```

```jsx
function Count(props) {

    useEffect( ()=>{ console.log(`My static number is ${props.num}`)},  [] ) ;
    // run only once

    useEffect( ()=>{ console.log(`My dynamic number is ${props.num}`)},  [props.num] ) ;
    // run at every change

    return <div>{props.num}</div> ;
}
```

```
My static number is 3           Count.js:5
My dynamic number is 3          Count.js:8
My dynamic number is 4          Count.js:8
My dynamic number is 5          Count.js:8
My dynamic number is 6          Count.js:8
My dynamic number is 7          Count.js:8
My dynamic number is 8          Count.js:8
My dynamic number is 9          Count.js:8
My dynamic number is 10         Count.js:8
```

TIMELINE

- Component Count is created (num=3) and mounted in App
- Function Count is called
- useEffects are registered (not executed)
- The JSX is returned (with 3)
- Component just mounted => run 1st effect
- Component just mounted => run 2nd effect
- …
- User clicks, App updates state, num changes to 4
- Function Count is called for re-rendering (num=4)
- The JSX is returned (4)
- `props.num` changed (prev=3, curr=4) => run 2nd effect
- …

useState Meets useEffect

- A state variable may be listed as a dependency in an effect
  - When the state changes, the effect is run
  - If the state is updated, but the value does not change, the effect is not run

- Inside a useEffect function, you may schedule a state update
  - The state will be updated after the effect is finished (*asynchronously*)
  - If the state value changes, the component is re-rendered

useState Meets useEffect

```
function QuickGate(props) {
    const [open, setOpen] = useState(false) ;

    useEffect(()=>{
        setTimeout(()=>setOpen(false), 500)
    }, [open]) ;

    const openMe = () => {
        setOpen(true) ;
    } ;

    return <div onClick={openMe}>
        {open ? <span>GO</span> : <span>STOP</span>}
    </div> ;
}
```

TIMELINE

- Component `QuickGate` is created and mounted in App
- Function `QuickGate` is called
- `useState` creates state open with default value
- `useEffect` is registered (not executed)
- The JSX is returned (STOP)
- Component just mounted => run effect
  - `setTimeout` is executed: Timeout is set
- Timeout expires
- `setOpen` is executed
- State open becomes `false` => no change
- ...
- User clicks
- openMe callback is called
  - `setOpen(true)` executed
- State open becomes `true`
- Component re-renders
- The JSX is returned (GO)
- `useEffect` finds open changed (from `false` to `true`)
  - `setTimeout` is executed: Timeout is set
- ...
- Timeout expires
  - `setOpen` is executed
- State open becomes `false`
- Component re-renders
- `useEffect` finds open changed (from `true` to `false`)
- ...

`useEffect` Optional Array Caveats

- Make sure the array includes **all** values from the component scope (such as props and state) that change over time and that are used by the effect

- Otherwise, your code will reference stale values from <u>previous</u> renders
  - **Rule**: every value *referenced inside the effect* function should also appear in the dependencies array
    - *arguments* of the functions
    - variables (and functions) accessed through *closure*

- If the array includes variables that *always change* when executing the effect, you risk having an infinite loop

useState & useEffect Meet fetch

```javascript
import { useEffect, useState } from 'react';

function FetchEmployeesByQuery({ query }) {
  const [employees, setEmployees] = useState([]);

  useEffect(() => {
    async function fetchEmployees() {
      const response = await fetch(
        `/employees?q=${encodeURIComponent(query)}`
      );
      const fetchedEmployees = await response.json(response);
      setEmployees(fetchedEmployees);
    }
    fetchEmployees();
  }, [query]);

  return (
    <div>
      {employees.map(name => <div>{name}</div>)}
    </div>
  );
}
```

- useEffect() can perform data fetching side-effect
- When props.query changes, the effect is run
  – Also at the first component mount
- fetchEmployees fetches data from the server
- When the response is available, the employees state is updated
  – Component will re-render

Note

- The `callback` argument of useEffect(callback) **cannot** be an async function.

- But you can always define and then invoke an `async` function inside the callback itself
  - Inside the function, you may then use `await`

```
function FetchEmployeesByQuery({ query }) {
  const [employees, setEmployees] = useState([]);

  useEffect(() => {   // <--- CANNOT be an async function
    async function fetchEmployees() {
      // ...
    }
    fetchEmployees(); // <--- But CAN invoke async functions
  }, [query]);

  // ...
}
```

Example

```
import {useEffect, useState} from "react";

function TextFlipper(props) {
    const [text, setText] = useState('') ;
    const [flipped, setFlipped] = useState('') ;

    useEffect( ()=>{
        const fetchFlipped = async () => {
            const response = await fetch('/flip?text='+text) ;
            const responseBody = await response.json() ;
            setFlipped( responseBody.text ) ;
        };
        fetchFlipped(text) ;
    }, [text] ) ;

    const handleChange = (ev) => {
        setText(ev.target.value) ;
    } ;

    return <div>
        Text: <input type='text' value={text} onChange={handleChange}/><br/>
        Flipped: {flipped}
    </div> ;
}
```

```
const express = require('express') ;
const flip = require('flip-text') ;

const app = express() ;

app.get('/flip', (req, res) => {
    const text = req.query.text ;
    const flipped = flip(text) ;
    res.json({text: flipped}) ;
});

app.listen(3001, ()=>{console.log('running')})
```

Text: Hello, world
Flipped: pꞁɹoʍ 'oꞁꞁǝH

Handling Slow Responses

```
function TextFlipper(props) {
    const [text, setText] = useState('') ;
    const [flipped, setFlipped] = useState('') ;
    const [waiting, setWaiting] = useState(true) ;

    useEffect( ()=>{
        const fetchFlipped = async () => {
            const response = await fetch('/flip?text='+text) ;
            const responseBody = await response.json() ;
            setFlipped( responseBody.text ) ;
            setWaiting(false);
        };
        setWaiting(true) ;
        fetchFlipped(text) ;
    }, [text] ) ;

    const handleChange = (ev) => {
        setText(ev.target.value) ;
    } ;

    return <div>
        Text: <input type='text' value={text} onChange={handleChange}/><br/>
        Flipped: {waiting && <span>🕐</span>}{flipped}
    </div> ;
}
```

- If HTTP API calls are slow, you can use an extra state to remember whether a call is still ongoing (or if it is been answered)
- The Effect will initially set it to 'waiting', and when the response is back, it may be reset to 'not waiting'
- The component rendering will show in some way that the result is still temporary

Clean-up After Side Effects

- Some side-effects need cleanup: close a socket, clear timers

- If the callback returns a function, then `useEffect()` considers this as an effect cleanup:

```
useEffect(() => {
  // Side-effect...

  return function cleanup() {
    // Side-effect cleanup...
  };
}, dependencies);
```

- Cleanup works in the following way:
  - After initial rendering, `useEffect()` invokes the callback having the side-effect. `cleanup()` function is **not** invoked.
  - On later renderings, before invoking the next side-effect callback, `useEffect()` invokes the `cleanup()` function from the previous side-effect execution (to clean up everything after the previous side-effect), *then* runs the current side-effect.
  - Finally, after unmounting the component, `useEffect()` invokes the `cleanup()` function from the latest side-effect.

Summary: Four Ways To Call **useEffect**

- Once, when the component mounts
  - `useEffect( () => callOnce(), [] )` `// empty 2nd arg`
- On every component render
  - `useEffect( () => callAtEveryRender() )` `// missing 2nd arg`
- On every component render, **if** some values changed
  - in addition, it is called when the component mounts
  - `useEffect( () => callIfAnyDepChange(dep1,dep2), [dep1,dep2])`
- When component unmounts
  - `useEffect( () => { doSomething();`
    `return ()=>cleanupFunction(); }, [] )`

https://dev.to/spukas/4-ways-to-useeffect-pf6

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How To Handle Other Lifecycle Situations

- Full lifecycle is more complex

- Other hooks available for particular situations
  - useLayoutEffect: it fires *synchronously* after all DOM mutations
  - useMemo: returns a *memoized* value (re-computed by a pure function when its parameters change)
  - useCallback: returns a *memoized* callback function

- *Not recommended in general*
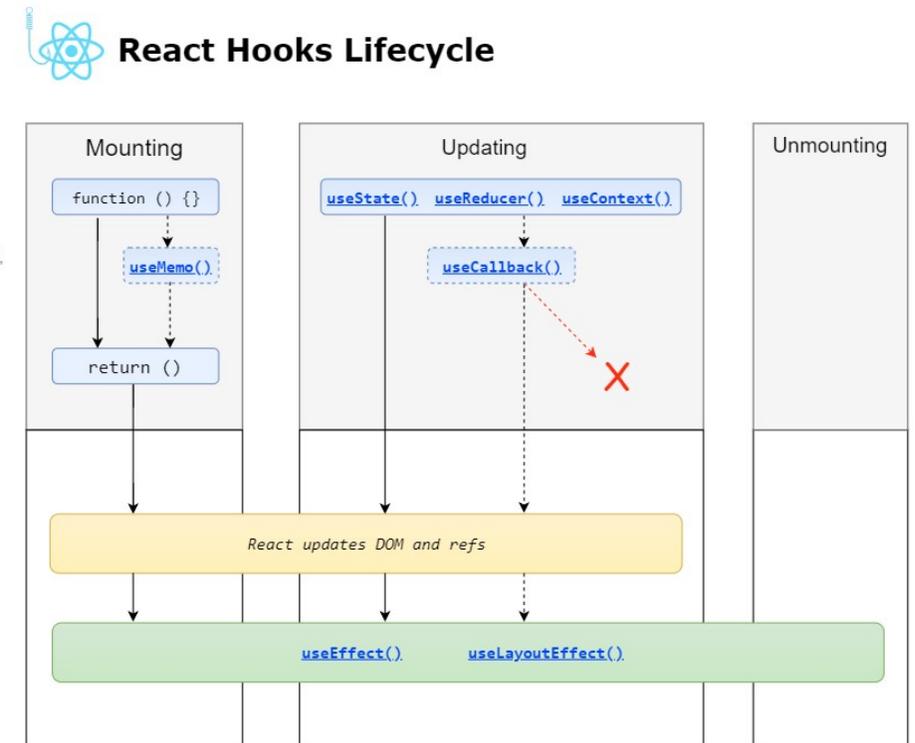
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The Road to Learn React, Chapter "Getting Real with APIs"

Taming the State in React, Chapter "Local State Management"

React as an API Client

HANDLING API CALLS IN REACT

Different Kinds Of State

Application State (or Entity State)

- Retrieved from the back-end

- Should update the back-end
  - on user-initiated CRUD actions

- Should "periodically" check for updates
  - caused by other users, by other open sessions, or by connected systems

- Globally managed, accessible by various components

Presentation State (or View State)

- Not stored in the back-end
  - only in React

- Does not need to persist

- Lives and dies within the controlling Component

- Implemented as **Local State**
 - by using useState

Frequent Use Cases

- How to integrate remote HTTP APIs

- Where/when to load data from remote APIs?

- Delays and "loading…"

- Updating remote data

API Client Classes

- *Recommendation*: keep your fetch methods in a separate JS module (e.g., `API.js`)
- Keeps details of HTTP methods inside the API module
  - API should not depend on React or application state/props
  - Application code should not call fetch or have any HTTP information
- Allows easy swapping with "stub" methods for testing

Conceptual Architecture
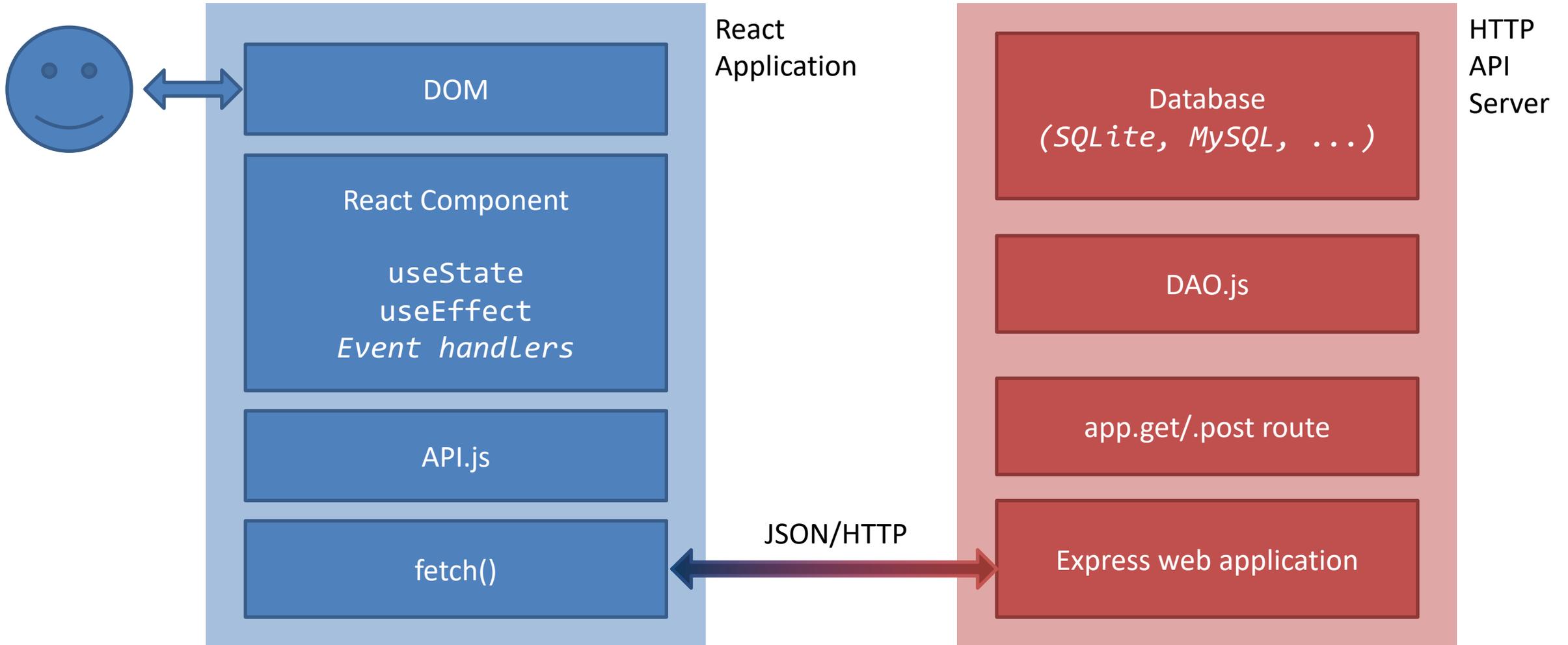
Rehydrating And Dehydrating

- Application State is retrieved via HTTP APIs
  - e.g., from info stored in a DB and accessed through the HTTP API server
- **Rehydrating** the Application State means getting it from the HTTP APIs
  - Must happen when the React application mounts
  - **Best place**: inside a `useEffect(fn, [])` method
- Rehydrating should **also** happen when we want to "refresh" the state
  - The React app cannot know whether *others* changed the info provided by the API server
- **Dehydrating** the Application State means extracting it from the React application
  - May happen several times during the React app execution
  - Should happen <u>whenever</u> something (in the Application State) is modified

Rehydrating At Mount Time

- Very similar to what we saw before…
- Rehydrating may require some time, while the component renders "empty" (with the initial state)
  - use the approach for *handling slow responses*
  - i.e., a loading/waiting local state

```jsx
import { useEffect, useState } from 'react';

function ShoppingList() {
  const [list, setList] = useState([]);
  const [loading, setLoading] = useState(true) ;

  useEffect(()=> {
    const getItems = async () => {
      const response = await fetch('/api/items');
      const items = await response.json();
      setList(items);
      setLoading(false);
    };
    getItems();
  }, []);

return (<>
  {loading && <span>🕐</span>}
  <ul>{list.map((item, i) =>
    <li key={i}>{item}</li>)}</ul>
  </>);
}
```

Rehydrating To Refresh The State

- Once you know that something has been changed in the API server, you can use `useEffect()` as before
  - with one or more dependencies, e.g., `[dep1, dep2]`

- **Beware**: two problems might arise
  - the "n-clients problem"   Next slides
  - infinite loops

The "N-Clients Problem"

- We are creating a web application that will be opened on *multiple* browsers at once
  - They read and write info from a *unique* API server, however
- What happens in the web app running in, e.g., Browser 1 when Browser 3 updates something in the API server?
  - How can one web app know that *someone else* changed *something* in the server?

Browser 2

Browser 1

API server

Browser 3

Browser 4
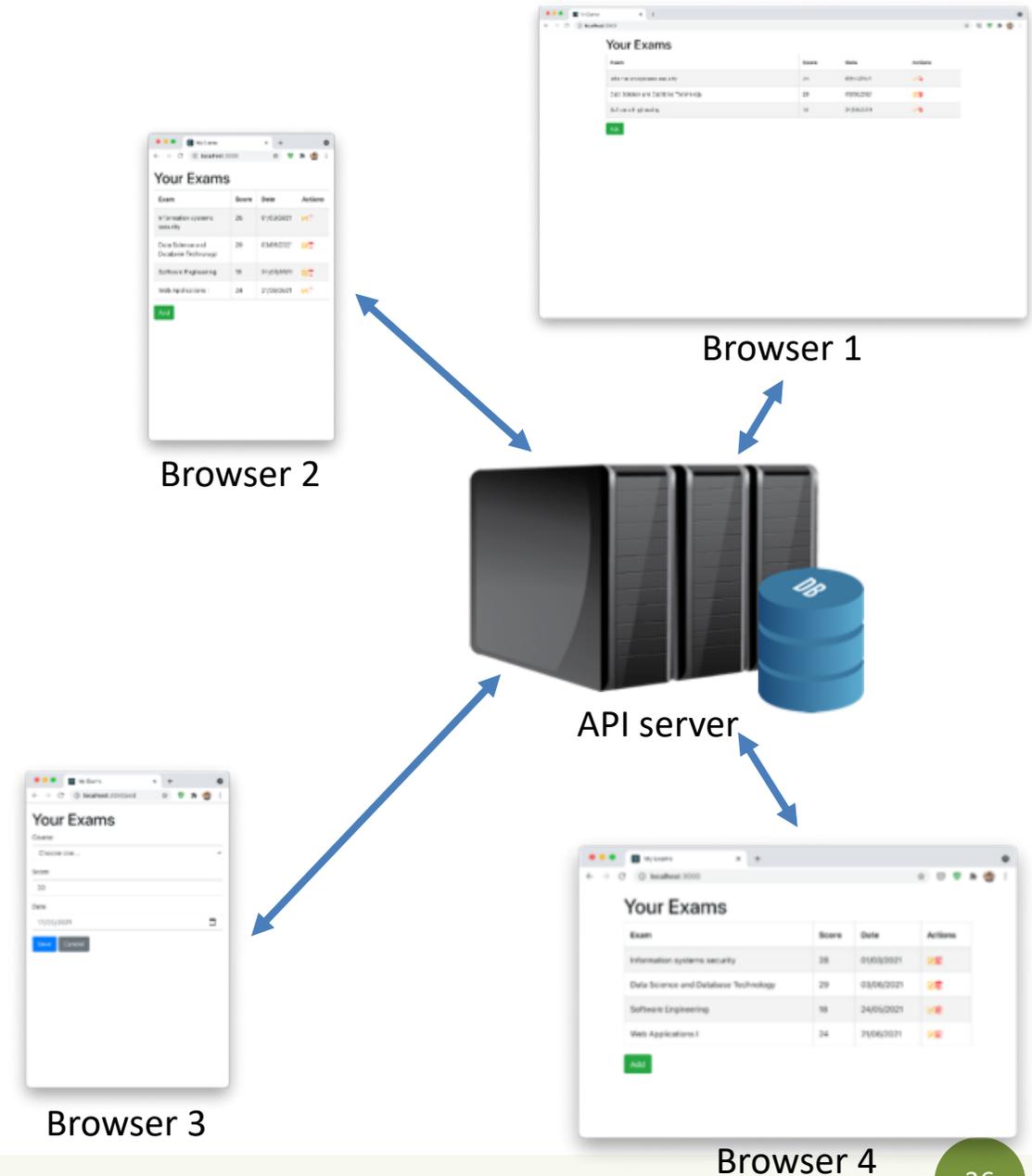
The "N-Clients Problem"

The Better-Than-Nothing Solution

- The *web app* asks for data as frequently as possible
  - when it loads a new page/view
  - after adding/updating/removing something
  - periodically (i.e., polling)
  - ...

- **Not a solution**: just a way to *minimize* the problem

The Real Solution

- The *server* communicates changes as soon as they appear
  - to *all* the current consumers of its information

- **Out of scope** for this course
  - unfortunately!

- For the curious:
  - WebSockets (e.g., https://socket.io)
  - PubSub mechanisms

Infinite Loops with `useEffect`

- One of the main pitfalls that might happen with `useEffect`
  - infinite loops both in rendering and in external (e.g., HTTP) calls
  - especially when `useEffect` is used with `useState`

- Two significant cases:
  1. The dependency array is missing, but it should not
  2. One of the items in the dependency array is a JavaScript Object { } or Array [ ]

Examples from: https://dmitripavlutin.com/react-useeffect-infinite-loop/

Example: Missing Dependencies

What is wrong, here?

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

function CountInputChanges() {
  const [value, setValue] = useState('');
  const [count, setCount] = useState(-1);


  useEffect( () => setCount((c) => (c + 1)) );


  const handleChange = (ev) => setValue(ev.target.value);


  return (
    <div>
      <input type="text" value={value} onChange={handleChange} />
      <div>Number of changes: {count}</div>
    </div> );
}
```

1. Set Up Dependencies Correctly

- Without the dependency (no dependency array), the code in the example will re-render the component **forever**

- It is also a clear error:
  - the update of count depends on the change of value

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

function CountInputChanges() {
  const [value, setValue] = useState('');
  const [count, setCount] = useState(-1);

  useEffect( () => setCount((c) => (c + 1)), [value] );

  const handleChange = ({ target }) =>
setValue(target.value);

  return (
    <div>
      <input type="text" value={value}
onChange={handleChange} />
      <div>Number of changes: {count}</div>
    </div> );

}
```

Example: Objects as Dependencies

What is wrong, here?

```
function CountSecrets() {
  const [secret, setSecret] = useState({ value: "", countSecrets: 0 });

  useEffect(() => {
    if (secret.value === 'secret')
      setSecret(s => ({...s, countSecrets: s.countSecrets + 1}));
  }, [secret]);

const onChange = (ev) => { setSecret(s => ({ ...s, value: ev.target.value })); };

return ( <div>
    <input type="text" value={secret.value} onChange={onChange} />
    <div>Number of secrets: {secret.countSecrets}</div>
  </div>
);
```

2a. Avoid Objects As Dependencies

- **Problem**: `secret` as a dependency!

- Inside `useEffect`, when the input value equals 'secret', `setSecret()` is called

- `setSecret()` increments the secrets counter, but also creates a new object
  - secret is now a new object, and the dependency has changed

- So `useEffect` invokes again the callback that updates the state, and a new `secret` object is created again, etc.

- **How to solve:** do <u>not</u> use objects as dependencies!

```jsx
import { useEffect, useState } from 'react';

function CountSecrets() {
  const [secret, setSecret] = useState({ value: "",
countSecrets: 0 });

  useEffect(() => {
    if (secret.value === 'secret')
      setSecret(s => ({...s, countSecrets: s.countSecrets
+ 1}));
  }, [secret.value]);


const handleChange = ({ target }) => { setSecret(s => ({
...s, value: target.value })); };

return ( <div>
    <input type="text" value={secret.value}
onChange={handleChange} />
    <div>Number of secrets: {secret.countSecrets}</div>
  </div>
);
```

2b. Avoid Arrays As Dependencies

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

function ShoppingList() {
  const [list, setList] = useState([]);

  useEffect(()=> {
    const getItems = async () => {
      const response = await fetch('/api/items');
      const items = await response.json();
      setList(items);
    };
    getItems();
  }, []); // don't use: [list]

return (
  <ul>{list.map((item, i) => <li
key={i}>{item}</li>)}</ul>
  );
}
```

- The same issue might happen with arrays…

- … so, it is better to avoid arrays as dependencies
  – you can use an empty dependency array [ ]
  – or an additional state to trigger useEffect
  – or any item in the array, the `length` property (if appropriate), or …

Dehydrating During Updates

```
const addItem = async () => {
  setList(items => [...items, element]);

  const response = await fetch('/api/items', {
    method: 'POST',
    body: element,
  });
  ...
};


return (...
    <input type="text" value={element} ... }></input>
    <button onClick={addItem}>Add</button>
  ...);
```

> The two updates (remote API, local state) run **in parallel**.
>
> **Optimistic** state update: it assumes that remote state will be updated without errors => **Risky!**

Dehydrating During Updates – Alternative

```
const addItem = async () => {

  const response = await fetch('/api/items', {
    method: 'POST',
    body: element,
  });
  if (response.ok)
    setList(items => [...items, element]);
  ...
};

return (...
    <input type="text" value={element} ... }></input>
    <button onClick={addItem}>Add</button>
  ...);
```

> The state is updated only **after** checking that the request is successfully
> => **No parallel updates!**
>
> **Issue**: the user of our app will <u>not</u> see the just added item for a while…

During Updates: Dehydrate And Rehydrate

```
function ShoppingList() {
  const [list, setList] = useState([]);
  const [element, setElement] = useState('');
  const [update, setUpdate] = useState(true);

  useEffect(()=> {
    if(update) {
      const getItems = async() => {
        const response = await fetch('/api/items');
        const items = await response.json();
        setList(items);
        setUpdate(false);
      };
      getItems();
    }
  }, [update]);

  const addItem = async () => {
    setElement('');
    setList(items => [...items, `${element} (temp)`]);

    const response = await fetch('/api/items', {
      method: 'POST',
      body: element,
    });
    if (response.ok)
      setUpdate(true);
  };

  return (<>
    <ul>{list.map((item, i) => <li key={i}>{item}</li>)}</ul>
    <input type="text" value={element}
onChange={(ev)=>setElement(ev.target.value)}></input>
    <button onClick={addItem}>Add</button>
  </>
  );
}
```

1. **Update** the state in parallel so that the user can see that the operation was *completed*
2. **Mark** the just updated item as *temporary*
   - e.g., by using a different background color, label, … than the others
3. **Refresh** the *entire* component as soon as the server completes the update operation
   - successfully or not

Full Stack React, "Appendix C: React Hooks"

React Handbook, chapter "Hooks"

https://reactjs.org/docs/hooks-rules.html

Peeking Under the Hood

THE RULES OF HOOKS

Quiz

- What is the "magic" behind `useState`?

- How can the same function return different state variables?

- How can the values be persisted across function calls?

```
function Example(props) {

  [hidden, setHidden] = useState(true) ;
  [count, setCount] = useState(0) ;
  [mode, setMode] = useState('view') ;

  . . .

  setHidden(false) ;
  . . .
  setCount( c => c+1 ) ;
  . . .
  setMode('edit') ;
  . . .

}
```

Answer

- React associates to each functional component an array of Hook "slots"
  - Slots are stored with the function, therefore they are persistent
- Each time you call a Hook, a new "slot" is used
  - The first time, it is created
  - The other times, it is reused

```
function Example(props) {

  [hidden, setHidden] = useState(true) ;
  [count, setCount] = useState(0) ;
  [mode, setMode] = useState('view') ;

  . . .

  setHidden(false) ;
  . . .
  setCount( c => c+1 ) ;
  . . .
  setMode('edit') ;
  . . .

}
```

Corollary

- React must "know" which functions may host Hooks
- Hooks must always be called in the same order each time a component renders

```
function Example(props) {

  [hidden, setHidden] = useState(true) ;
  [count, setCount] = useState(0) ;
  [mode, setMode] = useState('view') ;

  . . .

  setHidden(false) ;
  . . .
  setCount( c => c+1 ) ;
  . . .
  setMode('edit') ;
  . . .

}
```

Hook Usage Rules

- Only Call Hooks at the Top Level
  - Always call Hooks at the top level of your React function
  - Do not call Hooks inside loops, conditions, or nested functions

- Only Call Hooks from React Functions
  - Do not call Hooks from regular JavaScript functions
  - You may call Hooks from React function components
  - You may call Hooks from custom Hooks

https://reactjs.org/docs/hooks-rules.html

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