O'REILLY®

From Local State to Global Control

September 2023

Introduction

About me

- Author

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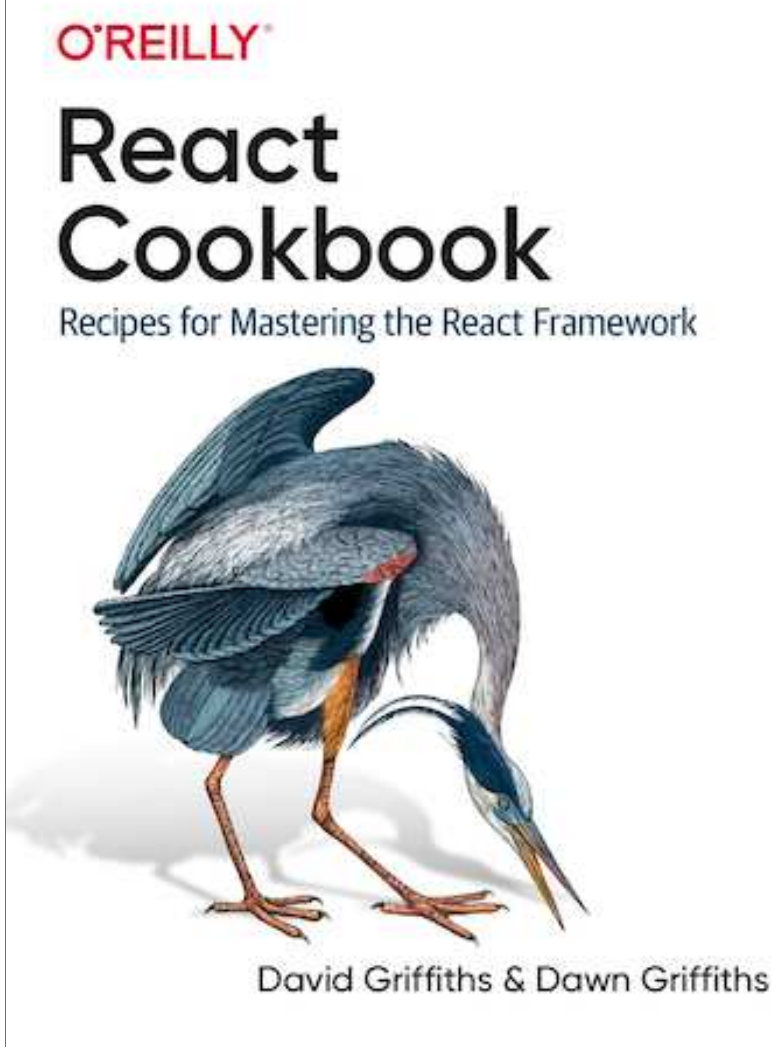

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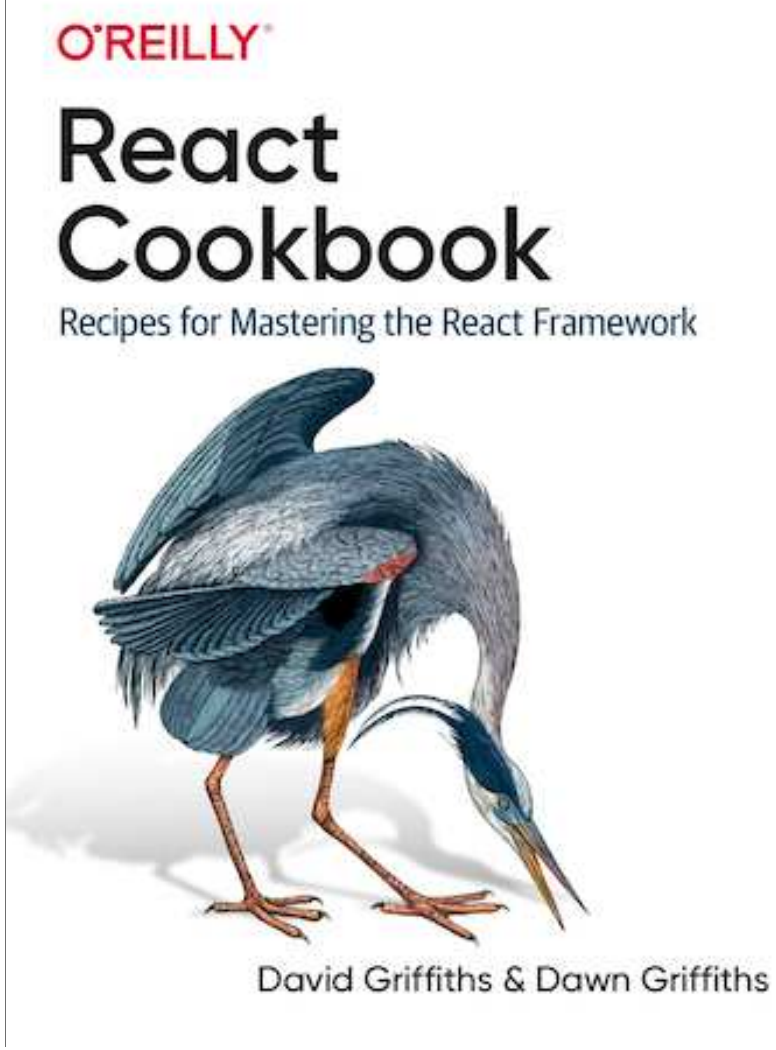
- https://www.herescreen.com



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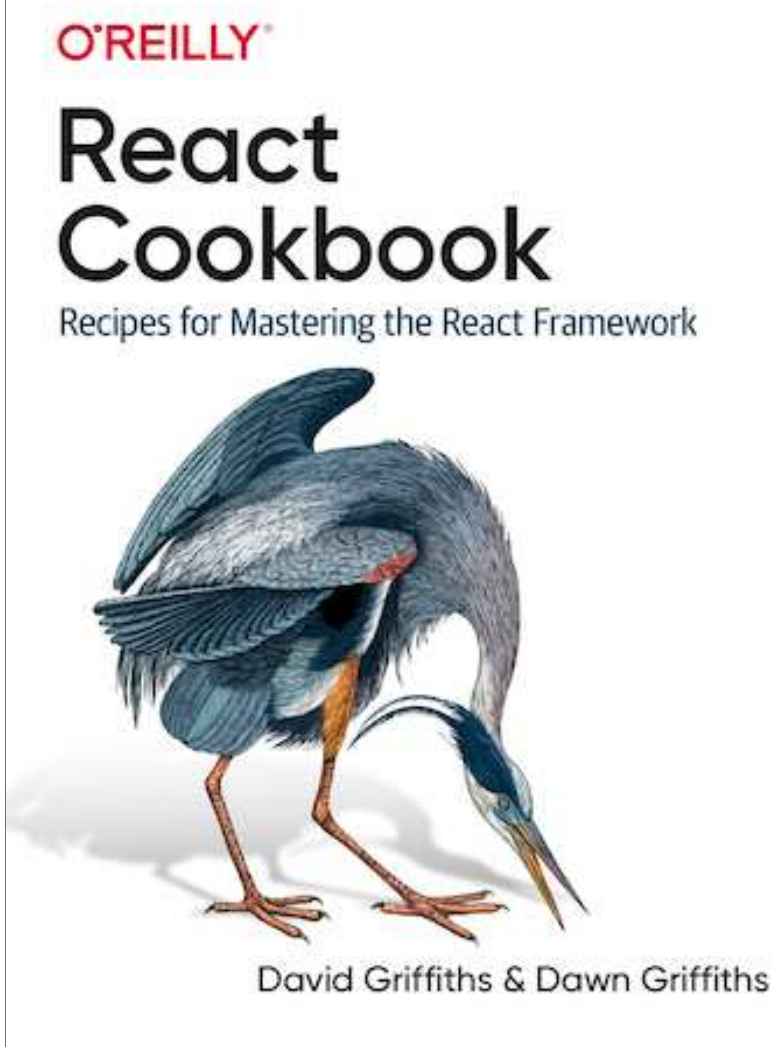
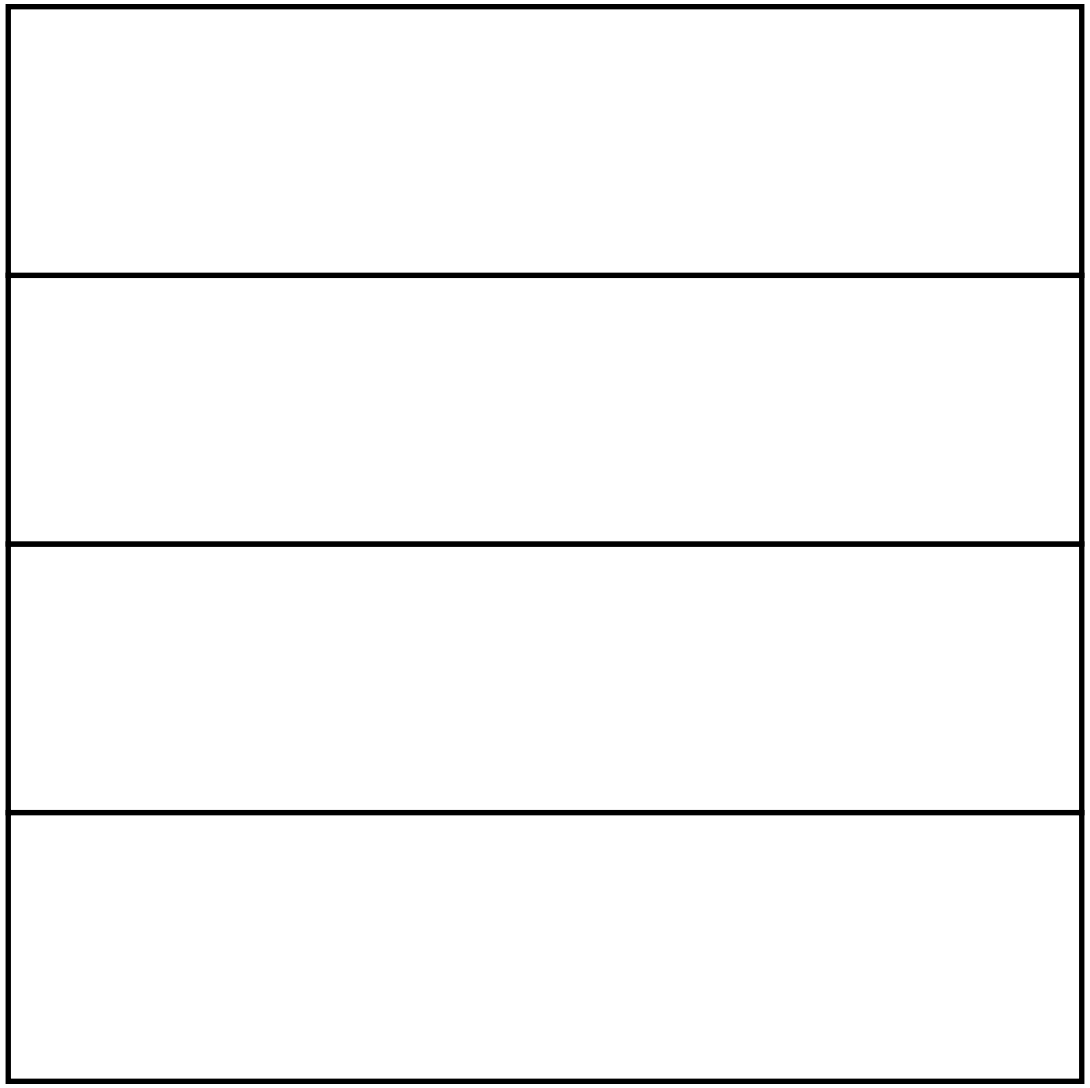
- https://www.herescreen.com
- https://linktr.ee/dogriffiths



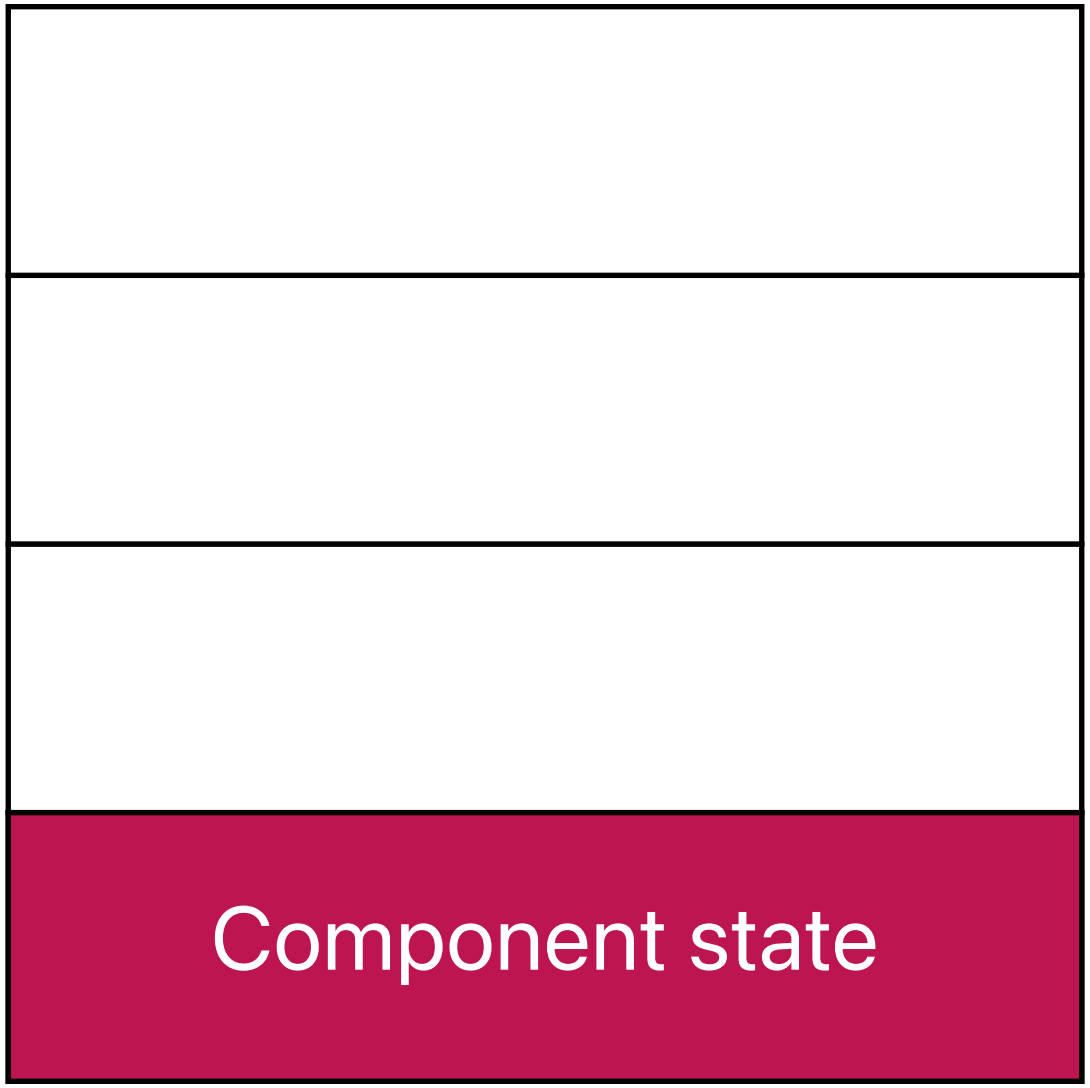
Why write the book?

Component state

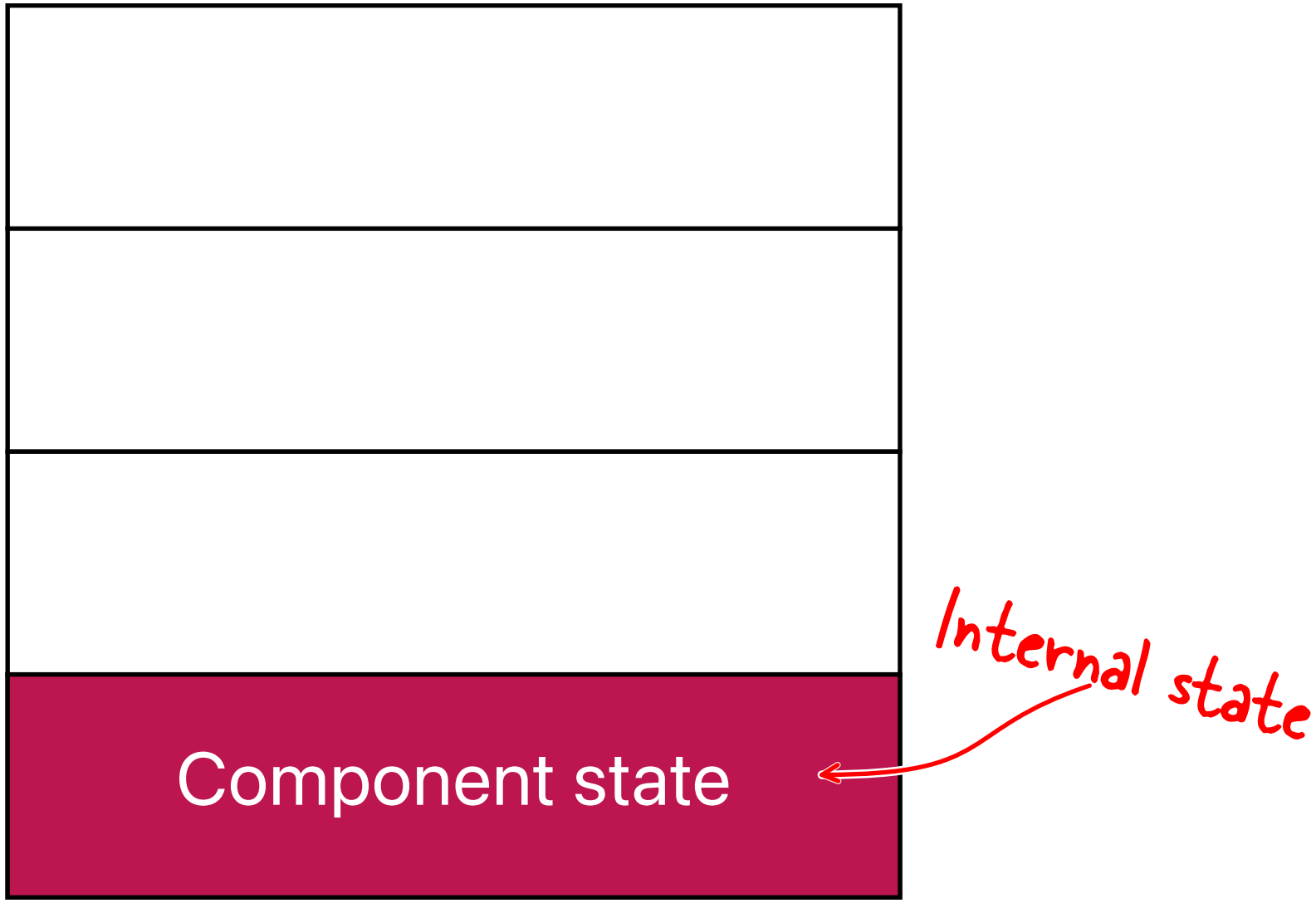
Different levels of state



Different levels of state



Different levels of state



useState

```
const [name, setName] = useState("")
return <>
</>
```

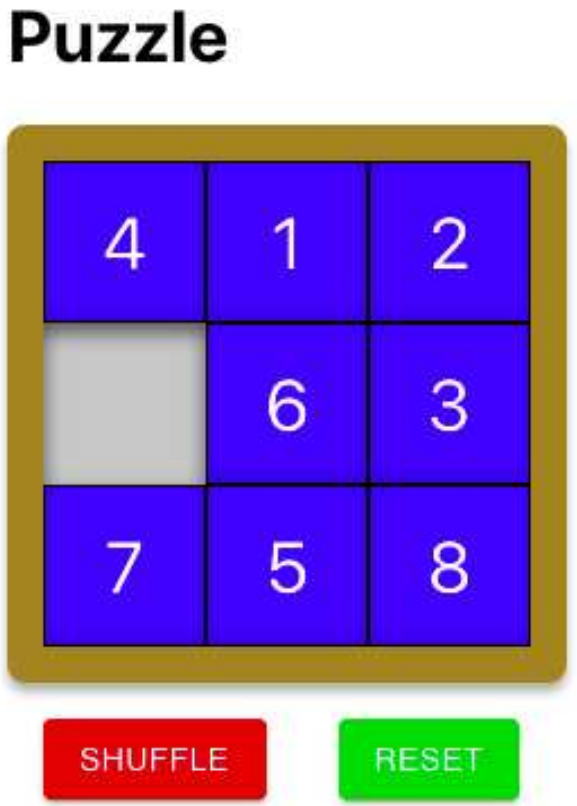
useState

```
const [name, setName] = useState("")
return <>
  Name: {name}
</>
```

useState

```
const [name, setName] = useState("")
return <>
  Name: {name}
  <input value={name}
         onChange={(evt) => setName(evt.target.value)}
      />
</>
```

Complex components



Developer response

Managing complex component state (recipe 3.1)

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- Some components might have many `useState()` calls

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- There might be complex code that then uses those values

Managing complex component state (recipe 3.1)

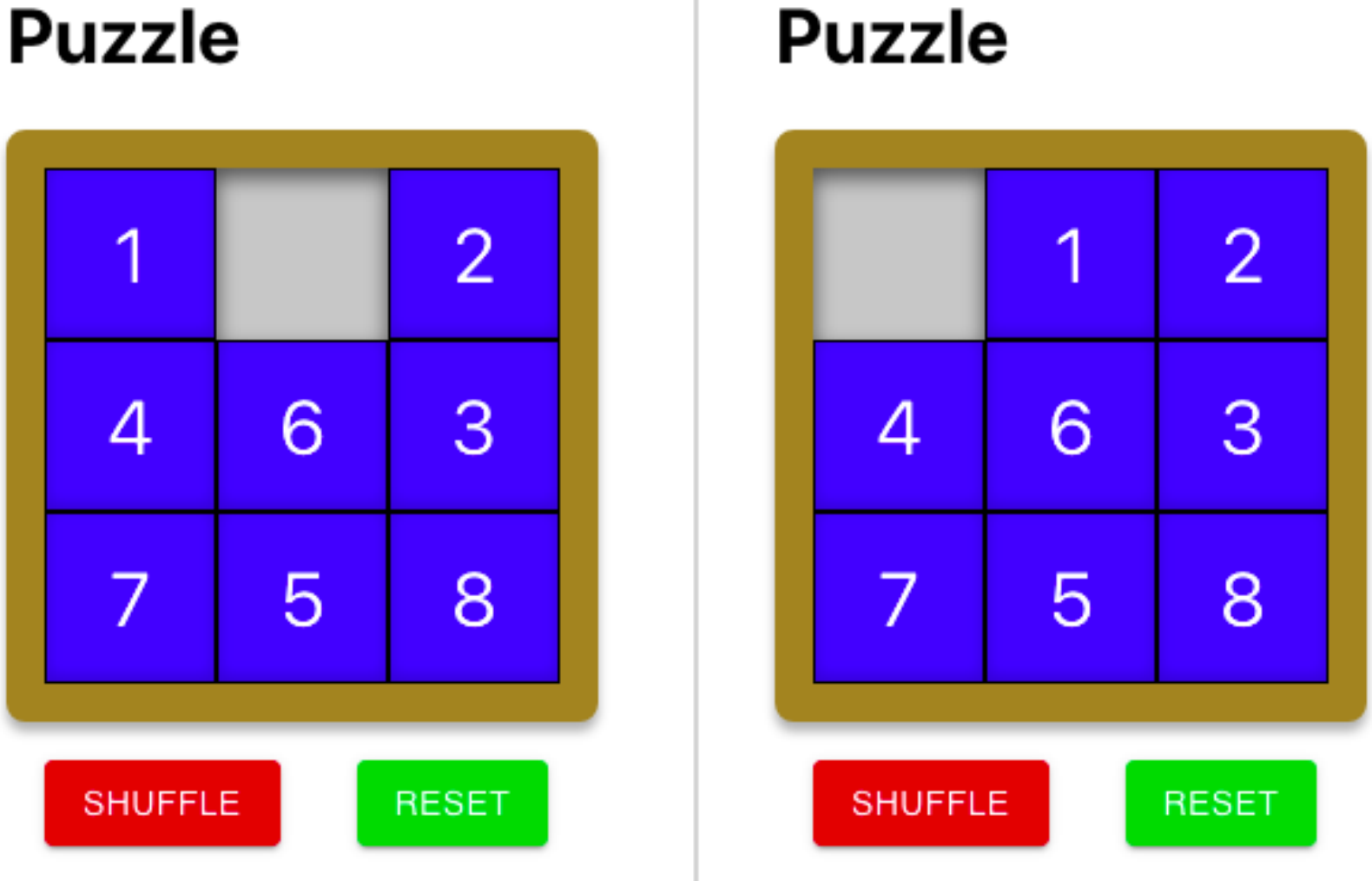
- Some components might have many `useState()` calls
- There might be complex code that then uses those values
- You can extract from the complex state code into a **reducer**

Create a reducer: reducer.js

```
function reducer(state, action) {
}

export default reducer
```

Moving a tile



Create a reducer: reducer.js

```
function reducer(state, action) {
}

export default reducer
```

Example state and action

```
state = {
  items: ['1', null, '2', '4', '6', '3', '7', '5', '8'],
}

action = {
    type: 'move',
    payload: 0
}
```

New state object returns

```
return {
  items: [null, '1', '2', '4', '6', '3', '7', '5', '8'],
}
```

Create a reducer: reducer.js

```
function reducer(state, action) {
}

export default reducer
```

Create a reducer: reducer.js

```
function reducer(state, action) {
  switch (action.type) {
  }
}

export default reducer
```

Create a reducer: reducer.js

```
function reducer(state, action) {
  switch (action.type) {
    ....
    case 'shuffle': {
      let newState = { ...state }
      do {
        for (let i = 0; i < 300; i++) {
          newState = reducer(
            { ...newState },
            {
              type: 'move',
              payload: Math.floor(Math.random() * 9),
            }
          )
        }
      } while (newState.complete)
      return newState
    }
    default: {
      throw new Error('Unknown action: ' + action.type)
    }
  }
}

export default reducer
```

Using a reducer

```
import reducer from './reducer'
```

Using a reducer

```
import reducer from './reducer'
...
const [state, dispatch] = useReducer(reducer, {
    items: ['4', '1', '2', '7', '6', '3', null, '5', '8'],
  })
```

Using a reducer

```
import reducer from './reducer'
...
const [state, dispatch] = useReducer(reducer, {
    items: ['4', '1', '2', '7', '6', '3', null, '5', '8'],
  })
...
return <>
  <p>There are {state.items.length} items</p>
</>
```

Using a reducer

```
import reducer from './reducer'
...
const [state, dispatch] = useReducer(reducer, {
    items: ['4', '1', '2', '7', '6', '3', null, '5', '8'],
  })
...
return <>
  <p>There are {state.items.length} items</p>
  <button onClick={() => dispatch({ type: 'shuffle' })}>
     Shuffle
  </button>
</>
```

Testing a reducer

```
import reducer from './reducer'

describe('reducer', () => {
})
```

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describe('reducer', () => {
    it('should say when it is complete', () => {
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        let state = {
            items: ['1', '2', '3', '4', '5', '6', '7', null, '8'],
        }
    })
})
```

Testing a reducer

```
import reducer from './reducer'

describe('reducer', () => {
    it('should say when it is complete', () => {
        let state = {
            items: ['1', '2', '3', '4', '5', '6', '7', null, '8'],
        }
        state = reducer(state, { type: 'move', payload: 8 })
    })
})
```

Testing a reducer

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import reducer from './reducer'

describe('reducer', () => {
    it('should say when it is complete', () => {
        let state = {
            items: ['1', '2', '3', '4', '5', '6', '7', null, '8'],
        }
        state = reducer(state, { type: 'move', payload: 8 })
        expect(state.complete).toBe(true)
    })
})
```

Testing a reducer

```
import reducer from './reducer'

describe('reducer', () => {
    it('should say when it is complete', () => {
        let state = {
            items: ['1', '2', '3', '4', '5', '6', '7', null, '8'],
        }
        state = reducer(state, { type: 'move', payload: 8 })
        expect(state.complete).toBe(true)
        state = reducer(state, { type: 'move', payload: 6 })
    })
})
```

Testing a reducer

```
import reducer from './reducer'

describe('reducer', () => {
    it('should say when it is complete', () => {
        let state = {
            items: ['1', '2', '3', '4', '5', '6', '7', null, '8'],
        }
        state = reducer(state, { type: 'move', payload: 8 })
        expect(state.complete).toBe(true)
        state = reducer(state, { type: 'move', payload: 6 })
        expect(state.complete).toBe(false)
    })
})
```

Testing a reducer

```
import reducer from './reducer'

describe('reducer', () => {
    it('should say when it is complete', () => {
        let state = {
            items: ['1', '2', '3', '4', '5', '6', '7', null, '8'],
        }
        state = reducer(state, { type: 'move', payload: 8 })
        expect(state.complete).toBe(true)
        state = reducer(state, { type: 'move', payload: 6 })
        expect(state.complete).toBe(false)
    })
    it('should be able to move 1 down if gap below', () => {
    })
})
```

Testing a reducer

```
import reducer from './reducer'

describe('reducer', () => {
    it('should say when it is complete', () => {
        let state = {
            items: ['1', '2', '3', '4', '5', '6', '7', null, '8'],
        }
        state = reducer(state, { type: 'move', payload: 8 })
        expect(state.complete).toBe(true)
        state = reducer(state, { type: 'move', payload: 6 })
        expect(state.complete).toBe(false)
    })
    it('should be able to move 1 down if gap below', () => {
        let state = {
            items: ['1', '2', '3', null, '5', '6', '7', '8', '4'],
        }
        state = reducer(state, { type: 'move', payload: 0 })
        expect(state.items).toEqual([null, '2', '3', '1', '5',
            '6', '7', '8', '4',
        ])
    })
})
```

Undo-ing a reducer (recipe 3.2)

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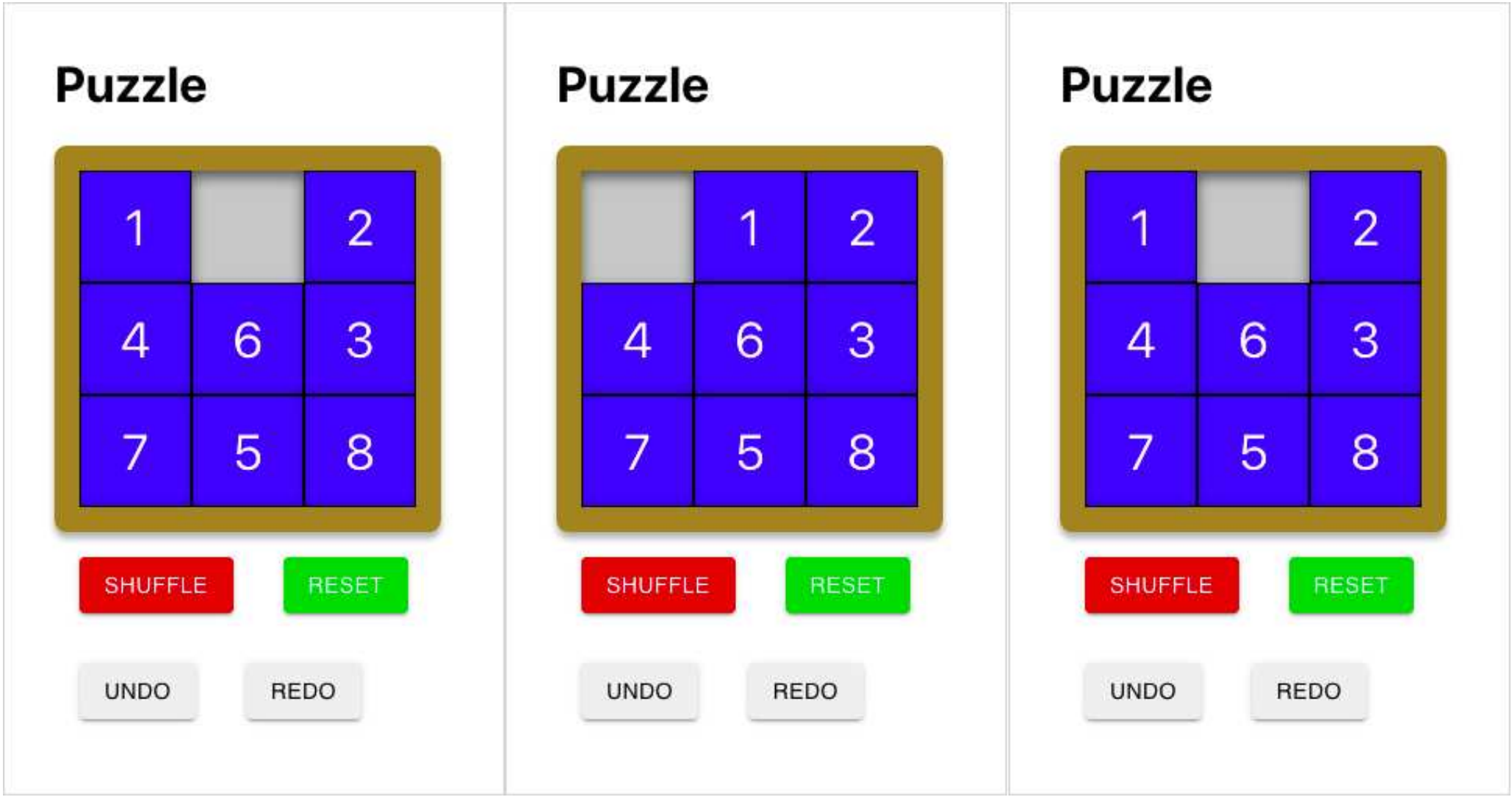


Undo-ing a reducer (recipe 3.2)

```
import reducer from './reducer'
import { useReducer } from 'react'

import './Puzzle.css'

const Puzzle = () => {
  const [state, dispatch] = useReducer(reducer, {
    items: ['4', '1', '2', '7', '6', '3', null, '5', '8'],
  })
```

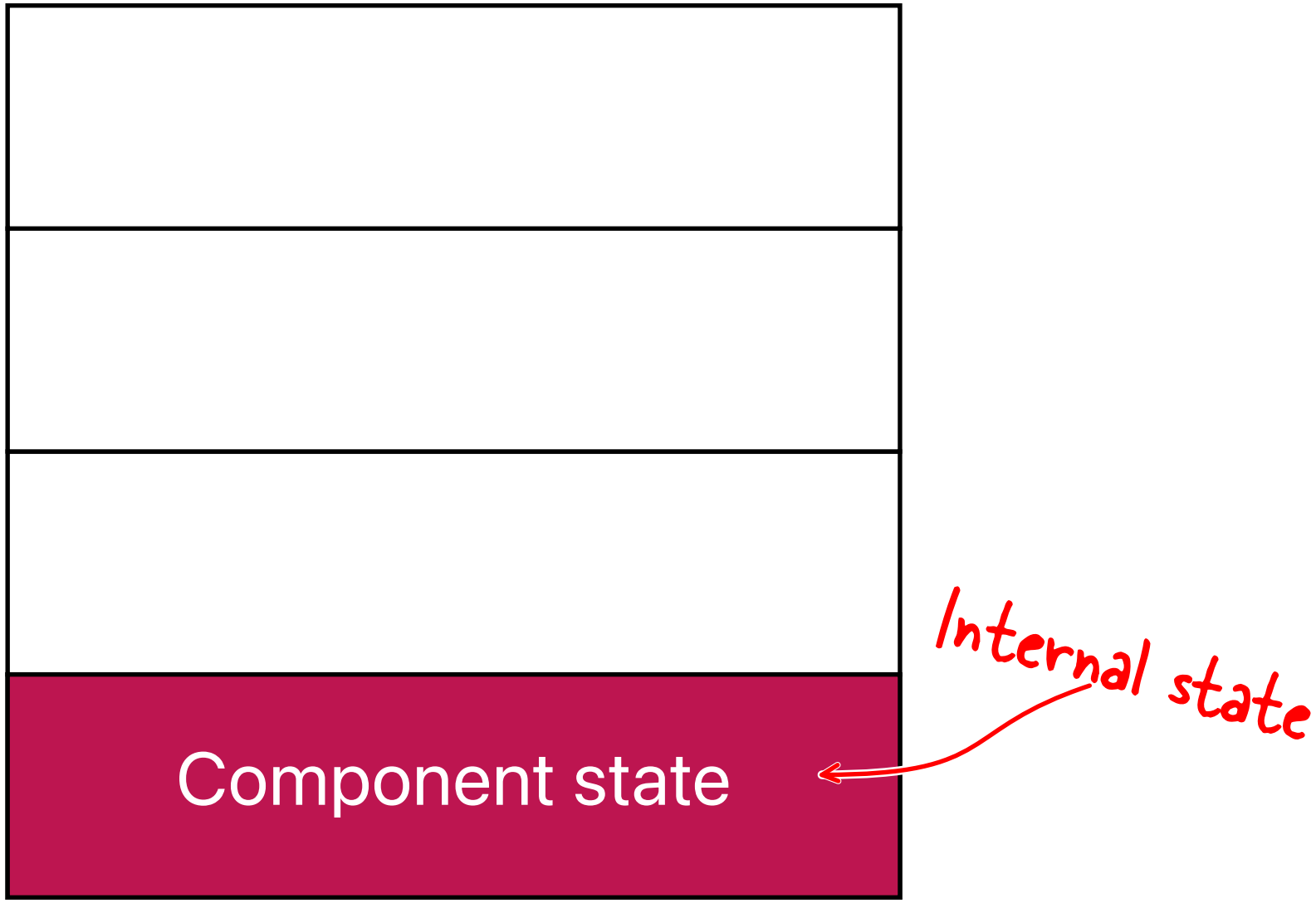
Undo-ing a reducer (recipe 3.2)

```
import reducer from './reducer'
import useUndoReducer from './useUndoReducer'

const Puzzle = () => {
  const [state, dispatch] = useUndoReducer(reducer, {
    items: ['4', '1', '2', '7', '6', '3', null, '5', '8'],
  })
....
```

Undo-ing a reducer (recipe 3.2)

```
import reducer from './reducer'
import useUndoReducer from './useUndoReducer'

const Puzzle = () => {
  const [state, dispatch] = useUndoReducer(reducer, {
    items: ['4', '1', '2', '7', '6', '3', null, '5', '8'],
  })
....
      <button
        onClick={() => dispatch({ type: 'undo' })}
      >
        Undo
      </button>
```

Different levels of state



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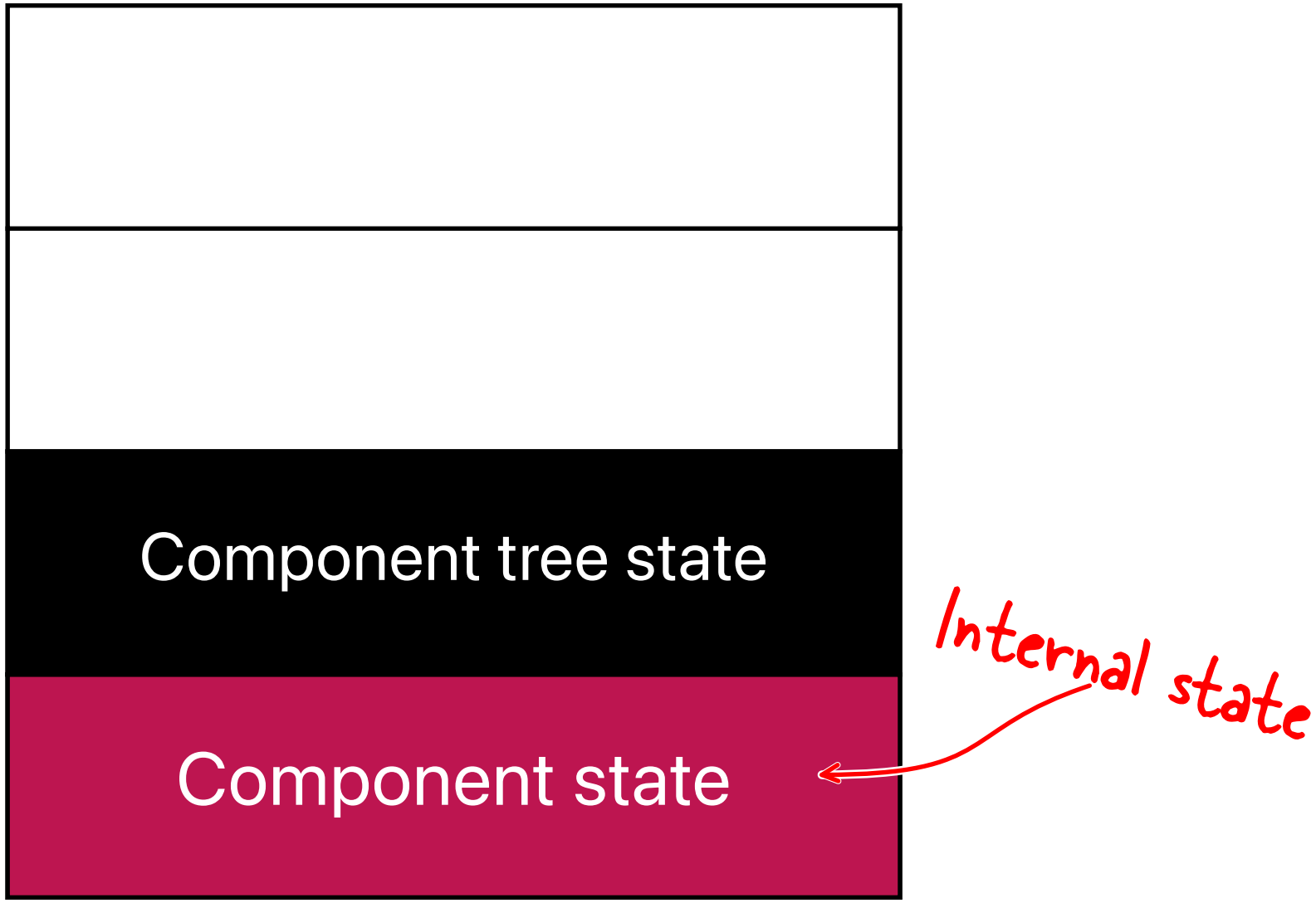

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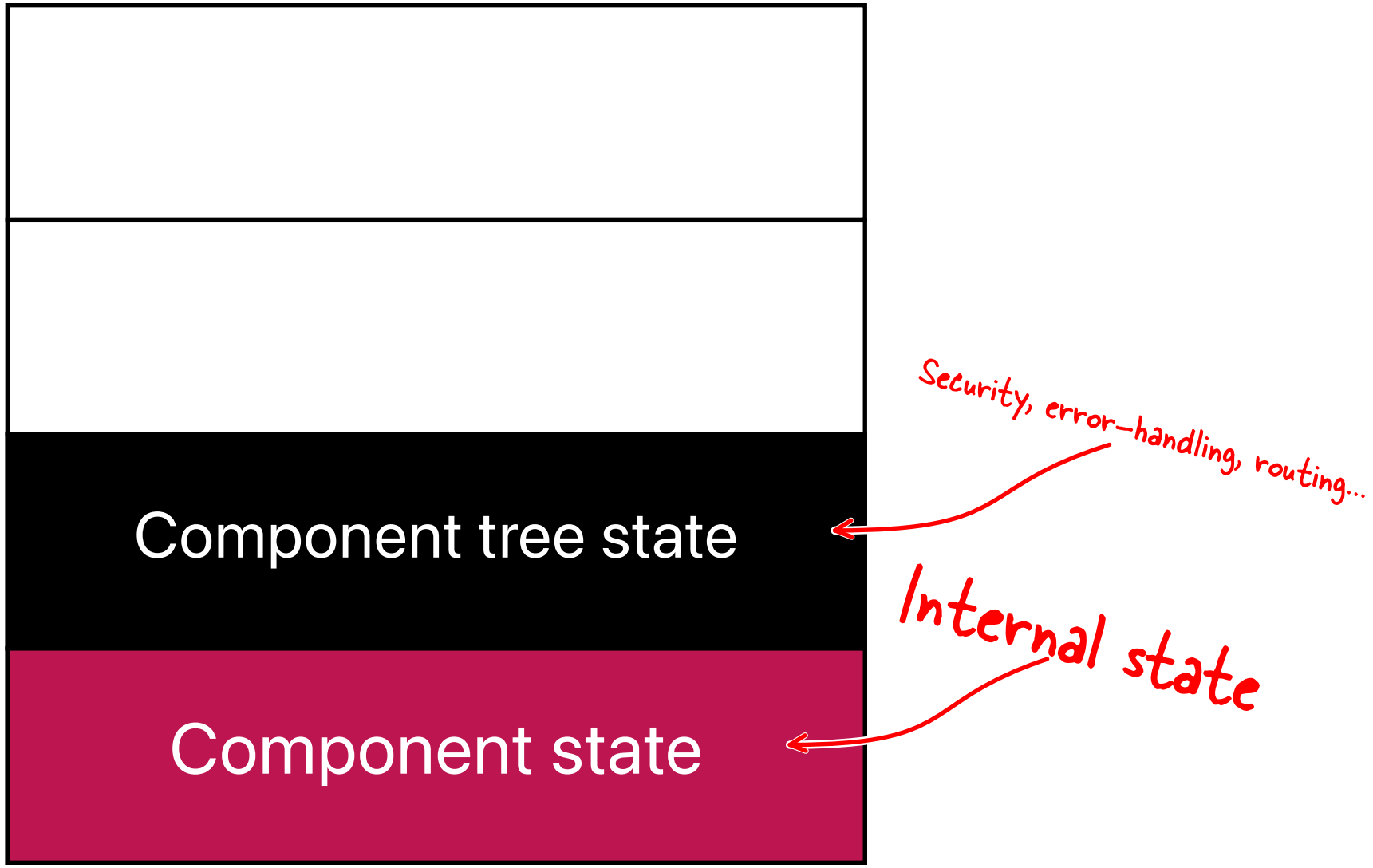
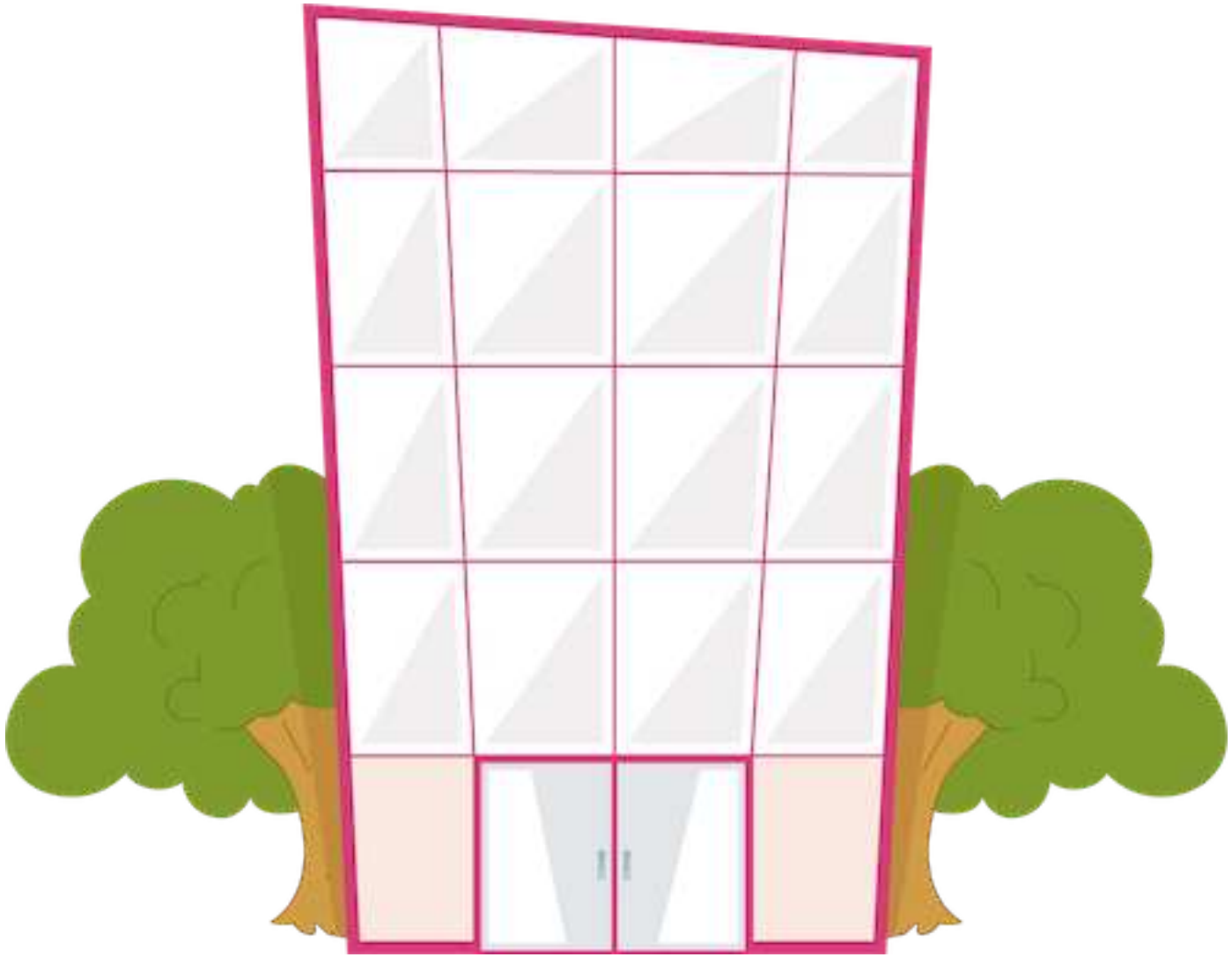
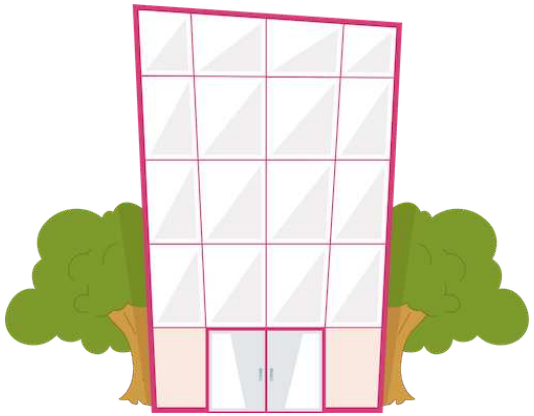
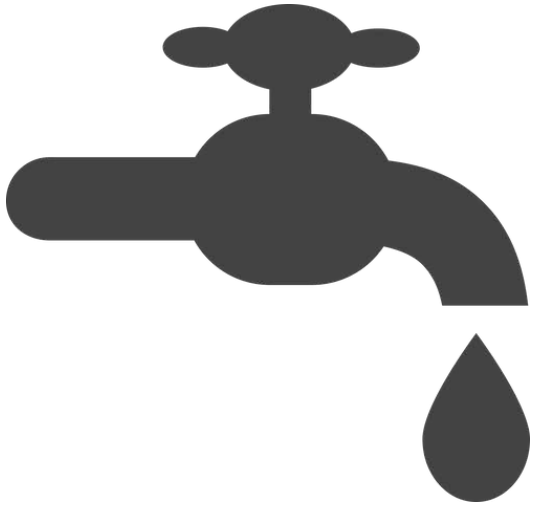


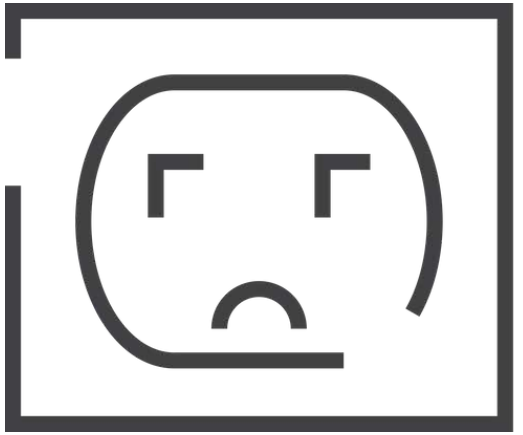
Utilities



Utilities







Use context to secure a component tree (recipe 7.5)

Create a context: SecurityContext.js

```
import React from 'react'

export default React.createContext({})
```

Create a provider: SecurityProvider.js

```
import { useRef, useState } from 'react'
import SecurityContext from './SecurityContext'
import LoginForm from './LoginForm'

export default (props) => {
  return (
    <SecurityContext.Provider
      value={{
      }}
    >
      {props.children}
    </SecurityContext.Provider>
  )
}
```

Create a provider: SecurityProvider.js

```
import { useRef, useState } from 'react'
import SecurityContext from './SecurityContext'
import LoginForm from './LoginForm'

export default (props) => {
  const [showLogin, setShowLogin] = useState(false)
  ....
  return (
    <SecurityContext.Provider
      value={{
        login: () => setShowLogin(true)
        ...
      }}
    >
      {props.children}
    </SecurityContext.Provider>
  )
}
```

Create a provider: SecurityProvider.js

```
import { useRef, useState } from 'react'
import SecurityContext from './SecurityContext'
import LoginForm from './LoginForm'

export default (props) => {
  const [showLogin, setShowLogin] = useState(false)
  ....
  return (
    <SecurityContext.Provider
      value={{
        login: () => setShowLogin(true)
        ...
      }}
    >
      {showLogin ? (
        <LoginForm
          onLogin={async (username, password) => {
            // Clever code to do login goes here....
          }}
        />
      ) : null}
      {props.children}
    </SecurityContext.Provider>
  )
}
```

Wrap the tree in the SecurityProvider

```
function App() {
  return (
    <div className="App">
      <BrowserRouter>
          <ComponentOne/>
          <ComponentTwo/>
          <ComponentThree/>
          ...
      </BrowserRouter>
    </div>
  )
}

export default App
```

Wrap the tree in the SecurityProvider

```
import SecurityProvider from './SecurityProvider'

function App() {
  return (
    <div className="App">
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          <ComponentOne/>
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          ...
      </BrowserRouter>
    </div>
  )
}

export default App
```

Wrap the tree in the SecurityProvider

```
import SecurityProvider from './SecurityProvider'

function App() {
  return (
    <div className="App">
      <BrowserRouter>
        <SecurityProvider>
          <ComponentOne/>
          <ComponentTwo/>
          <ComponentThree/>
          ...
        </SecurityProvider>
      </BrowserRouter>
    </div>
  )
}

export default App
```

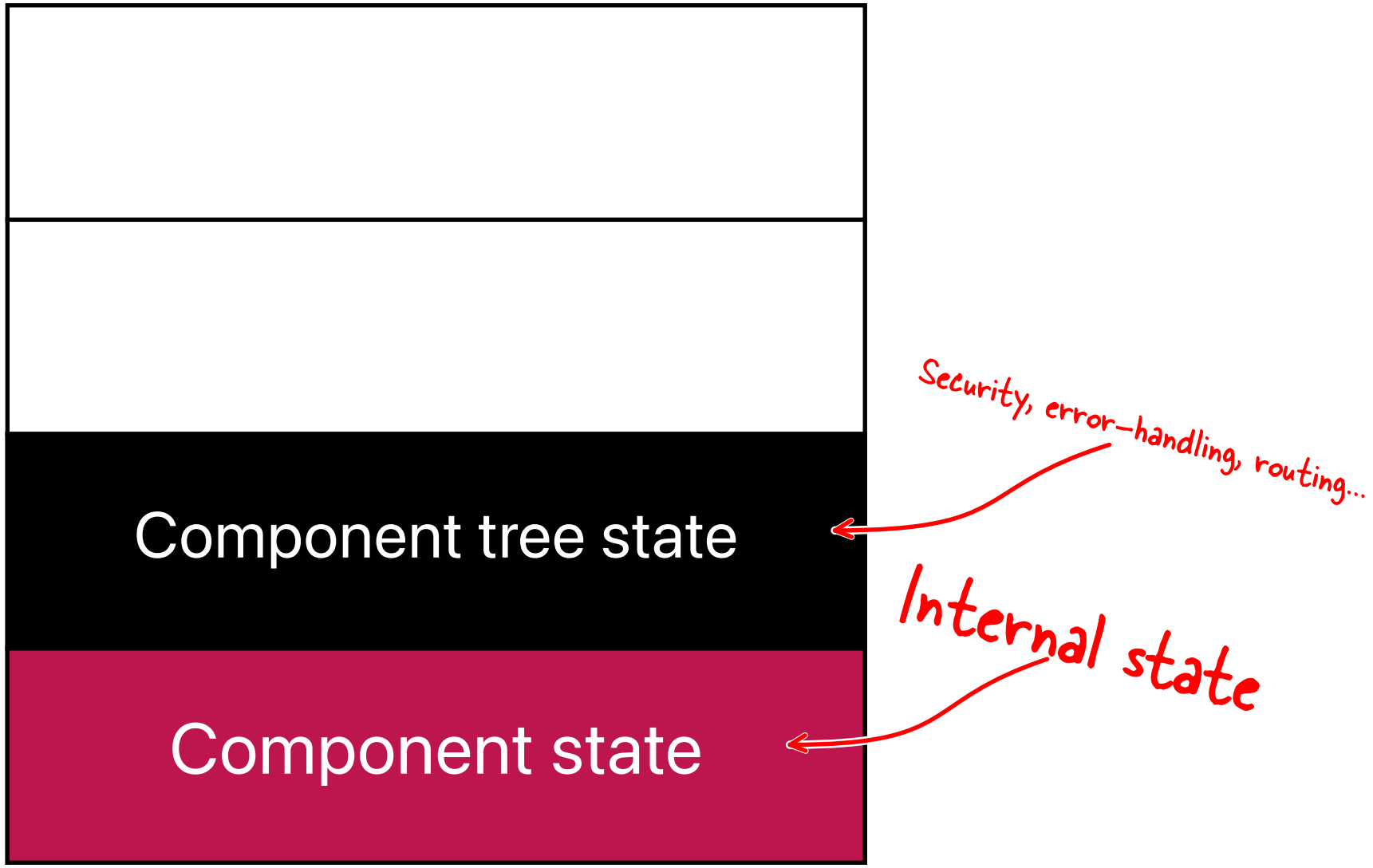
Access security from ComponentOne.js

```
const security = useContext(SecurityContext)
```

Access security from ComponentOne.js

```
const security = useContext(SecurityContext)
<button
  onClick={() => security.login())}
>
  Open login form
</button>
```

Different levels of state



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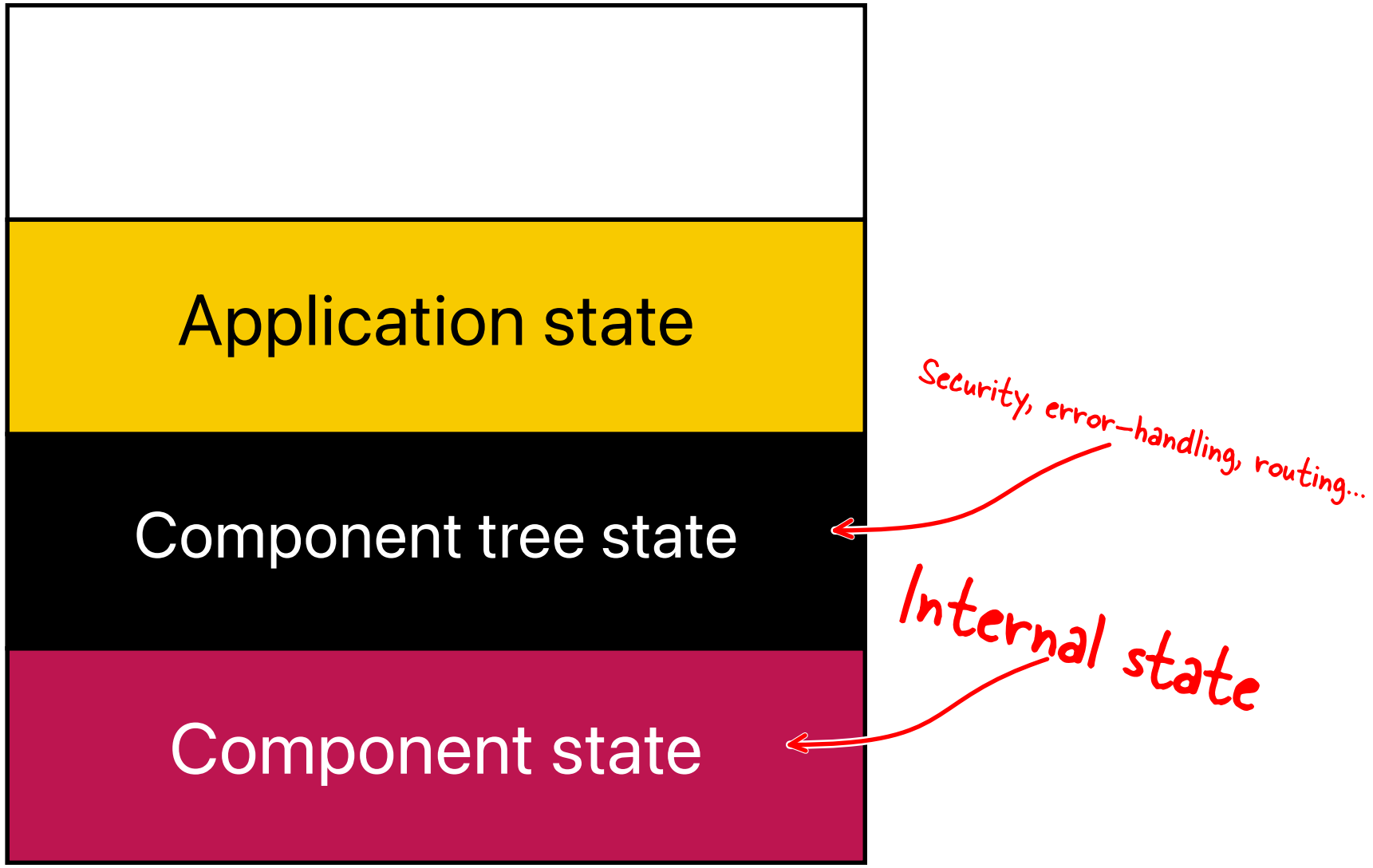

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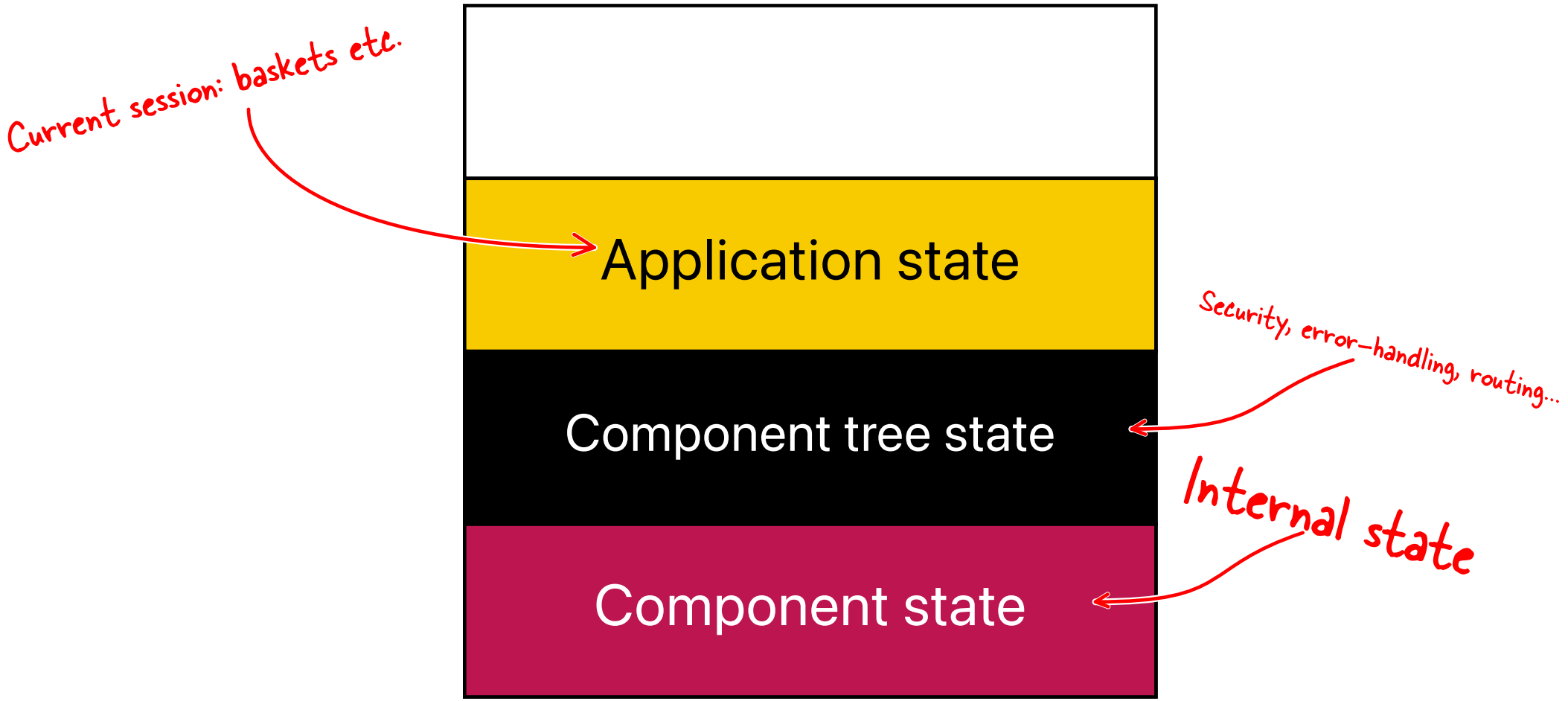

Managing central application state (recipe 3.6)

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Managing central application state (recipe 3.6)

- Some state needs to available to entire app
- Needs be managed by separate code...
- ...so could use a reducer
- And we need it to be available to entire component tree...
- ...so accessible through a context
- The solution: Redux

Reducer to manage a shopping basket

```
const reducer = (state = {}, action = {}) => {
  switch (action.type) {
    case 'buy': {
    }
    case 'clearBasket': {
    }
    default:
      return { ...state }
  }
}

export default reducer
```

Reducer to manage a shopping basket

```
const reducer = (state = {}, action = {}) => {
  switch (action.type) {
    case 'buy': {
      const basket = state.basket ? [...state.basket] : []
      // Code to add to basket goes here...
      return {
        ...state,
        basket,
      }
    }
    case 'clearBasket': {
    }
    default:
      return { ...state }
  }
}

export default reducer
```

Reducer to manage a shopping basket

```
const reducer = (state = {}, action = {}) => {
  switch (action.type) {
    case 'buy': {
      const basket = state.basket ? [...state.basket] : []
      // Code to add to basket goes here...
      return {
        ...state,
        basket,
      }
    }
    case 'clearBasket': {
      return {
        ...state,
        basket: [],
      }
    }
    default:
      return { ...state }
  }
}

export default reducer
```

Create a store using the basket reducer App.js

```
function App() {
  return (
    <div className="App">
          <MyFirstComponent/>
          <MySecondComponent/>
          <Basket/>
    </div>
  )
}

export default App
```

Create a store using the basket reducer App.js

```
import { Provider } from 'react-redux'
import { createStore } from 'redux'
import reducer from './reducer'
const store = createStore(reducer)
function App() {
  return (
    <div className="App">
      <Provider store={store}>
          <MyFirstComponent/>
          <MySecondComponent/>
          <Basket/>
      </Provider>
    </div>
  )
}

export default App
```

Use the store from Basket.js

```
import { useDispatch, useSelector } from 'react-redux'
const Basket = () => {
}

export default Basket
```

Use the store from Basket.js

```
import { useDispatch, useSelector } from 'react-redux'
const Basket = () => {
  const basket = useSelector((state) => state.basket)

  return (
    <div className="Basket">
    </div>
  )
}

export default Basket
```

Use the store from Basket.js

```
import { useDispatch, useSelector } from 'react-redux'
const Basket = () => {
  const basket = useSelector((state) => state.basket)

  return (
    <div className="Basket">
      <h2>Basket</h2>
      {basket.map((item) => (
        <div className="Basket-item">
          <div className="Basket-itemName">{item.name}</div>
          ...
        </div>
      ))}
    </div>
  )
}

export default Basket
```

Use the store from Basket.js

```
import { useDispatch, useSelector } from 'react-redux'
const Basket = () => {
  const basket = useSelector((state) => state.basket)
  const dispatch = useDispatch()

  return (
    <div className="Basket">
      <h2>Basket</h2>
      {basket.map((item) => (
        <div className="Basket-item">
          <div className="Basket-itemName">{item.name}</div>
          ...
        </div>
      ))}
      <button onClick={() => dispatch({ type: 'clearBasket' })}>
        Clear
      </button>
    </div>
  )
}

export default Basket
```

Using Redux libraries

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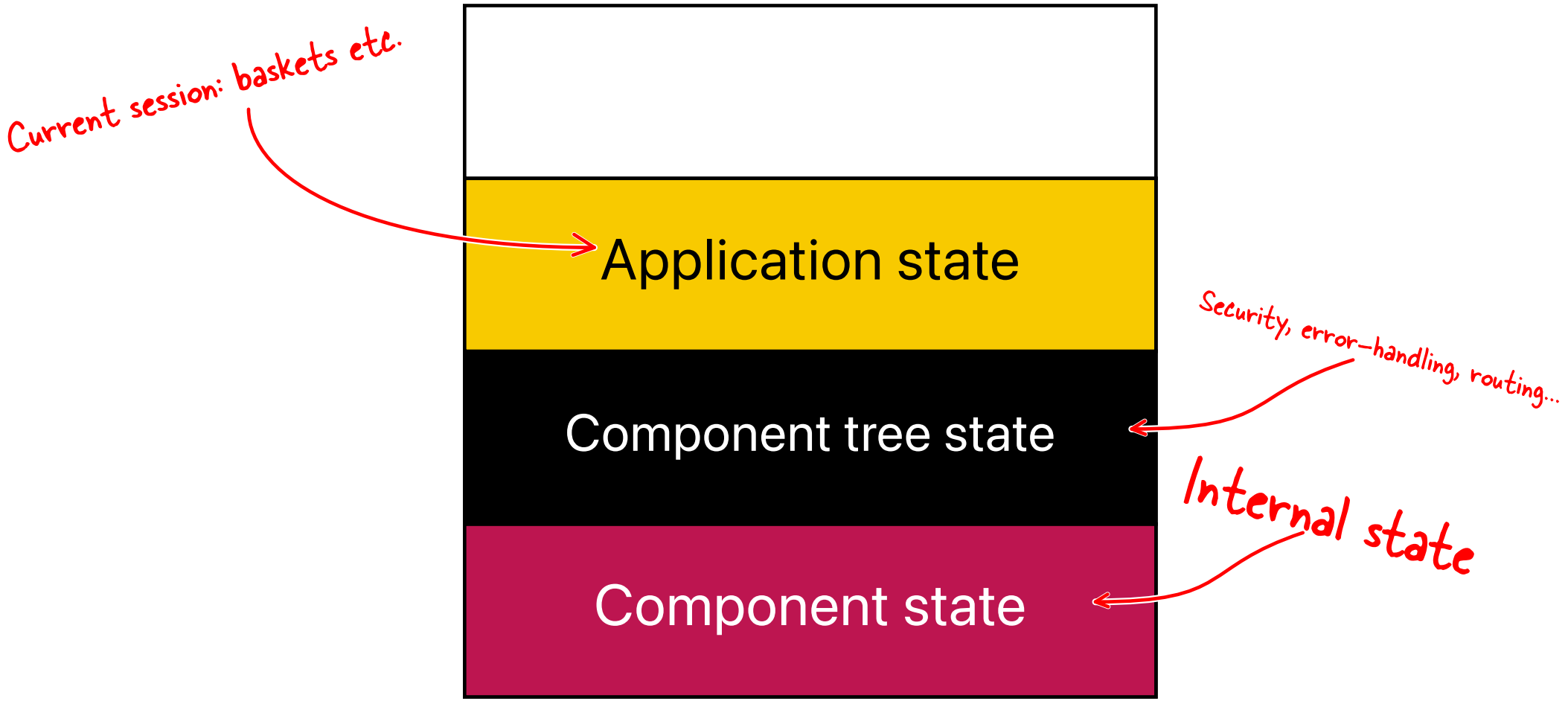
Using Redux libraries

- Can use middleware to sync Redux store with a server (recipe 3.6)
- Can use `redux-persist` to save the store in LocalStorage
- ...means you can refresh the page and the data is safe (recipe 3.7)
- Can use with libraries like `reselect` to derive states (recipe 3.8)

Different levels of state



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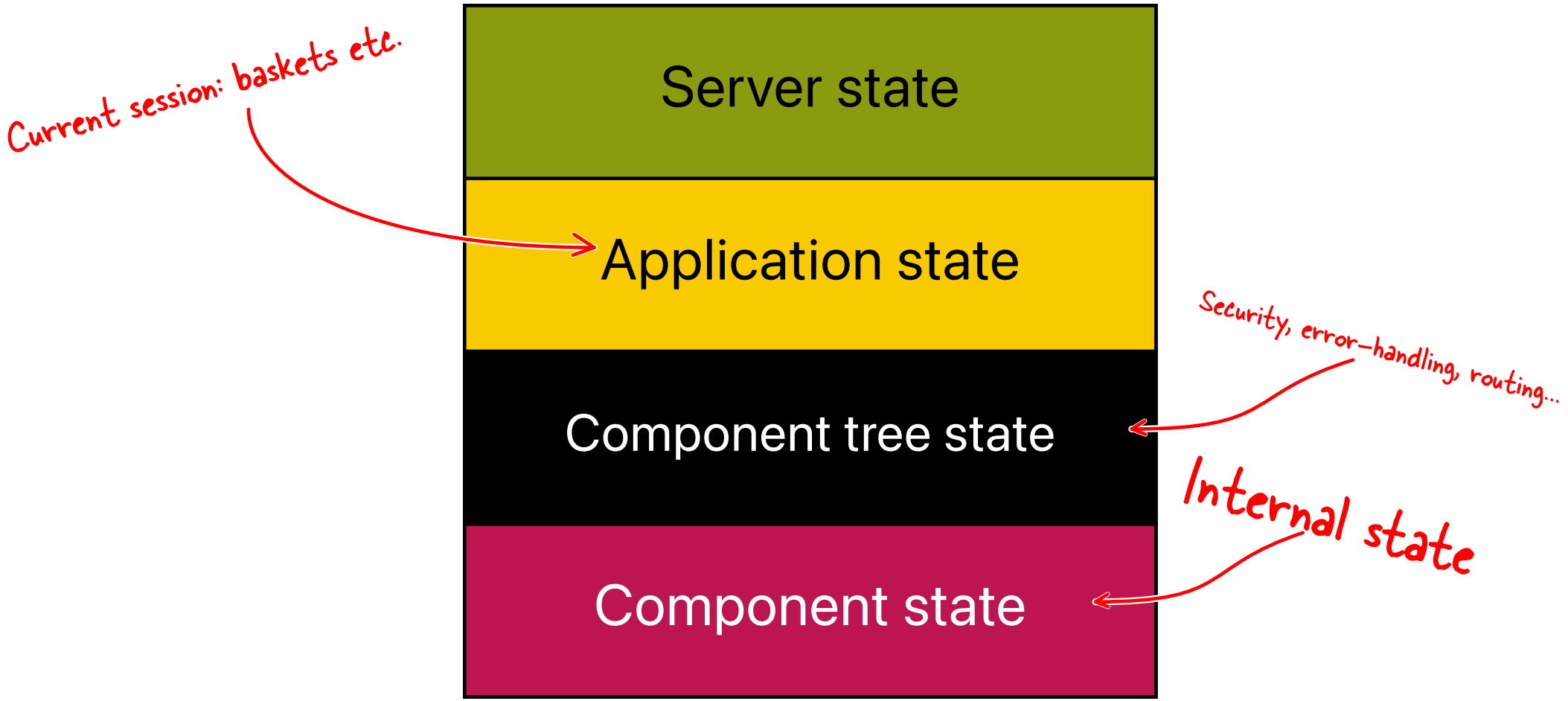

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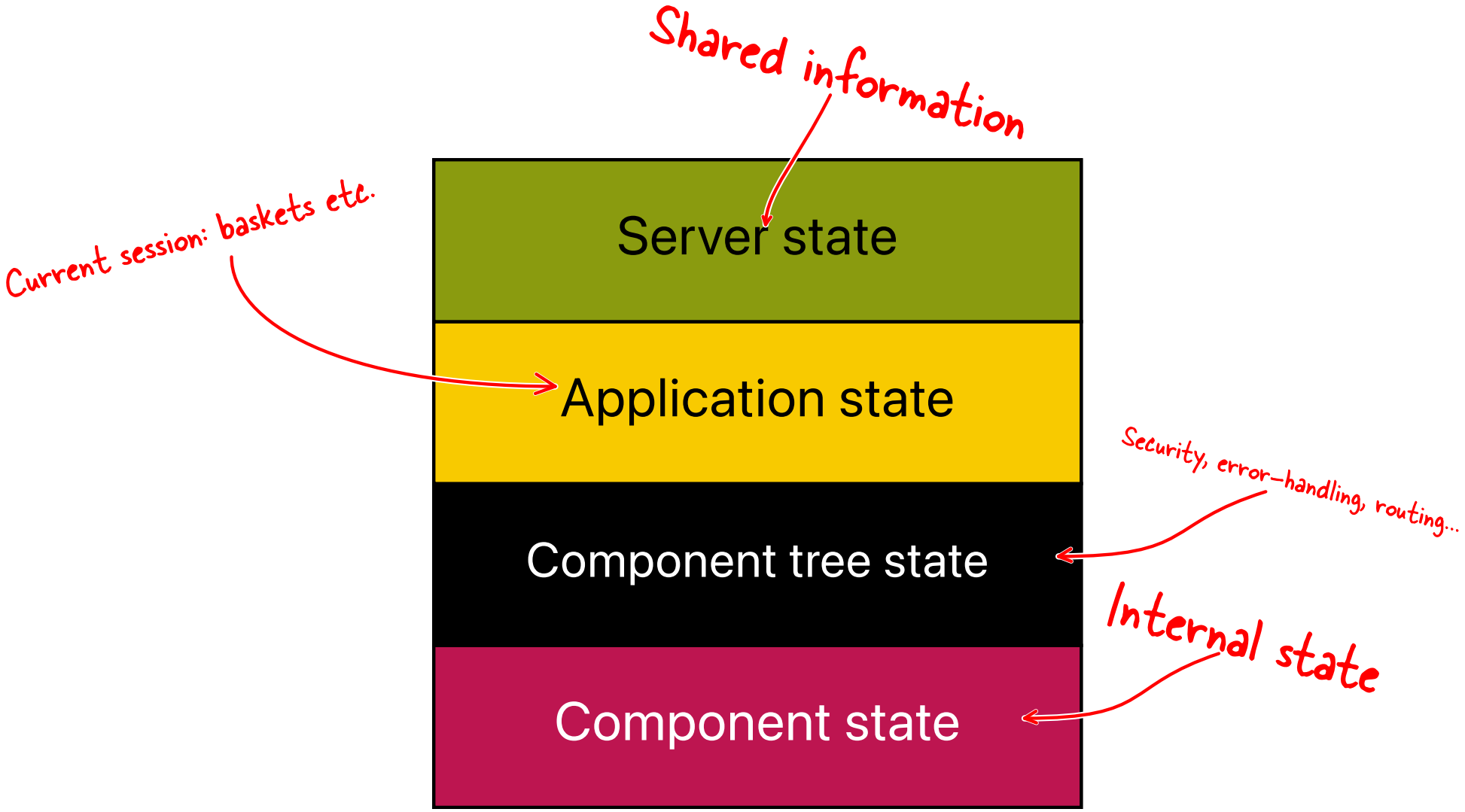

Reading data when offline? (recipe 11.3)

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- Many users are on mobile devices

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- Many users are on mobile devices
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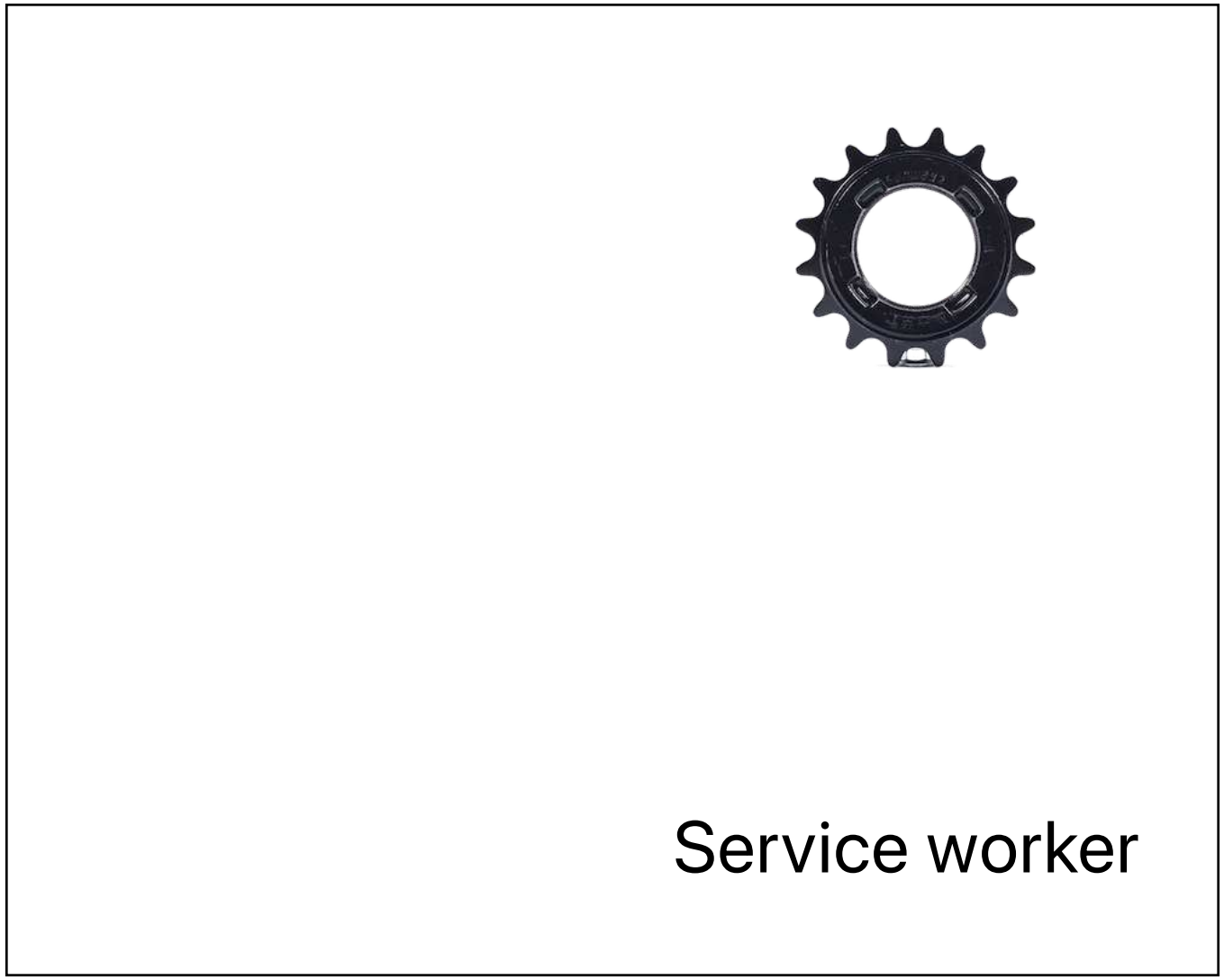
Reading data when offline? (recipe 11.3)

- Many users are on mobile devices
- Mobile devices have poor network connections
- Can you cache data locally so it can work offline?

Use a Service Worker

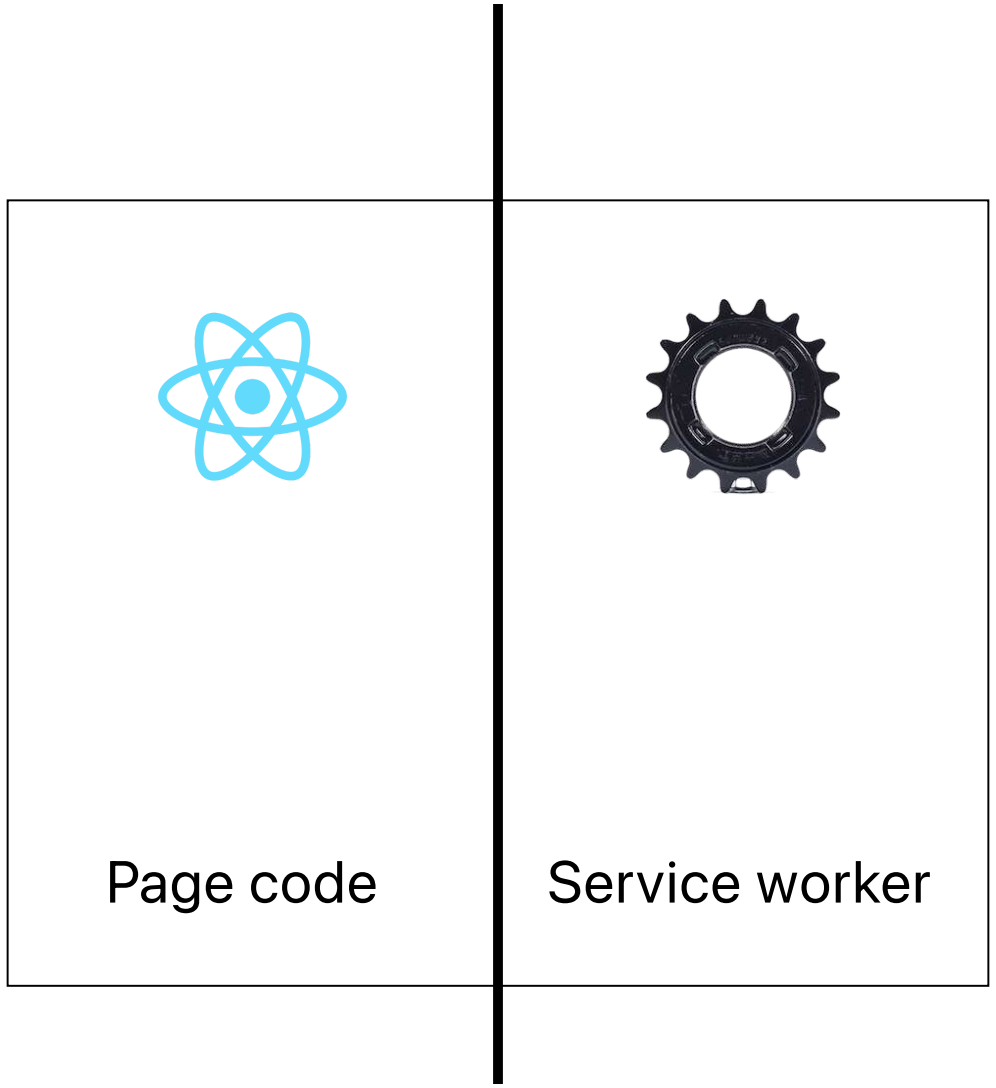


Use a Service Worker

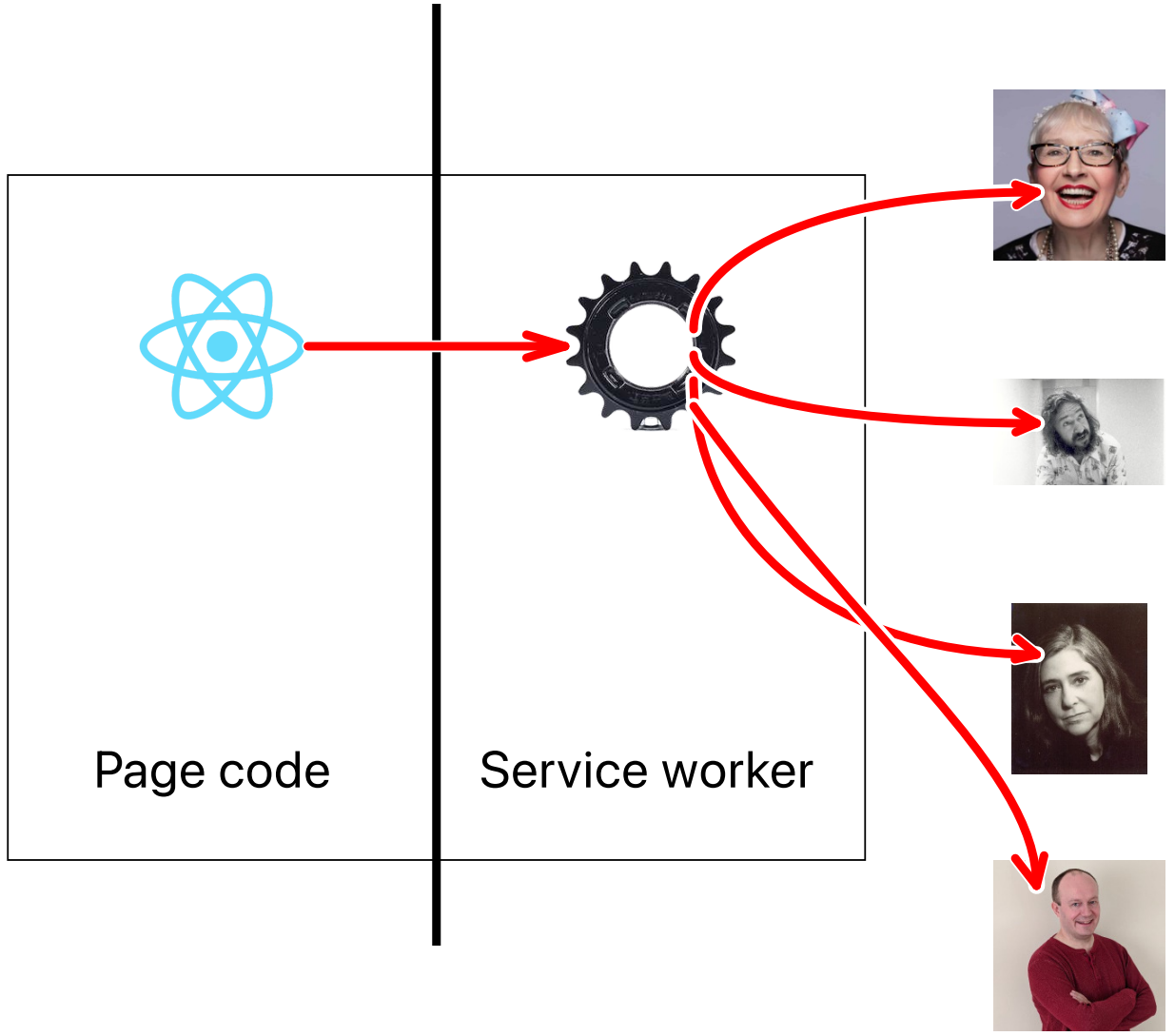
Web worker

Service worker

Use a Service Worker



Use a Service Worker



Service workers

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- JavaScript that runs in the background (not the page)

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- Can intercept all networks connections

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- JavaScript that runs in the background (not the page)
- Can intercept all networks connections
- Can use cache storage for images, fonts, network responses

Service workers (part 2)

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- Only available with HTTPS or with localhost

Service workers (part 2)

- Not normally used when in development mode
- Only available with HTTPS or with localhost
- Might need to unregister when developing

Register a service worker index.js

```
import React from 'react';
import ReactDOM from 'react-dom';
import './index.css';
import App from './App';
import * as serviceWorkerRegistration from './serviceWorkerRegistration';

ReactDOM.render(
  <React.StrictMode>
    <App />
  </React.StrictMode>,
  document.getElementById('root')
);
```

Register a service worker index.js

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ReactDOM.render(
  <React.StrictMode>
    <App />
  </React.StrictMode>,
  document.getElementById('root')
);

serviceWorkerRegistration.register();
```

The service worker: service-worker.js

```
import { registerRoute } from 'workbox-routing';
import { StaleWhileRevalidate } from 'workbox-strategies';

// All the other service-worker code...
```

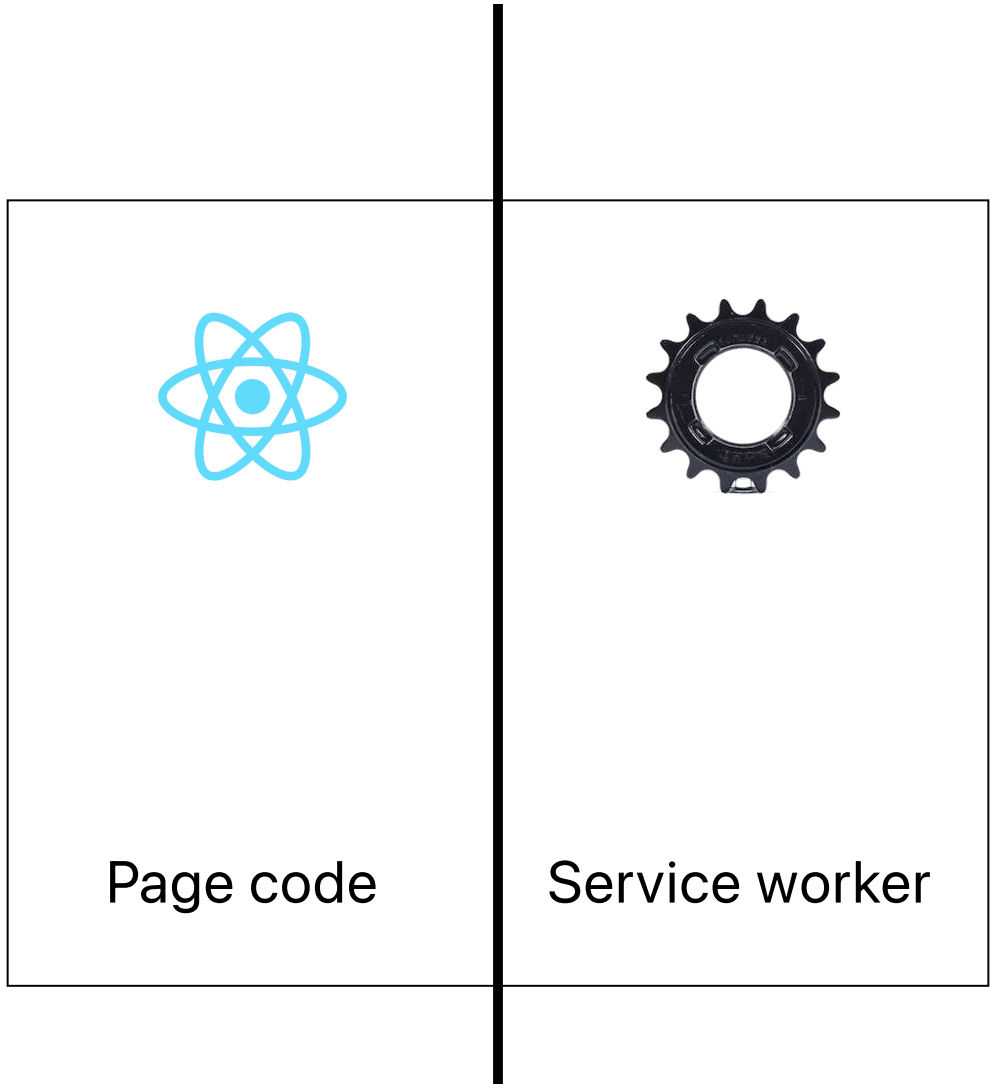
The service worker: service-worker.js

```
import { registerRoute } from 'workbox-routing';
import { StaleWhileRevalidate } from 'workbox-strategies';

// All the other service-worker code...

registerRoute(
    ({url}) => url.origin === 'https://fonts.googleapis.com',
    new StaleWhileRevalidate({
        cacheName: 'stylesheets',
    })
);
```

StaleWhileRevalidate



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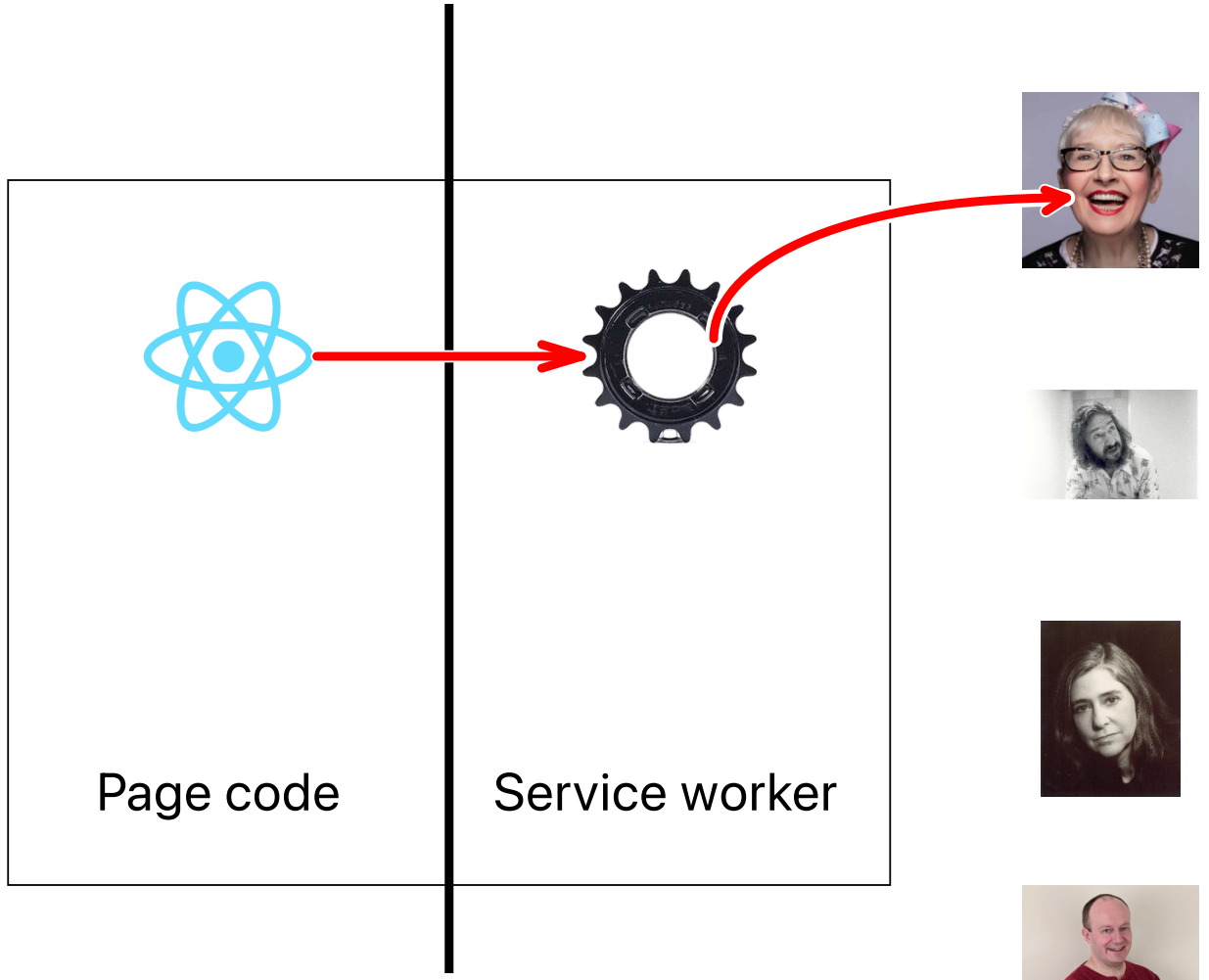
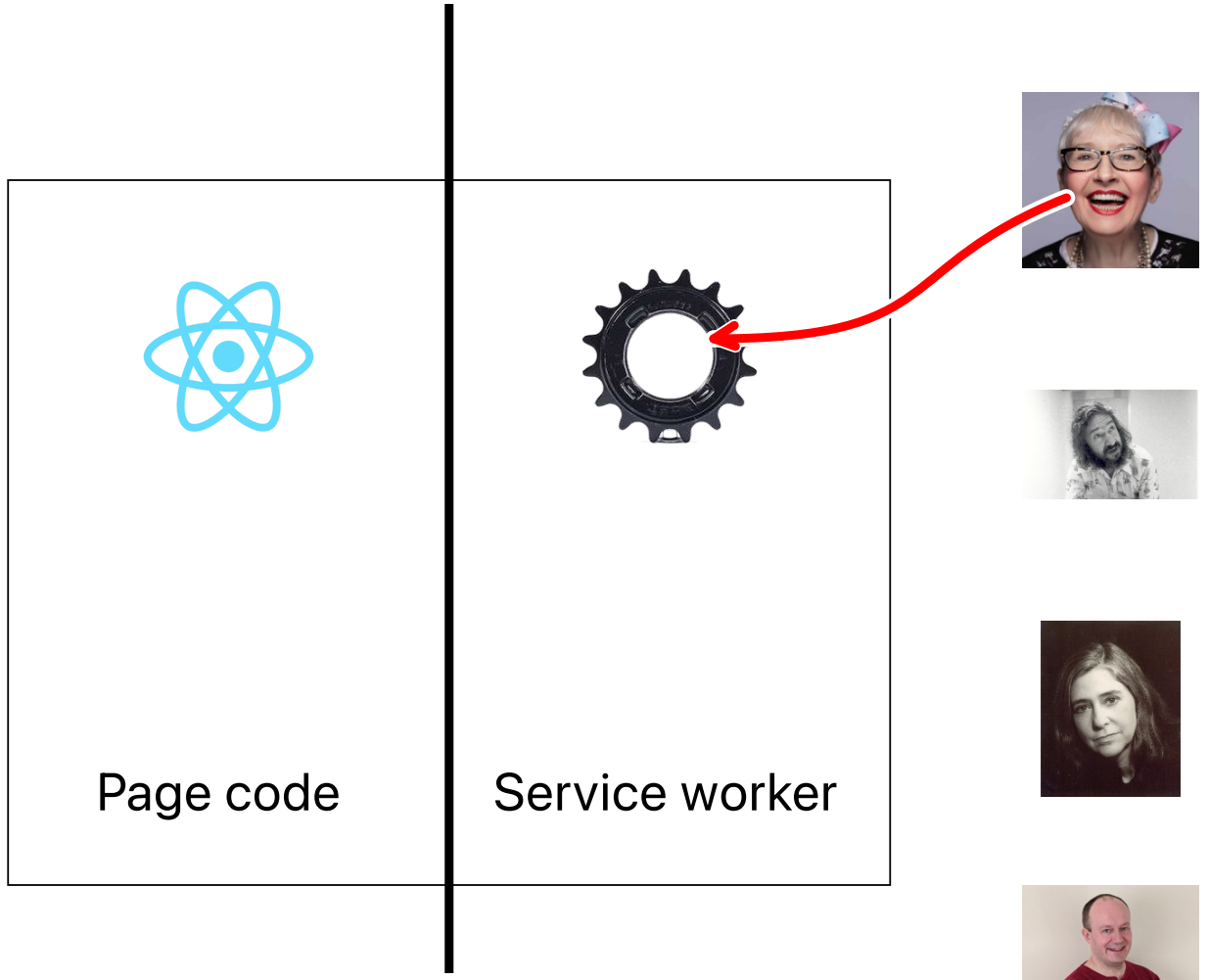


StaleWhileRevalidate



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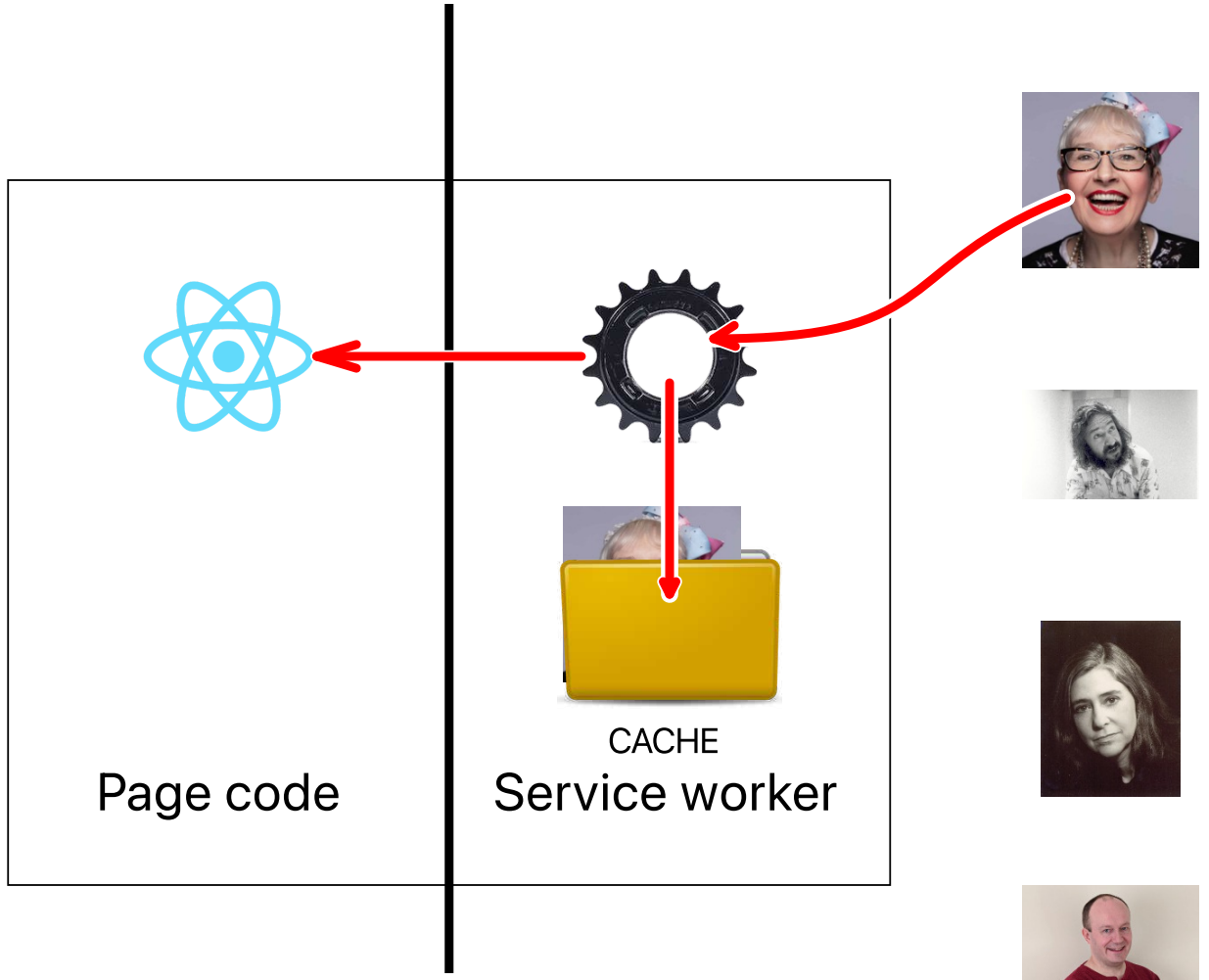

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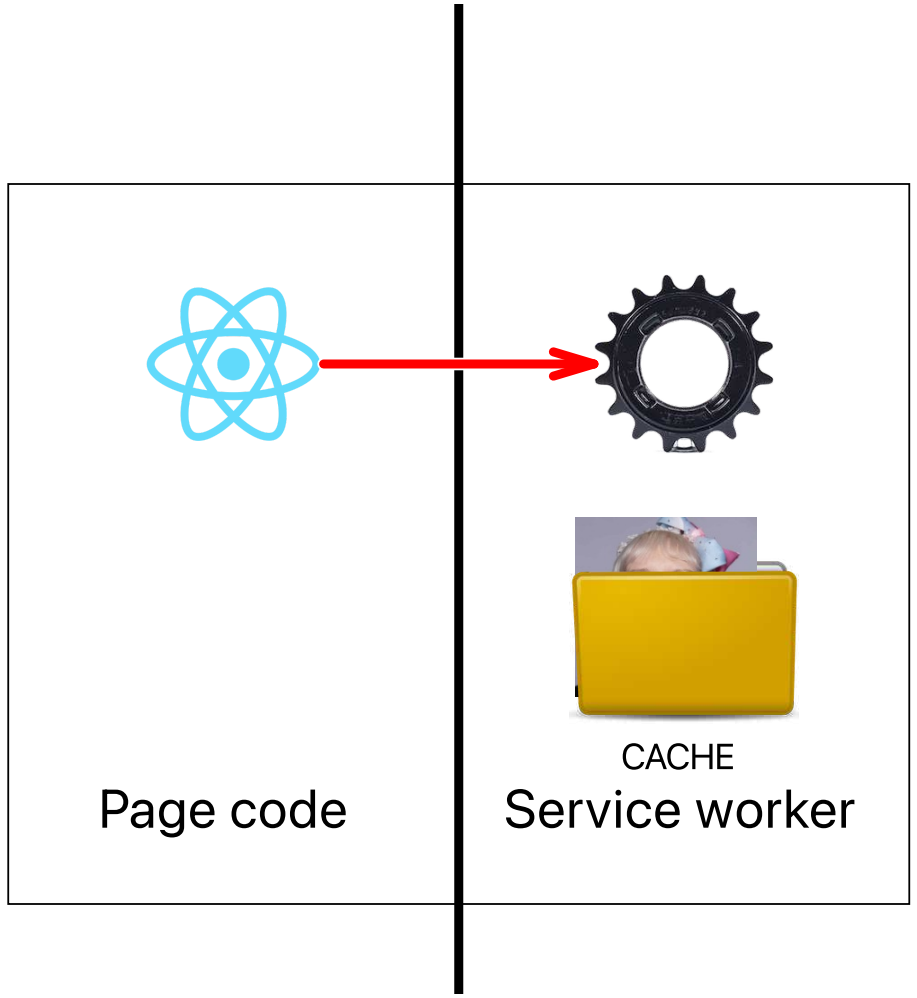

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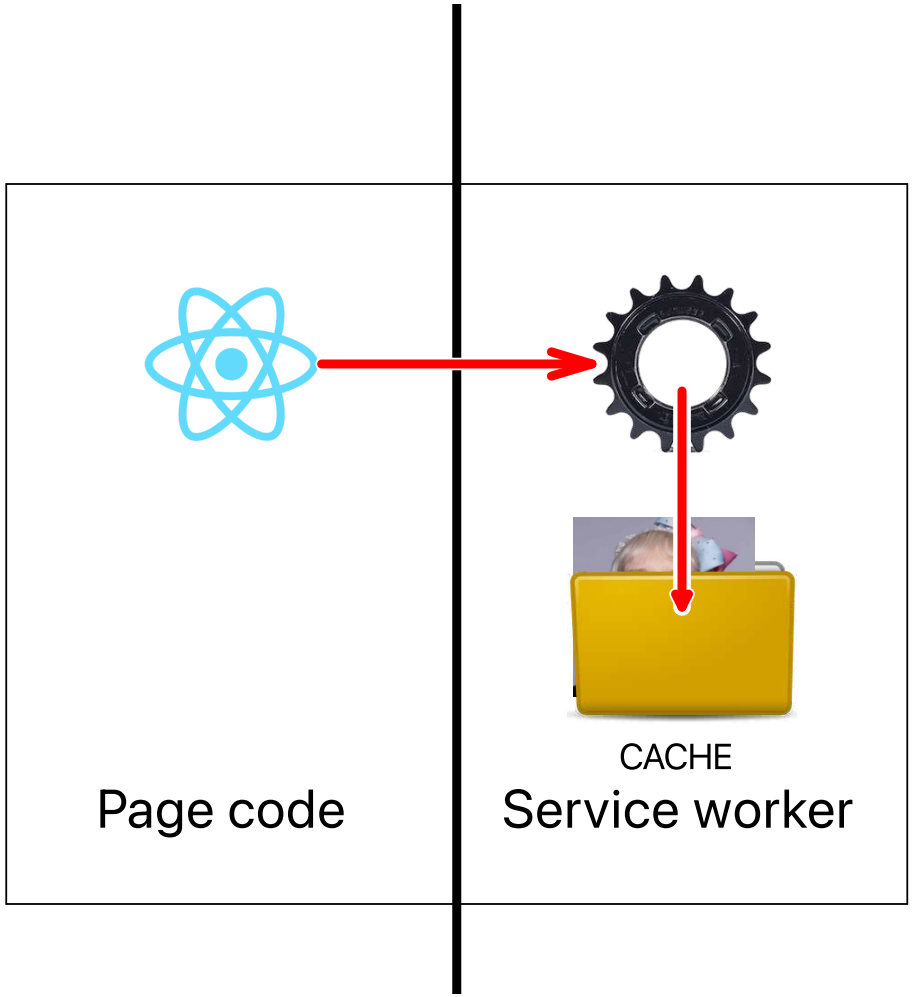

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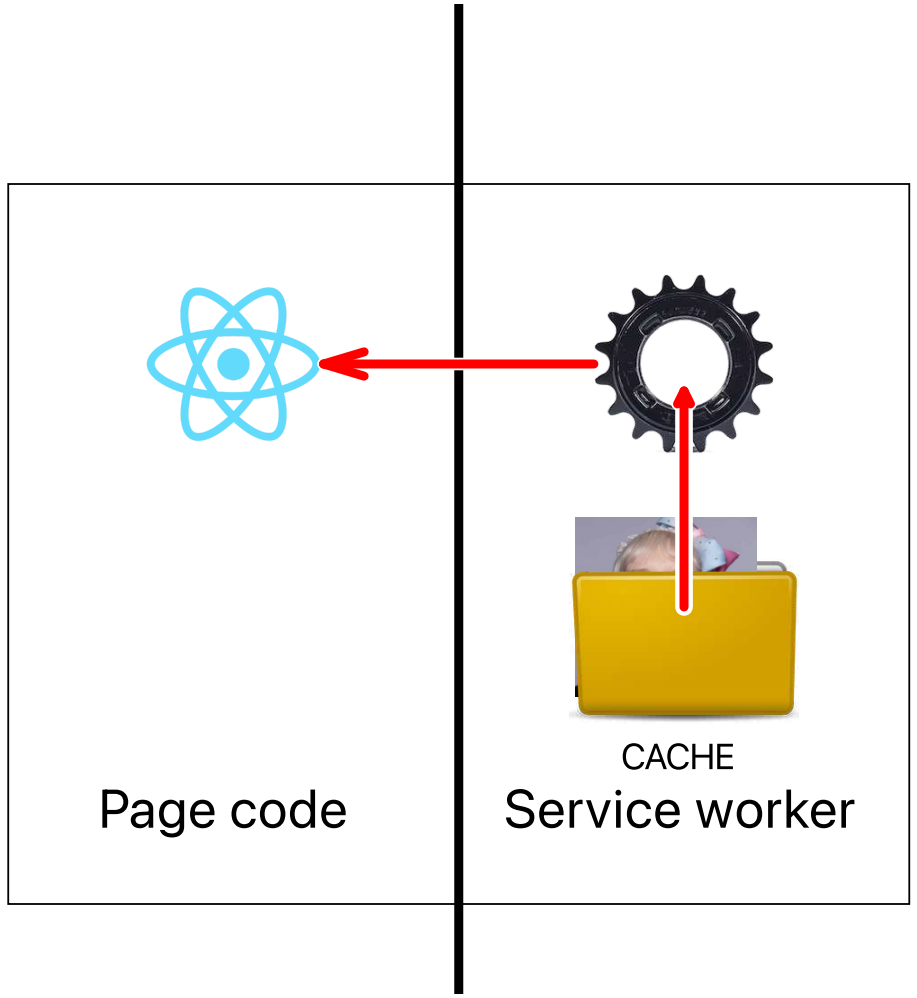

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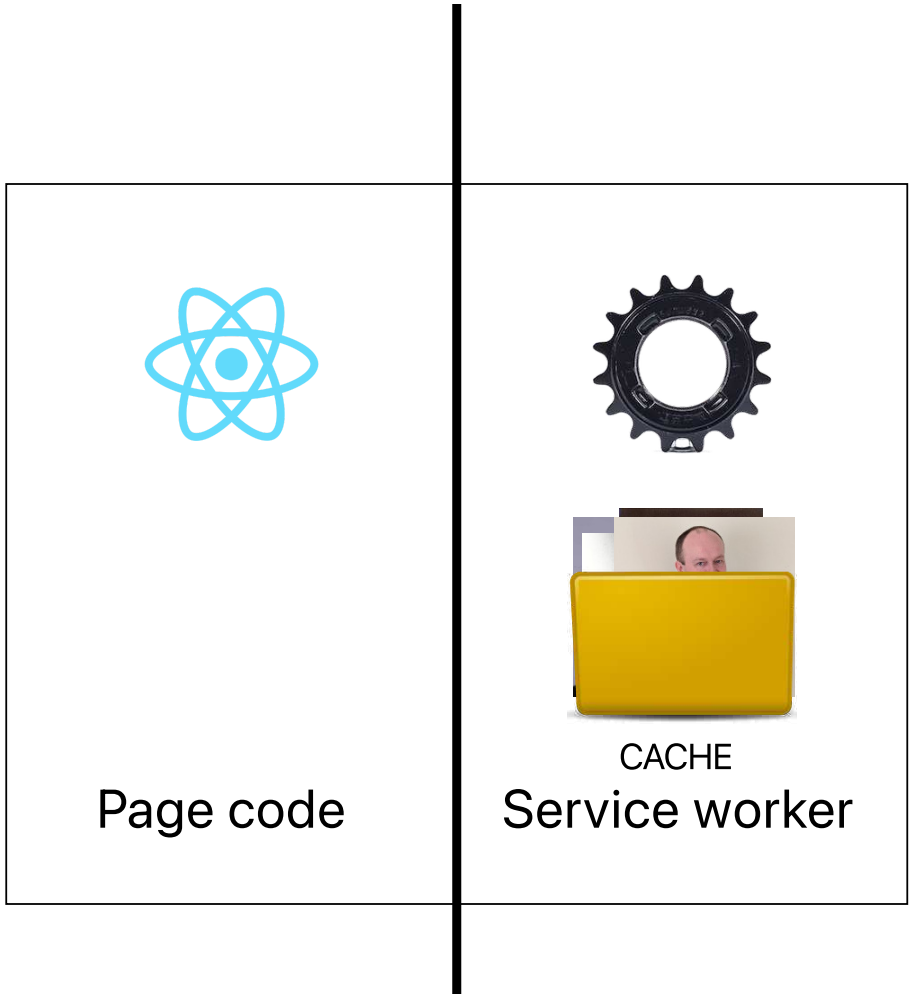

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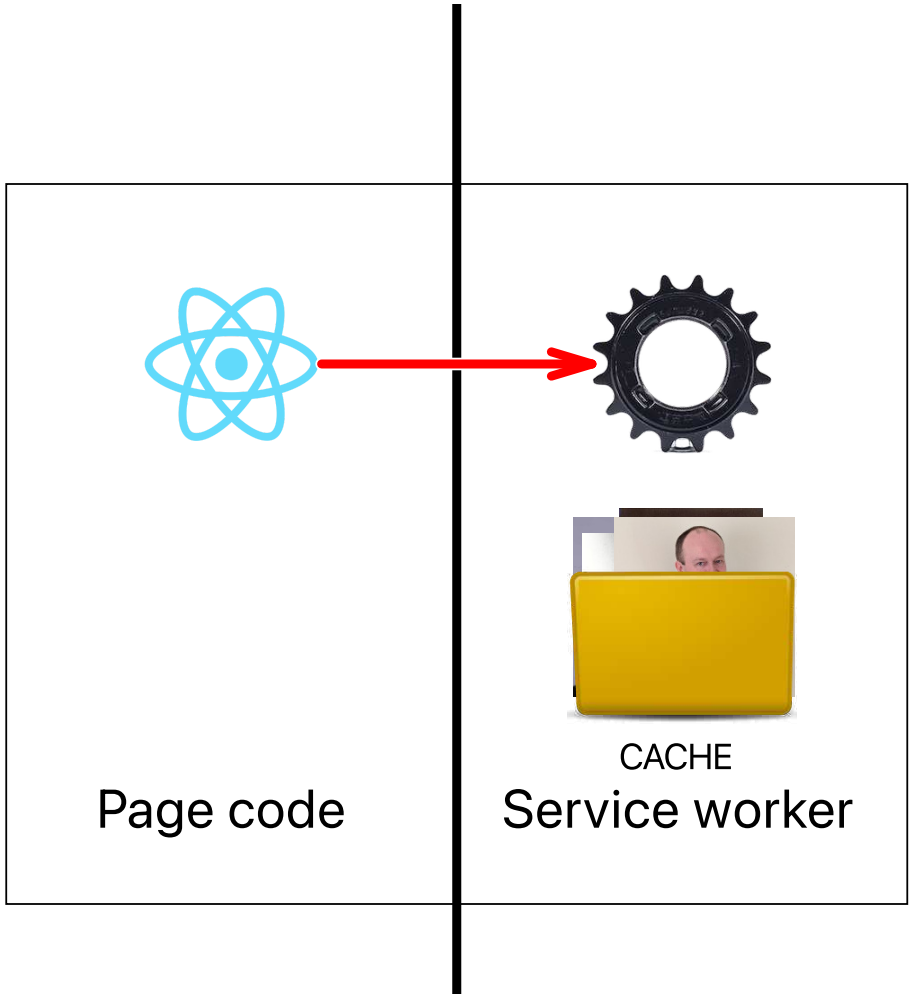

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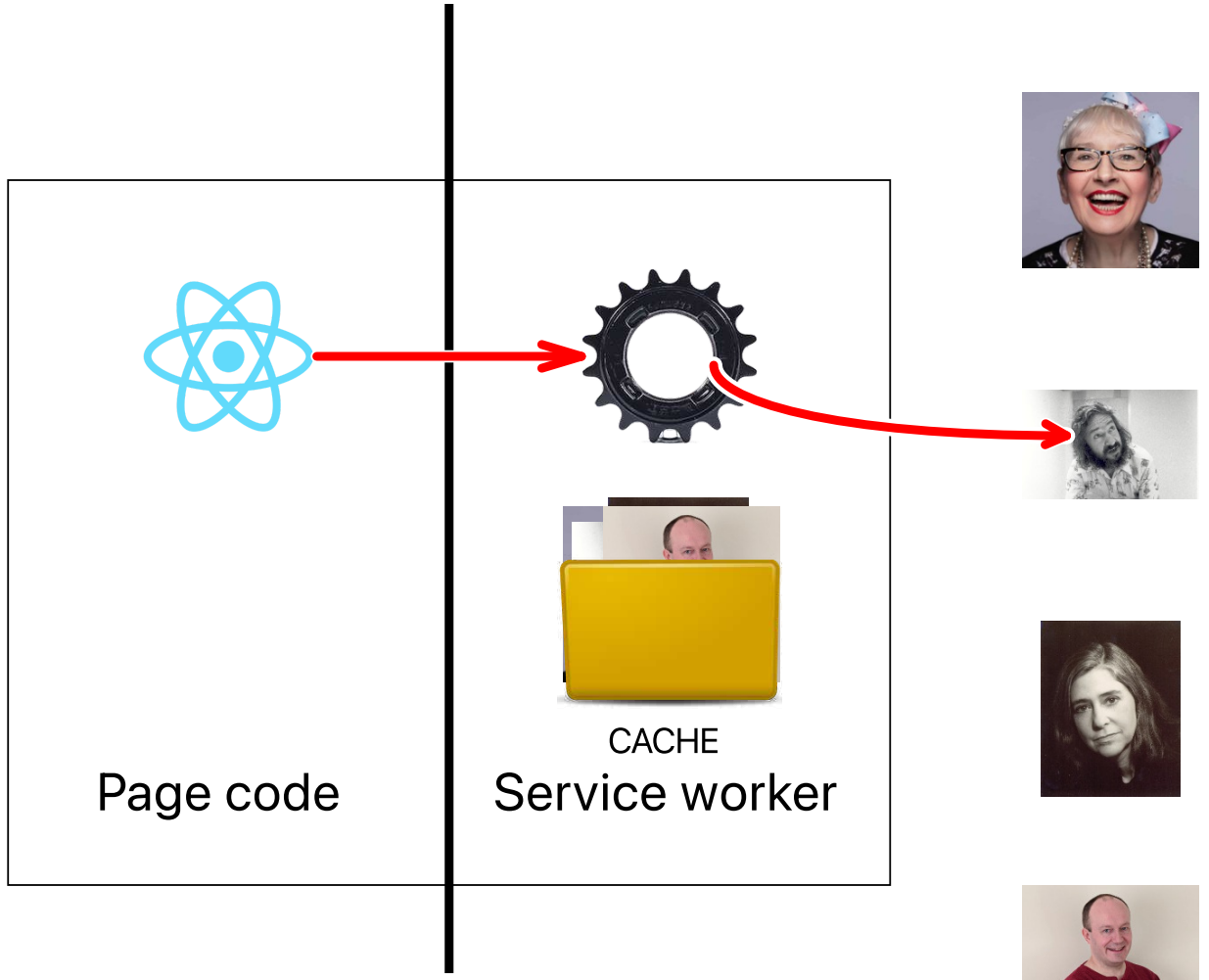

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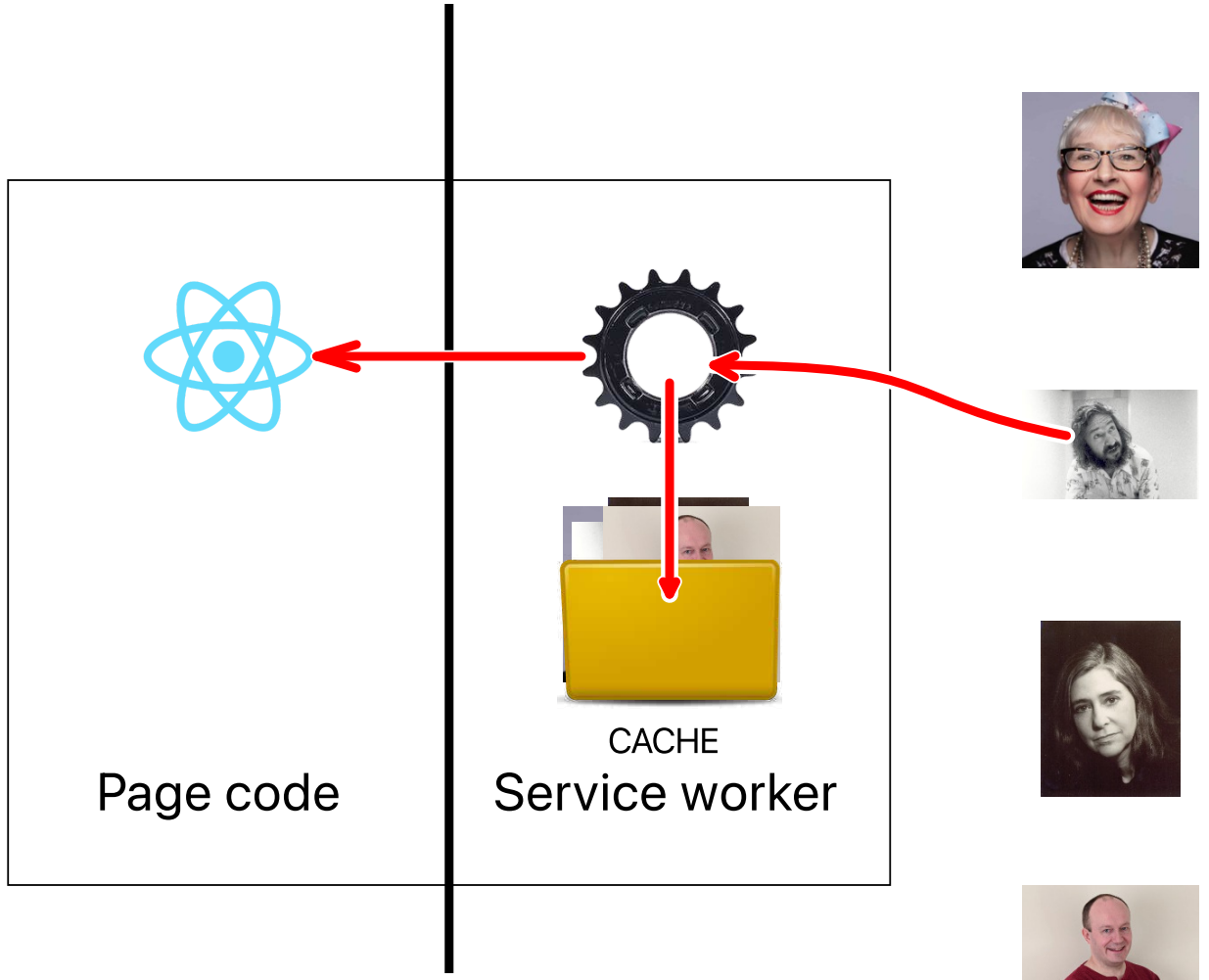

Sending data when offline? (recipe 11.6)

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- They might want to send changes to the server

Sending data when offline? (recipe 11.6)

- When people are offline they might want to do more than read
- They might want to send changes to the server
- But how can that work when they have no connection?

Typical code to send data

```
const sendData = () => {
        const options = {
            method: 'POST',
            body: JSON.stringify({timeIs: new Date()}),
            headers: {
                'Content-Type': 'application/json'
            }
        };
        fetch('/endpoint', options)
    };
```

Use background-sync in the server-worker

```
import { registerRoute } from 'workbox-routing';
import {NetworkOnly, StaleWhileRevalidate} from 'workbox-strategies';
import {BackgroundSyncPlugin} from "workbox-background-sync";

// All the other service-worker code...
```

Use background-sync in the server-worker

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import { registerRoute } from 'workbox-routing';
import {NetworkOnly, StaleWhileRevalidate} from 'workbox-strategies';
import {BackgroundSyncPlugin} from "workbox-background-sync";

// All the other service-worker code...

registerRoute(
    /\/endpoint/,
    new NetworkOnly({
        plugins: [new BackgroundSyncPlugin(
            'endPointQueue1', {
            maxRetentionTime: 24 * 60
        })]
    }),
    'POST'
);
```

Get the code!

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- All of the code from today:

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- https://tinyurl.com/rcookbook1

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