

O'REILLY®

# From Local State to Global Control

September 2023





# Introduction





# About me

- Author

# About me

- Author



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## React Cookbook

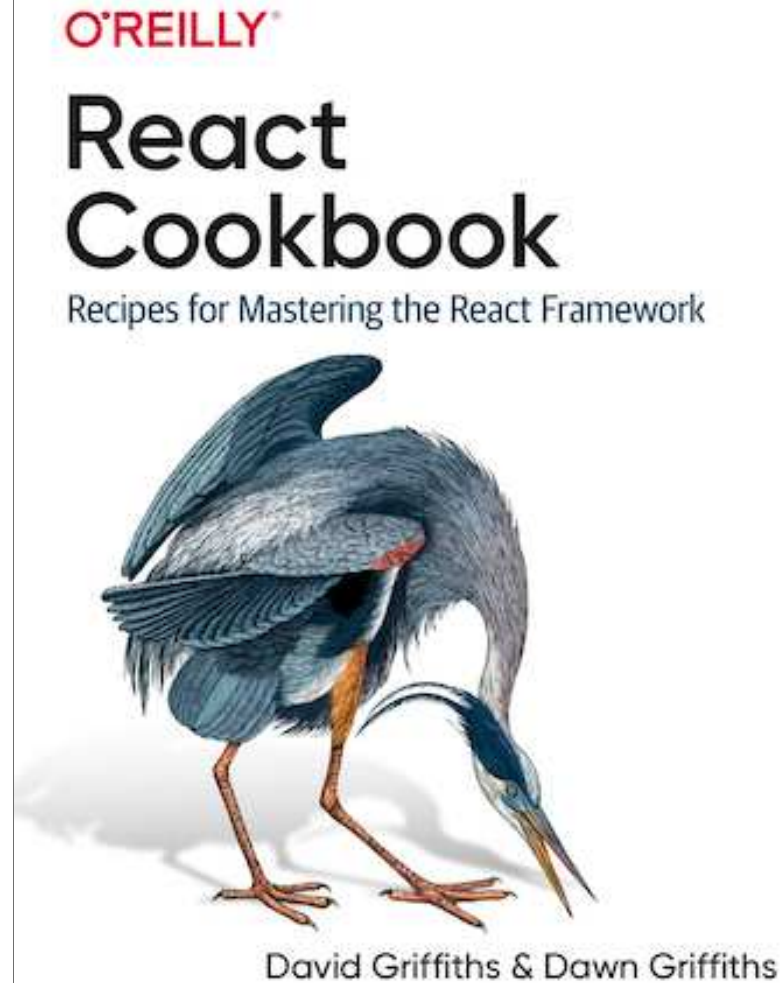
Recipes for Mastering the React Framework



David Griffiths & Dawn Griffiths

# About me

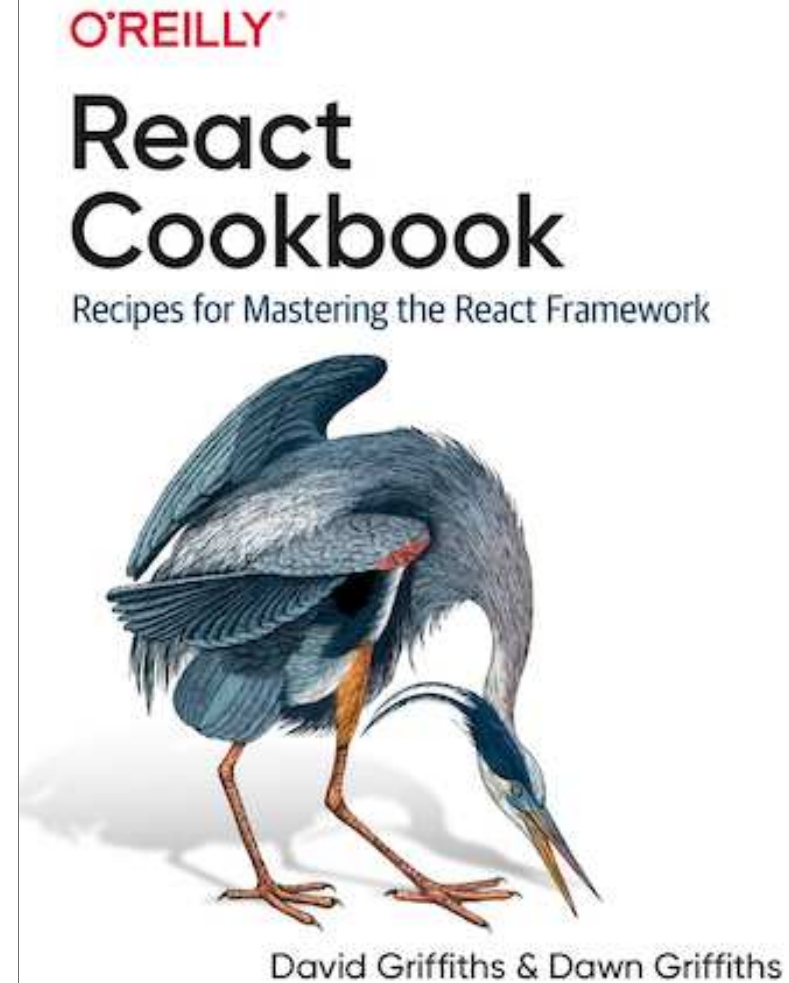
- Author
- <https://www.herescreen.com>





# About me

- Author
- <https://www.herescreen.com>
- <https://linktr.ee/dogriffiths>





# Why write the book?





# Component state



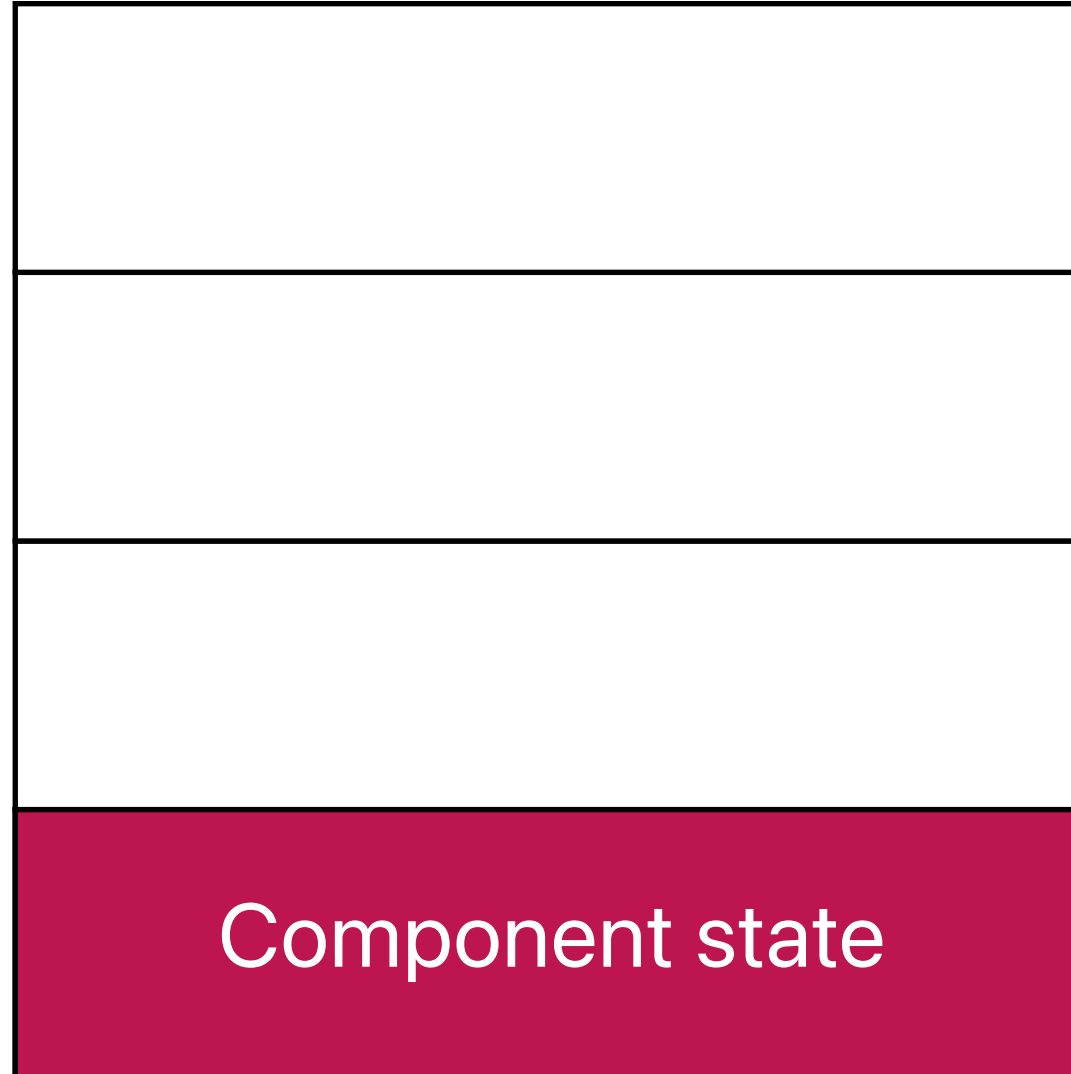




# Different levels of state

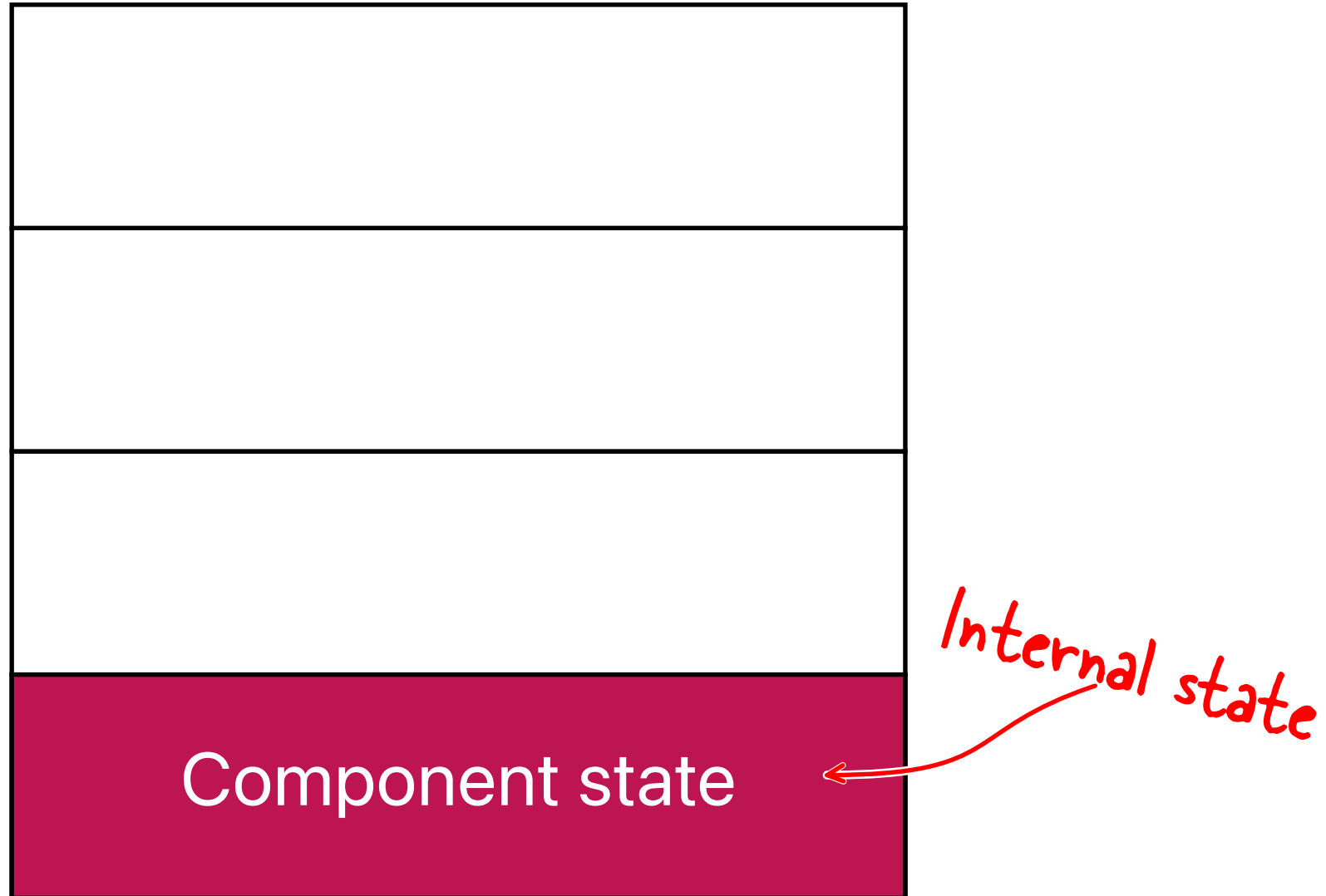



# Different levels of state





# Different levels of state





# useState

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





# useState

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



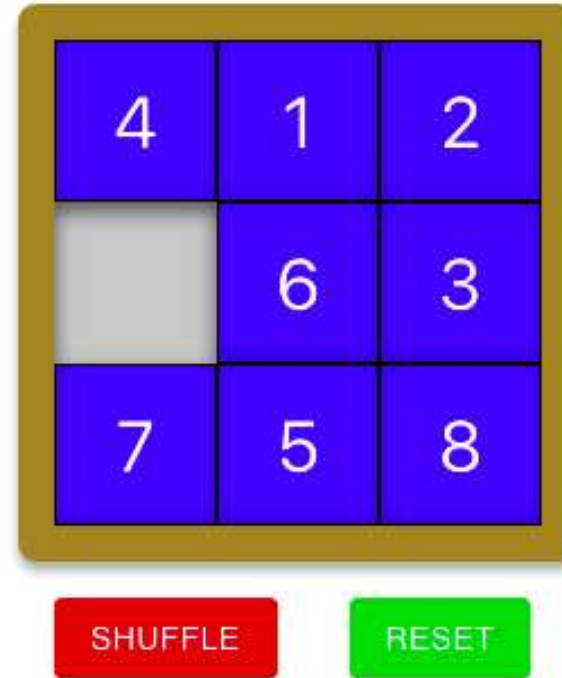
# useState

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



# Complex components

## Puzzle



# Developer response







## Managing complex component state (recipe 3.1)



# Managing complex component state (recipe 3.1)



# Managing complex component state (recipe 3.1)



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

# Managing complex component state (recipe 3.1)



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

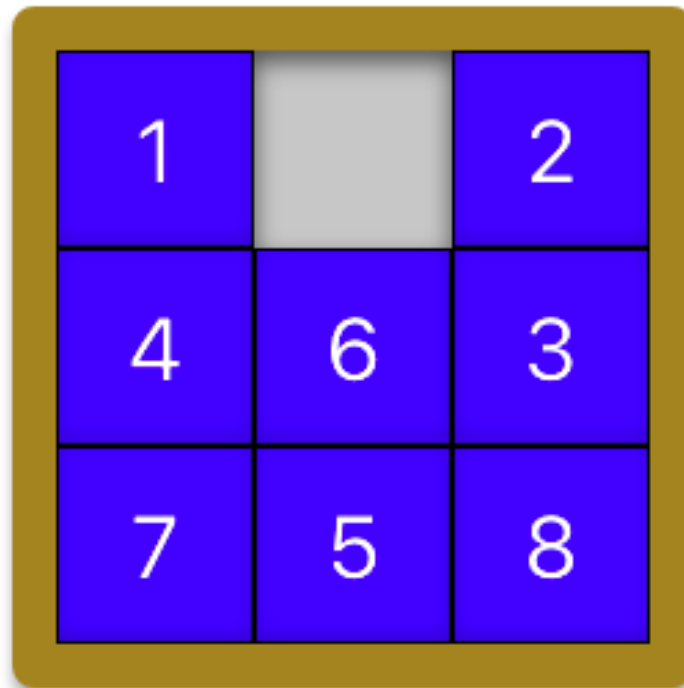
```
function reducer(state, action) {  
}
```

```
export default reducer
```



# Moving a tile

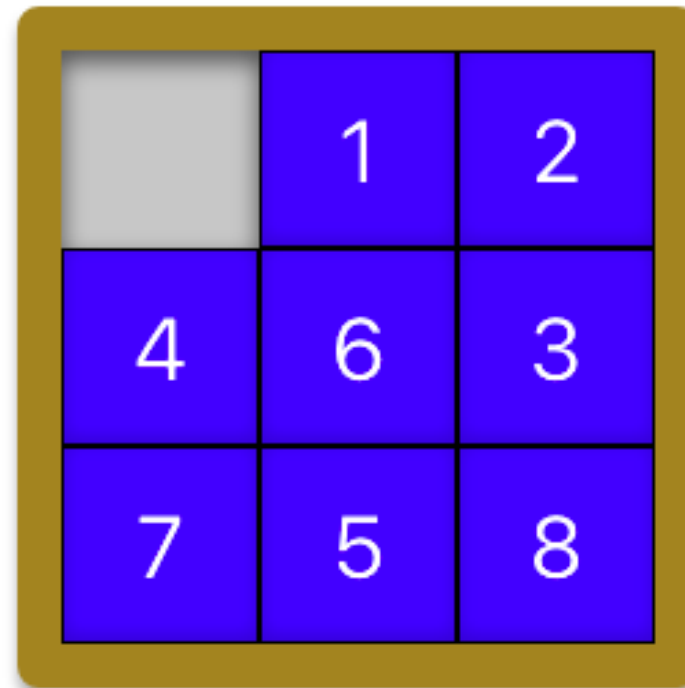
Puzzle



SHUFFLE

RESET

Puzzle



SHUFFLE

RESET



## 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'],  
  complete: false  
}  
  
action = {  
  type: 'move',  
  payload: 0  
}
```



# New state object returned

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



## 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 'move': {  
      const position = action.payload  
      const newItems = [...state.items]  
      const col = position % 3  
      // Complicated code goes here...  
      return {  
        ...state,  
        items: newItems,  
        complete: arraysEqual(newItems, CORRECT),  
      }  
    }  
    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', () => {
})
```



# Testing a reducer

```
import reducer from './reducer'

describe('reducer', () => {
  it('should say when it is complete', () => {
  })
})
```



# 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'],
    }
  })
})
```



# 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

```
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: 5 })
  })
})
```



# 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: 5 })
    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: 5 })
    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: 5 })
    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)



# Undo-ing a reducer (recipe 3.2)

**Puzzle**

1		2
4	6	3
7	5	8

SHUFFLE RESET

UNDO REDO

**Puzzle**

	1	2
4	6	3
7	5	8

SHUFFLE RESET

UNDO REDO

**Puzzle**

1		2
4	6	3
7	5	8

SHUFFLE RESET

UNDO REDO



# 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'],
  })
  ....
}
```



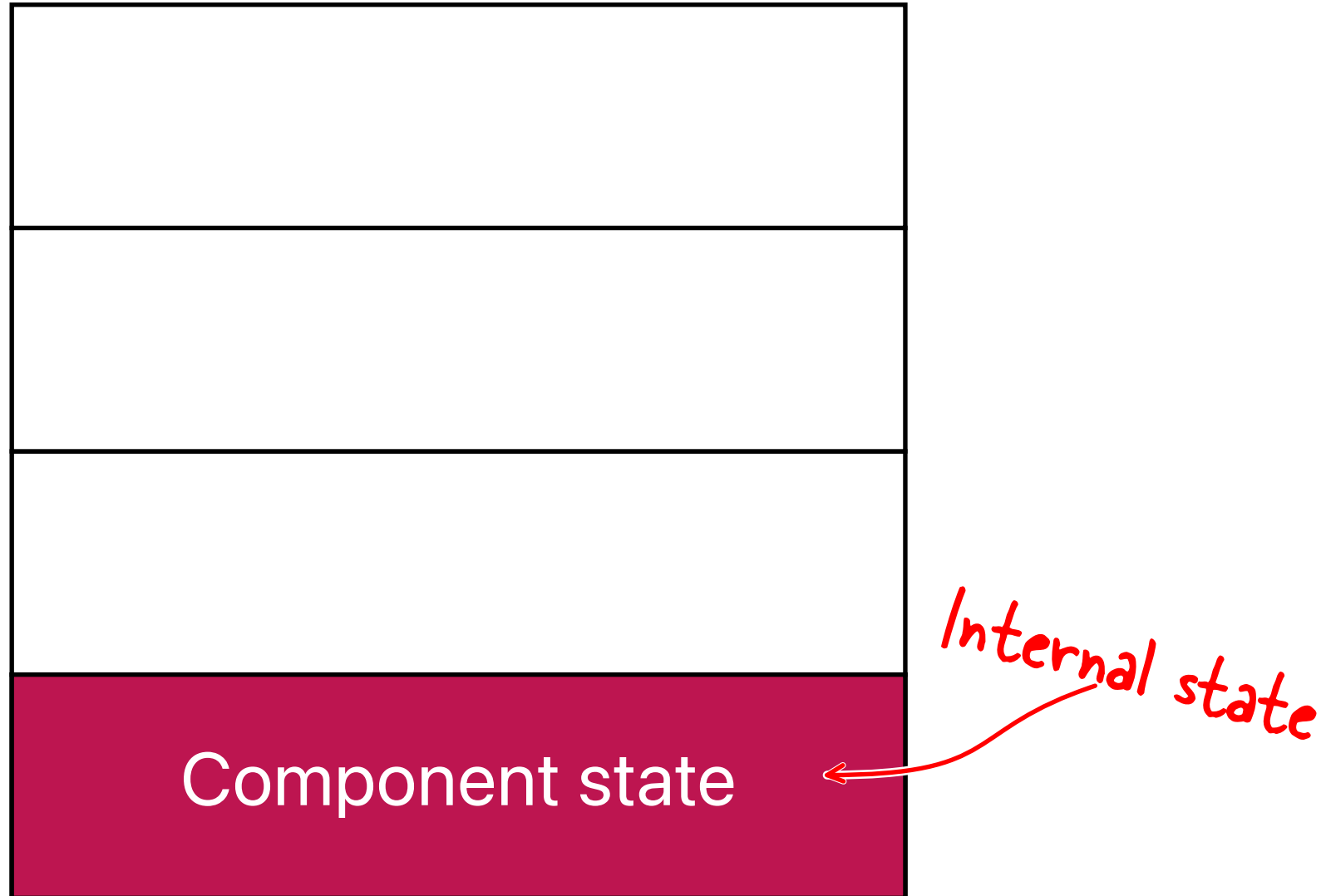
# Undo-ing a reducer (recipe 3.2)

```
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>
```



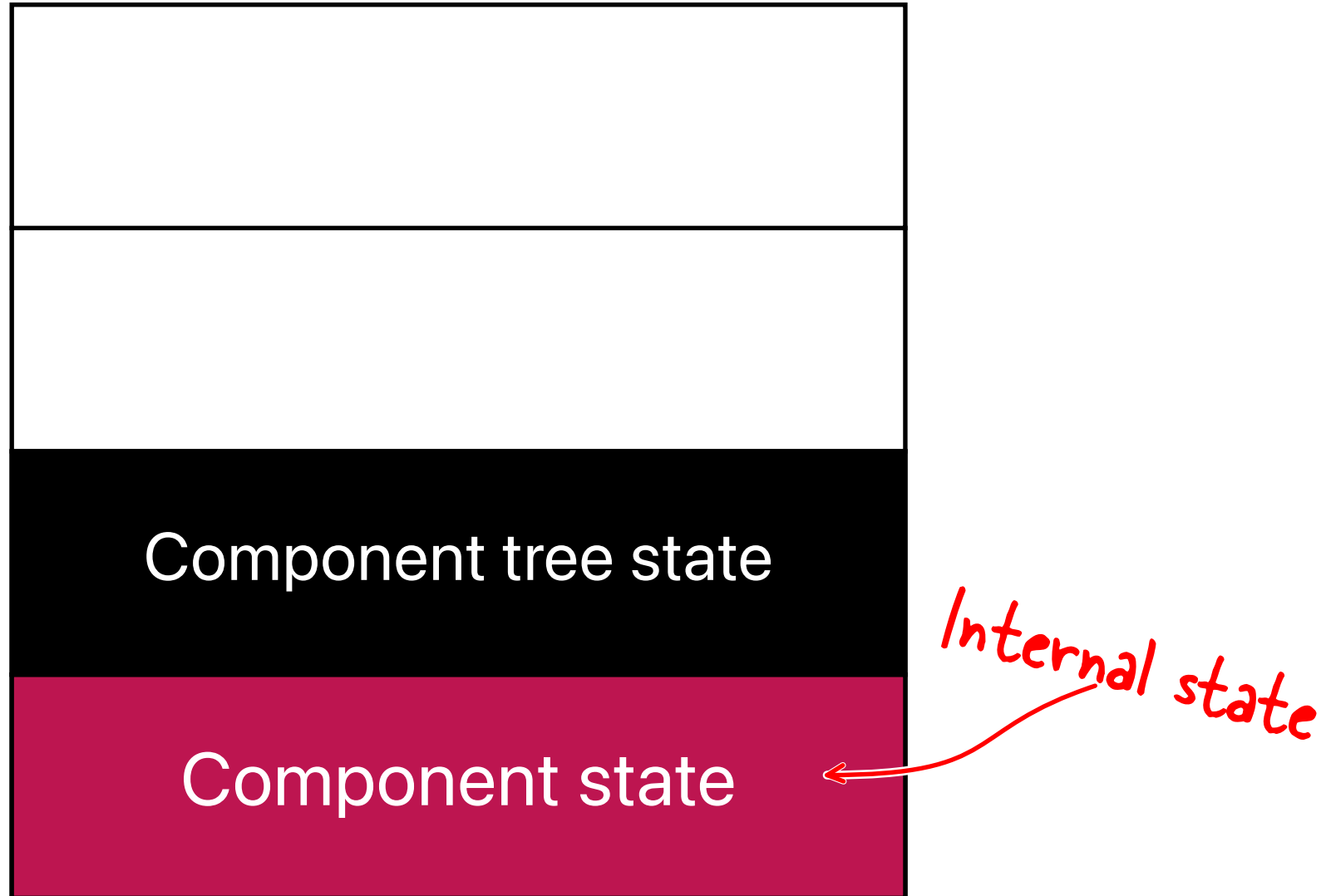
# Different levels of state





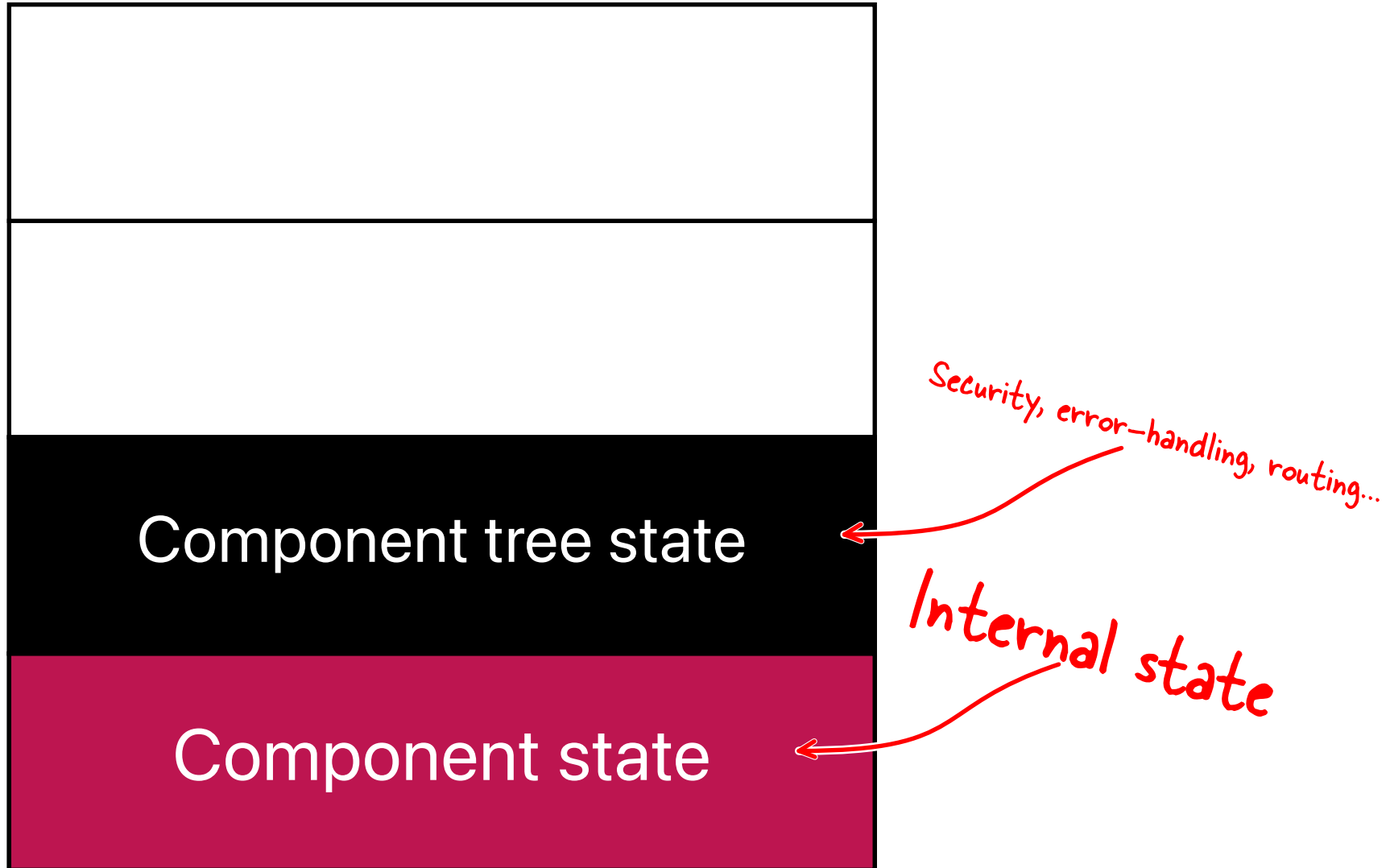


# Different levels of state

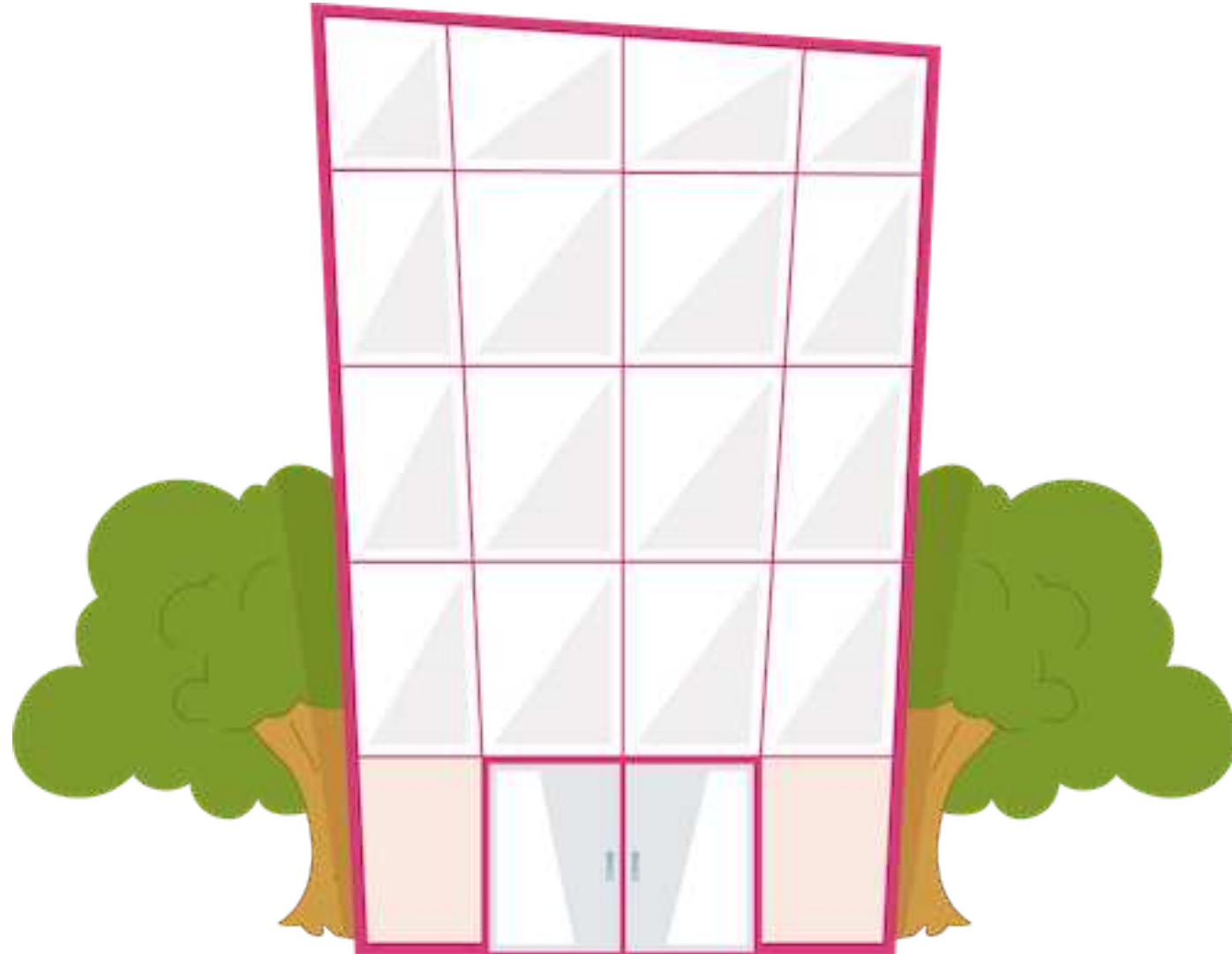




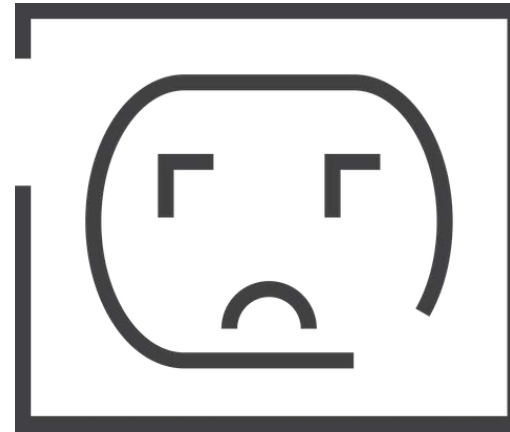
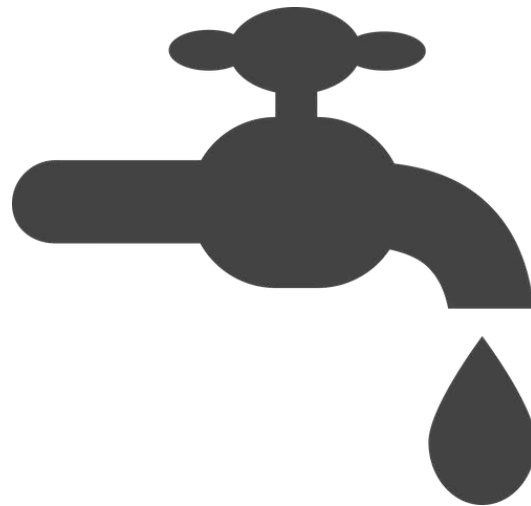
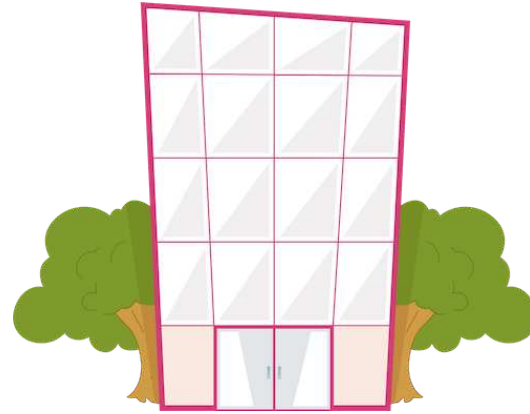
# Different levels of state



# 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">  
      <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">
      <BrowserRouter>
        <SecurityProvider>
          <ComponentOne/>
          <ComponentTwo/>
          <ComponentThree/>
          ...
        </SecurityProvider>
      </BrowserRouter>
    </div>
  )
}

export default App
```



# Access security from ComponentOne.js

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

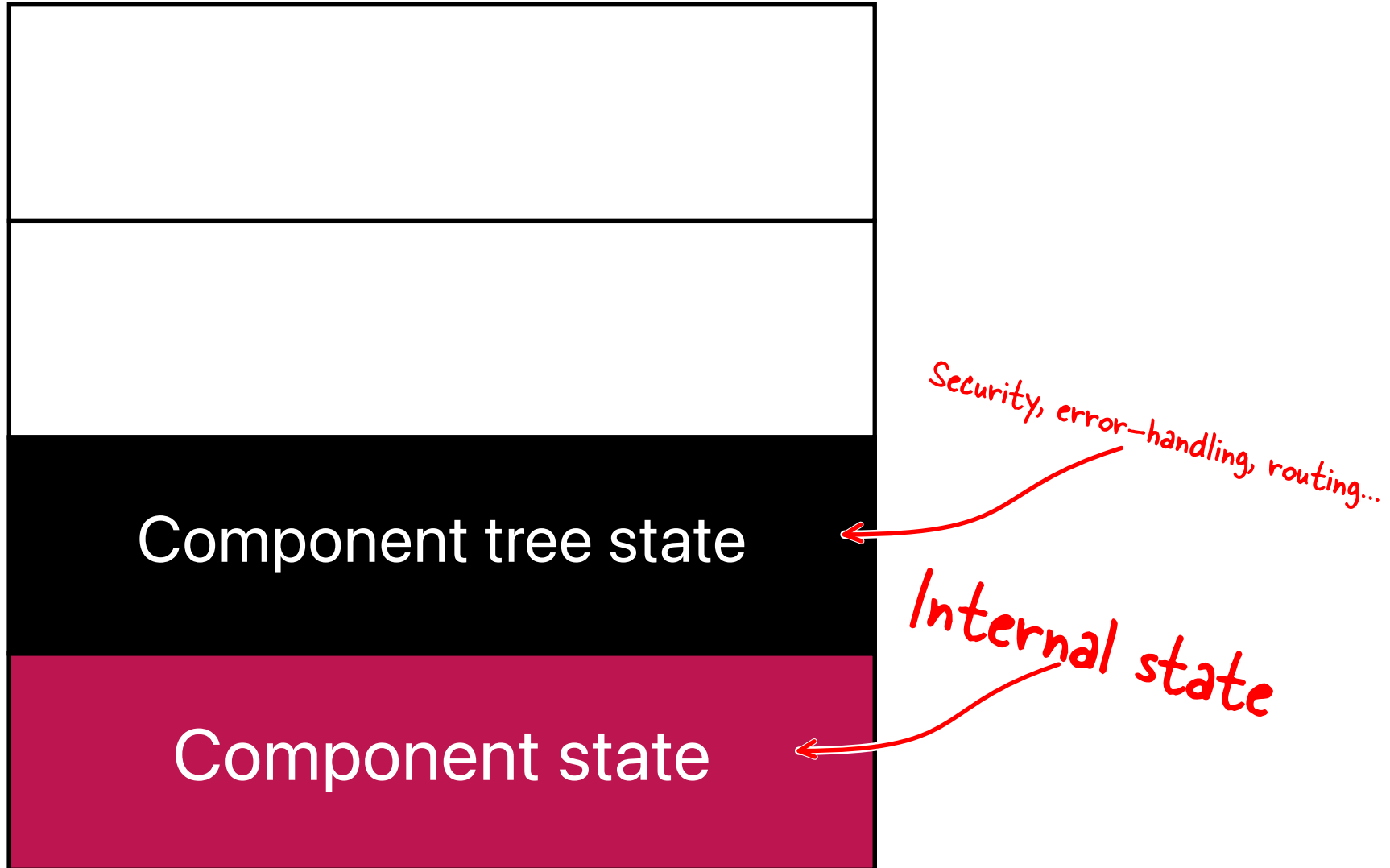


# Access security from ComponentOne.js

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

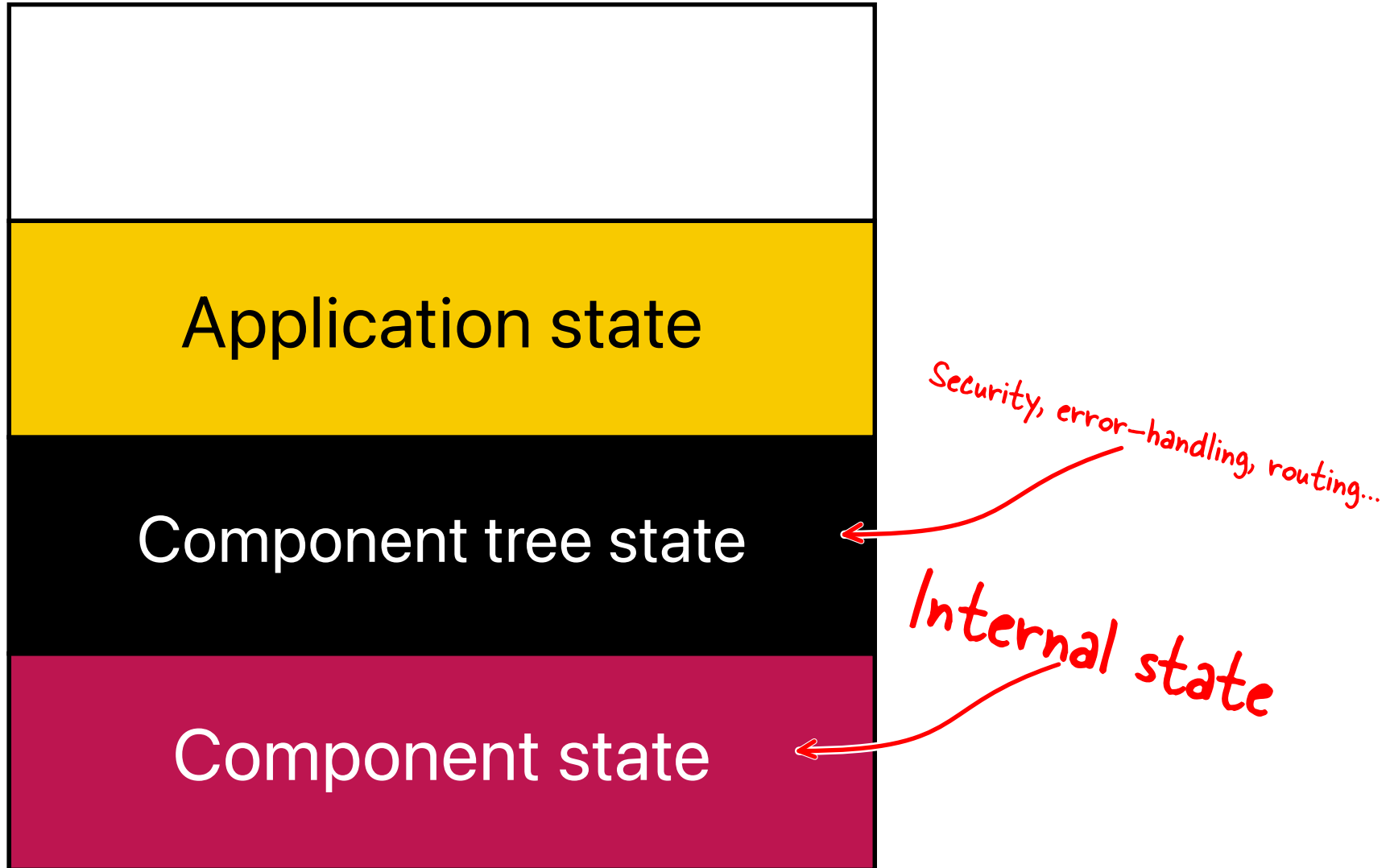


# Different levels of state





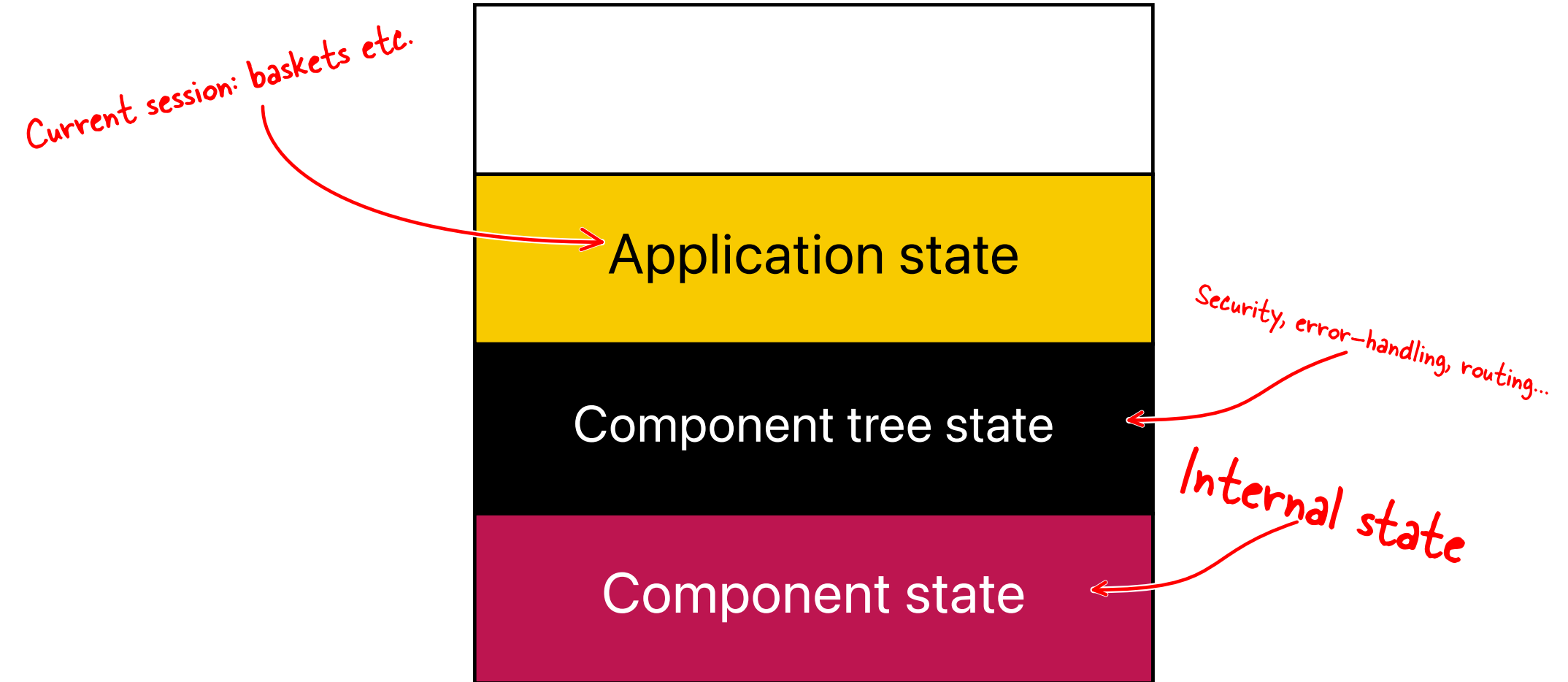
# Different levels of state







# Different levels of state





## Managing central application state (recipe 3.6)



# Managing central application state (recipe 3.6)





# Managing central application state (recipe 3.6)

- Some state needs to be available to entire app



# Managing central application state (recipe 3.6)

- Some state needs to be available to entire app
- Needs to be managed by separate code...



# Managing central application state (recipe 3.6)

- Some state needs to be available to entire app
- Needs to be managed by separate code...
- ...so could use a reducer



# Managing central application state (recipe 3.6)

- Some state needs to be available to entire app
- Needs to be managed by separate code...
- ...so could use a reducer
- And we need it to be available to entire component tree...



# Managing central application state (recipe 3.6)

- Some state needs to be available to entire app
- Needs to 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





# Managing central application state (recipe 3.6)

- Some state needs to be available to entire app
- Needs to 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



# Using Redux libraries

- Can use middleware to sync Redux store with a server (recipe 3.6)



# 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`



# 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)

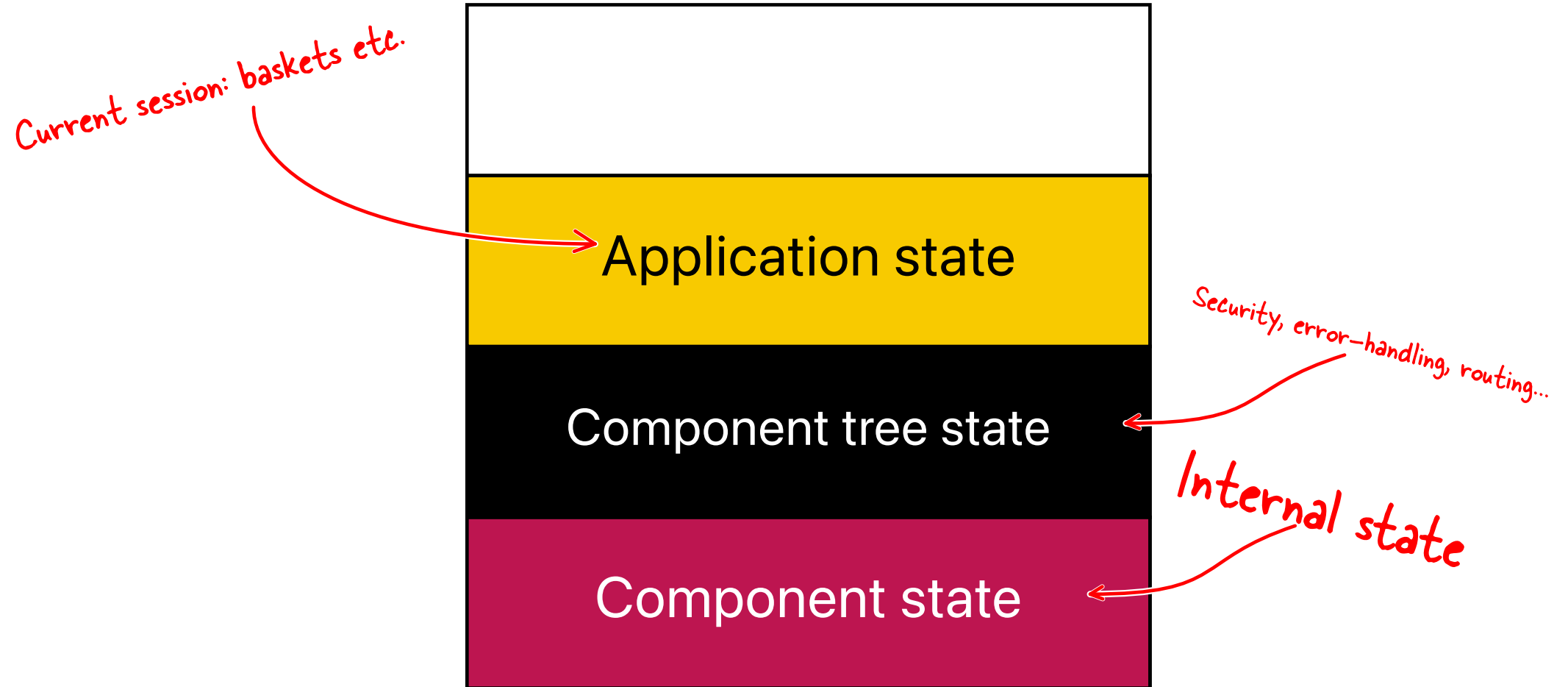


# Using Redux libraries

- 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)



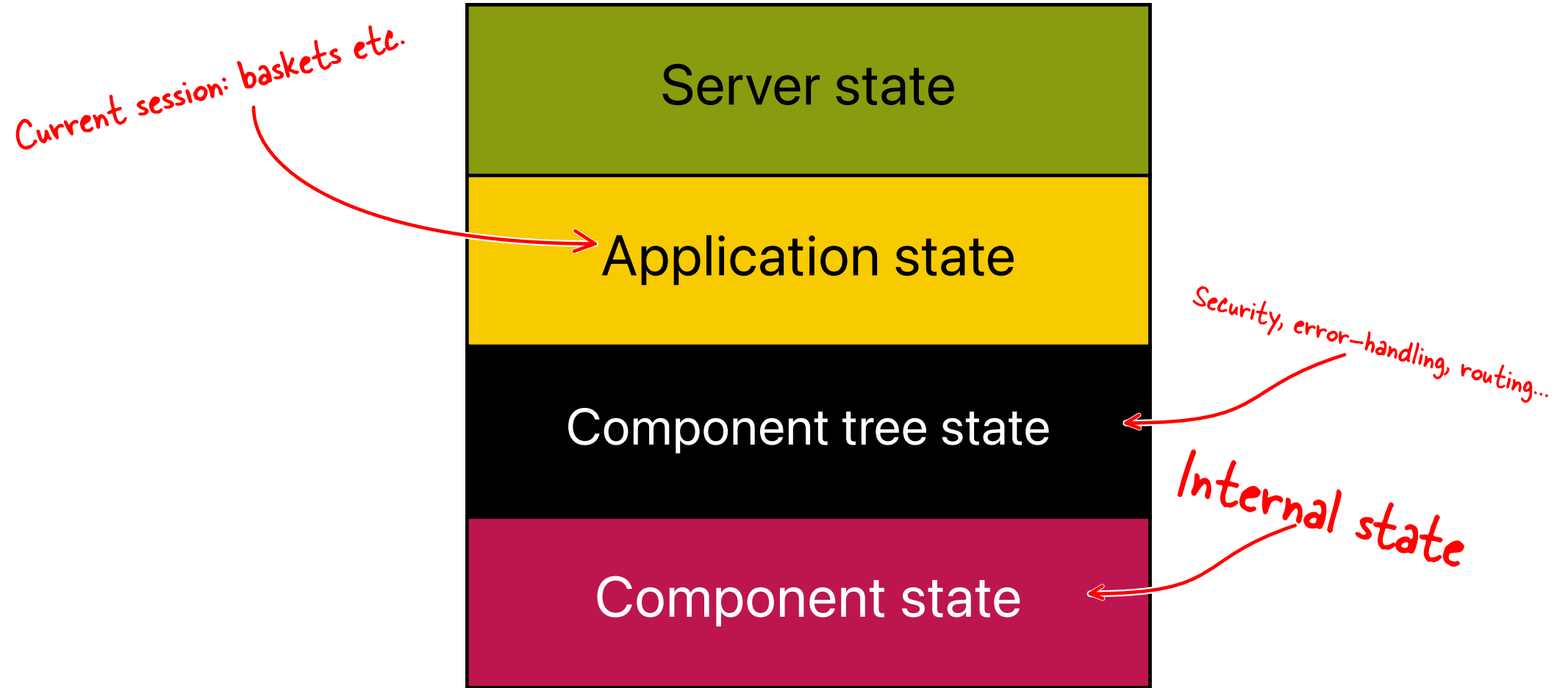
# Different levels of state





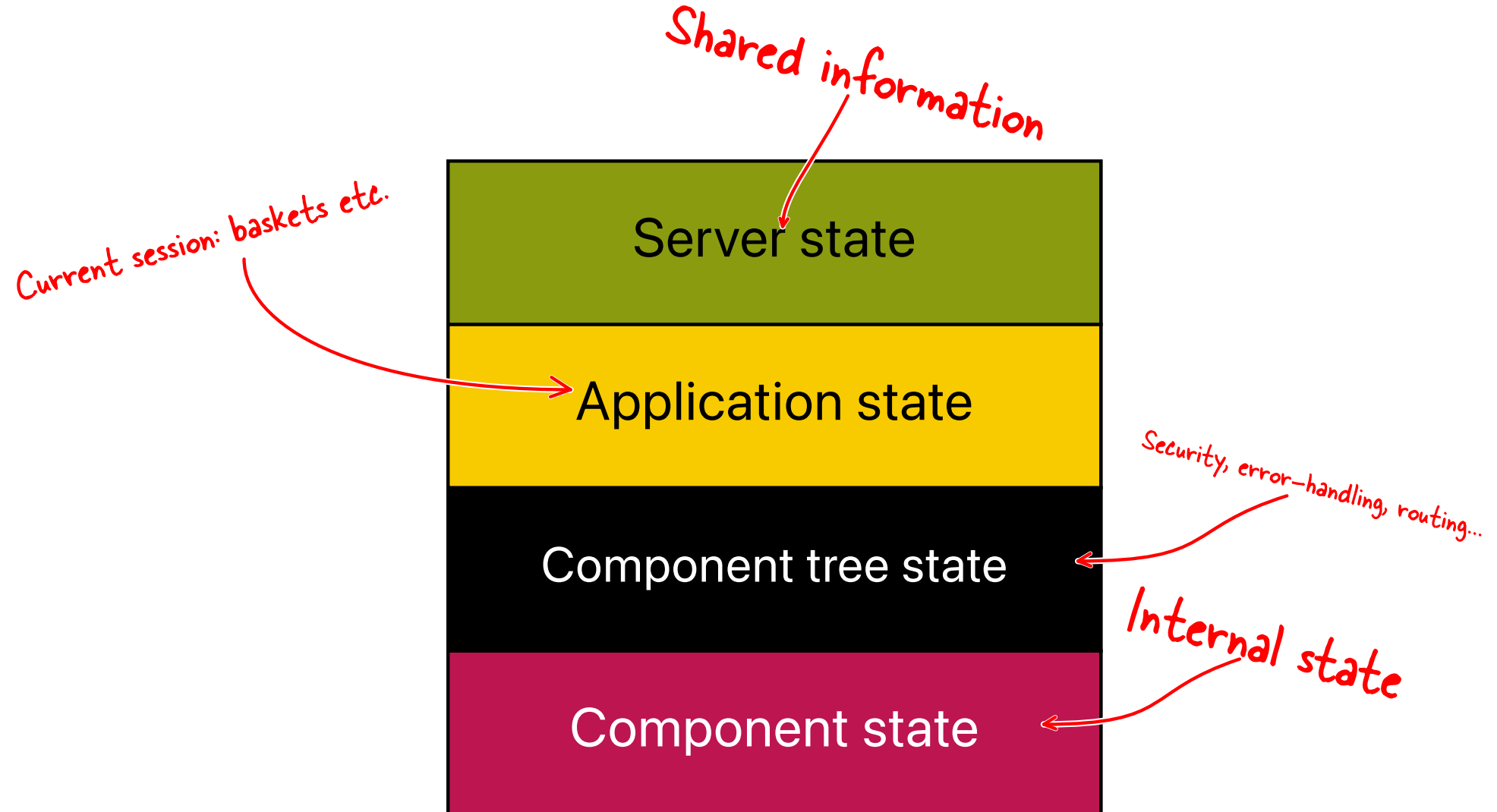


# Different levels of state





# Different levels of state





# Reading data when offline? (recipe 11.3)





# **Reading data when offline? (recipe 11.3)**



# Reading data when offline? (recipe 11.3)

- Many users are on mobile devices



# Reading data when offline? (recipe 11.3)

- Many users are on mobile devices
- Mobile devices have poor network connections



# 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



Service worker



# Use a Service Worker

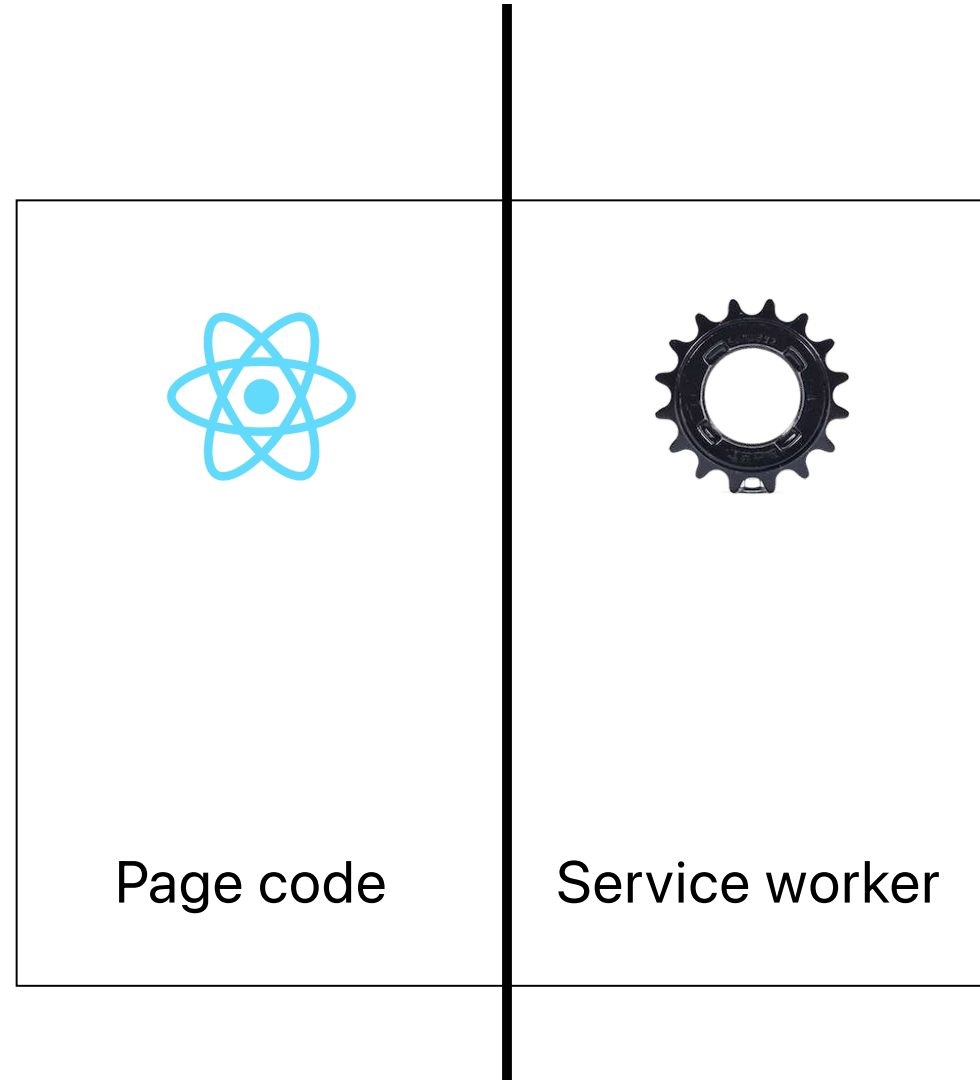
Web worker



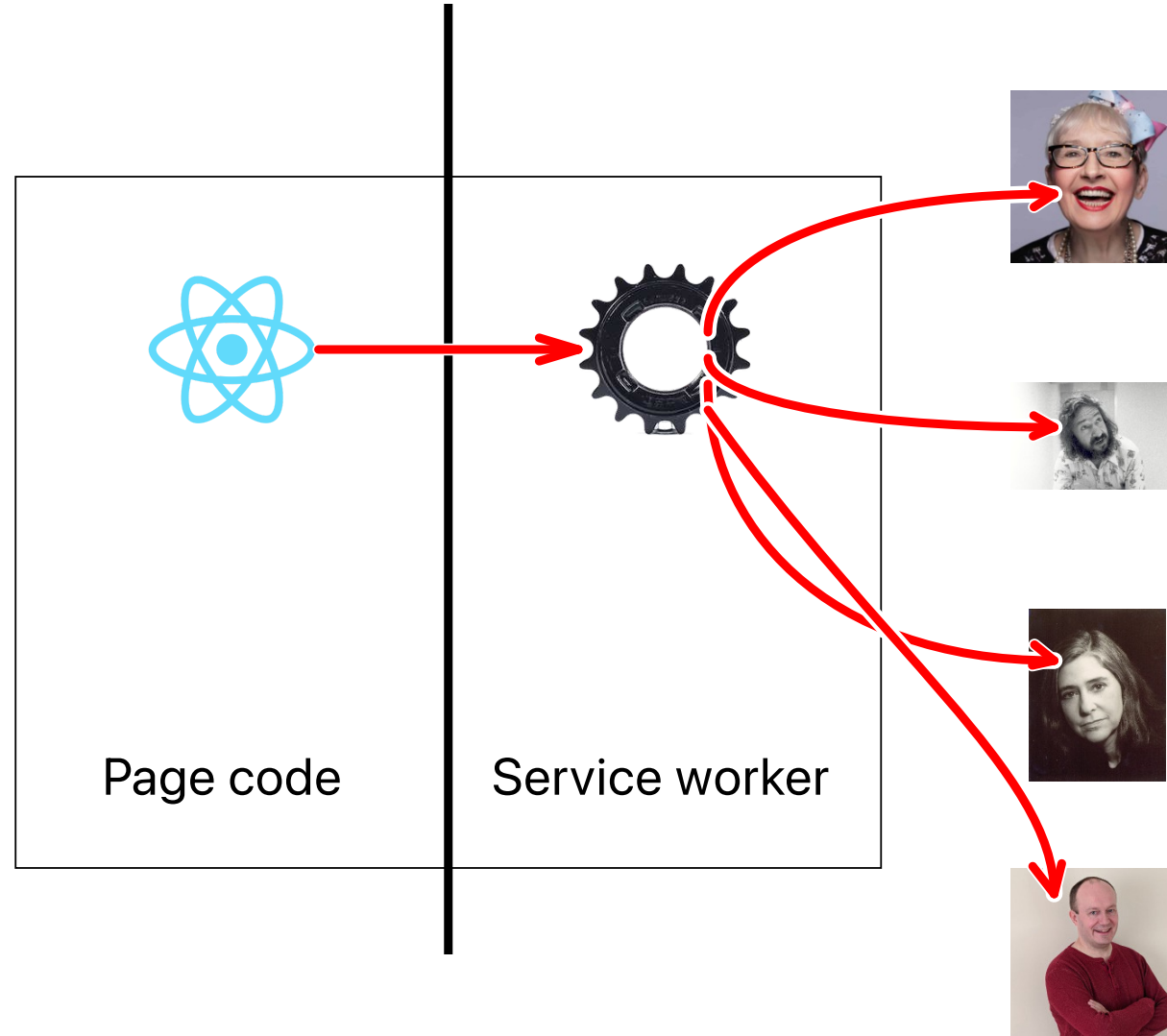
Service worker



# Use a Service Worker



# Use a Service Worker





# Service workers



# Service workers

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



# Service workers

- JavaScript that runs in the background (not the page)
- Can intercept all networks connections



# Service workers

- 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)**





# Service workers (part 2)

- Not normally used when in development mode



# Service workers (part 2)

- Not normally used when in development mode
- 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

```
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')
);

serviceWorkerRegistration.register();
```



# The service worker: service-worker.js

```
import { registerRoute } from 'workbox-routing';  
import { StaleWhileRevalidate } from 'workbox-strategies';  
  
// All the other service-worker code...
```



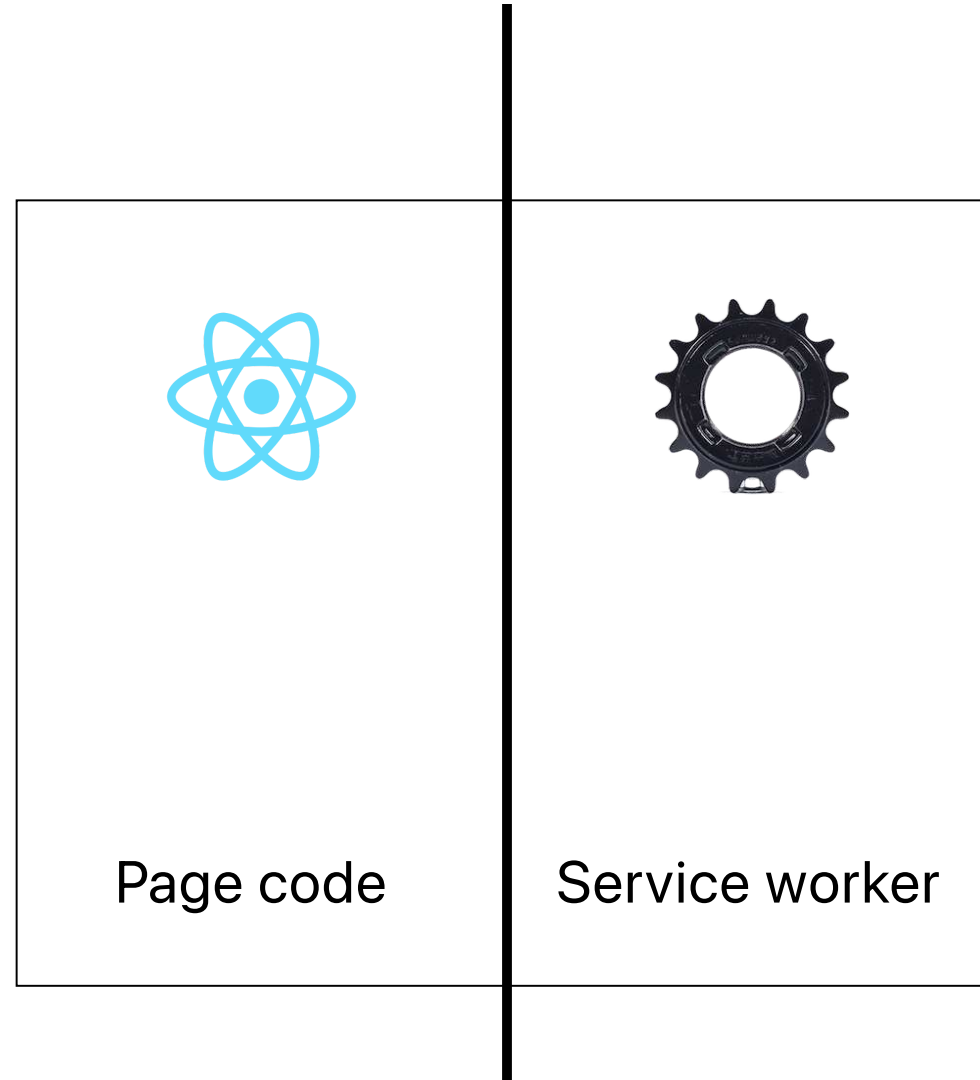
# The service worker: service-worker.js

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

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

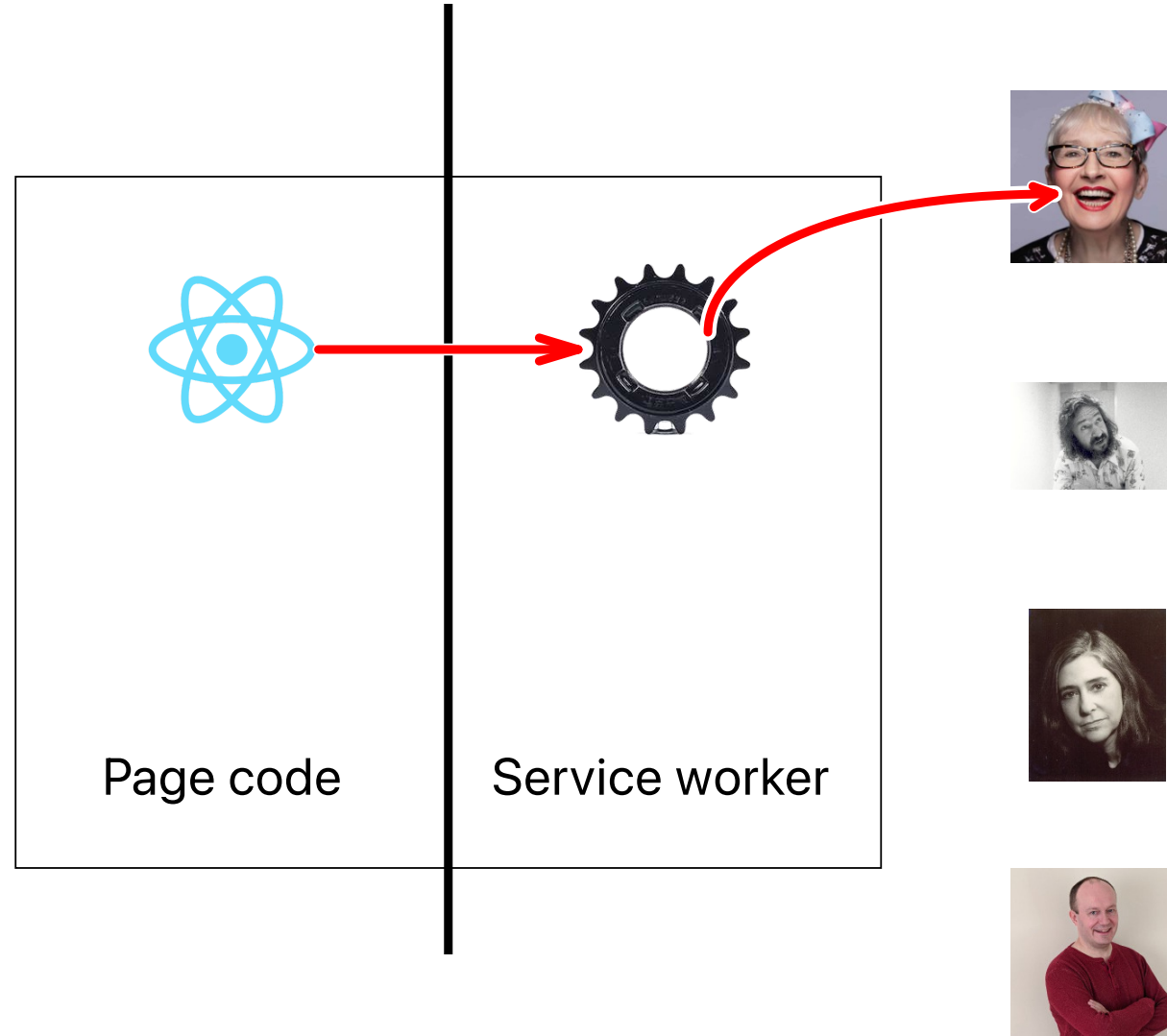
```
registerRoute(  
  ({url}) => url.origin === 'https://fonts.googleapis.com',  
  new StaleWhileRevalidate({  
    cacheName: 'stylesheets',  
  })  
);
```

# StaleWhileRevalidate

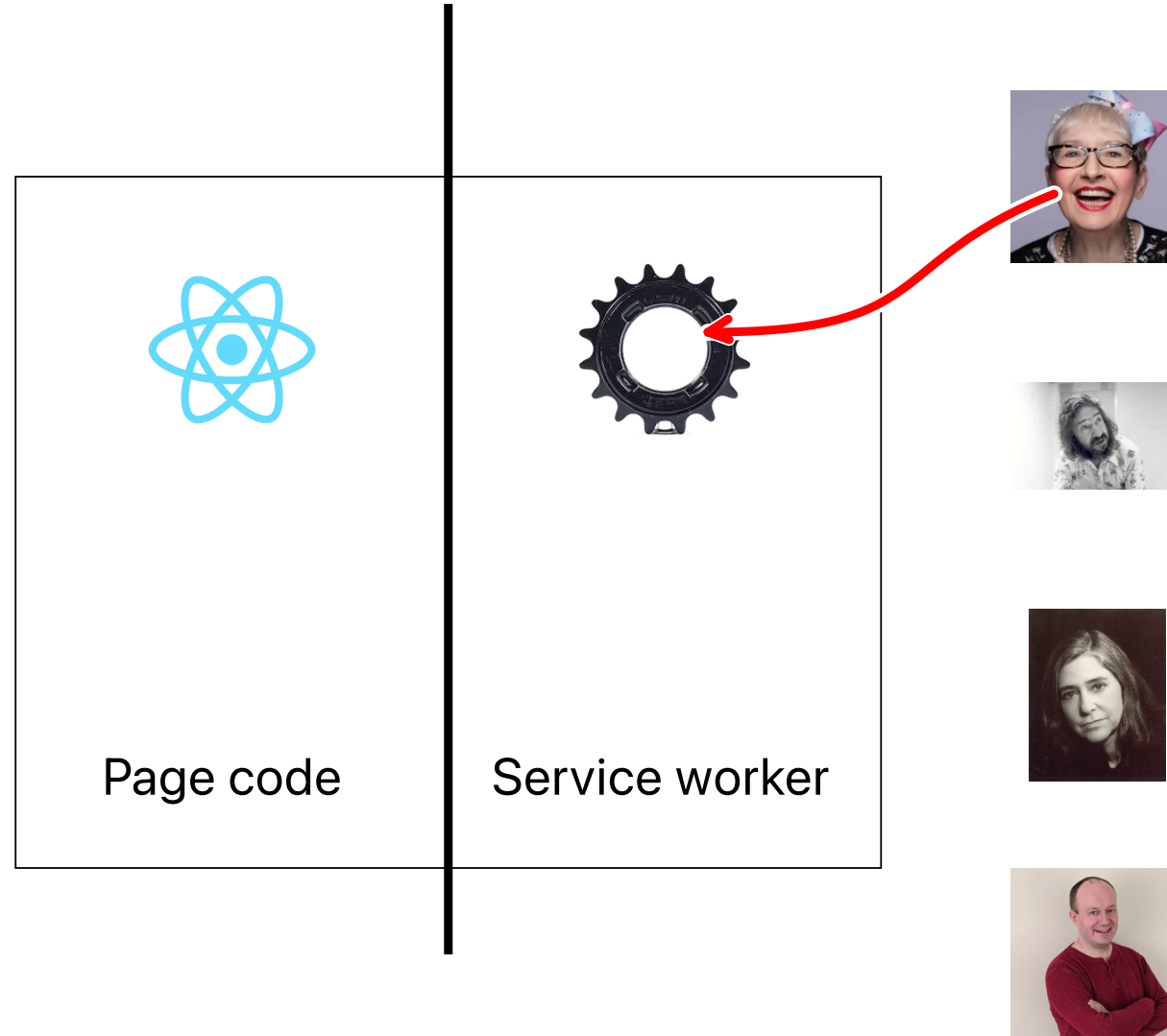




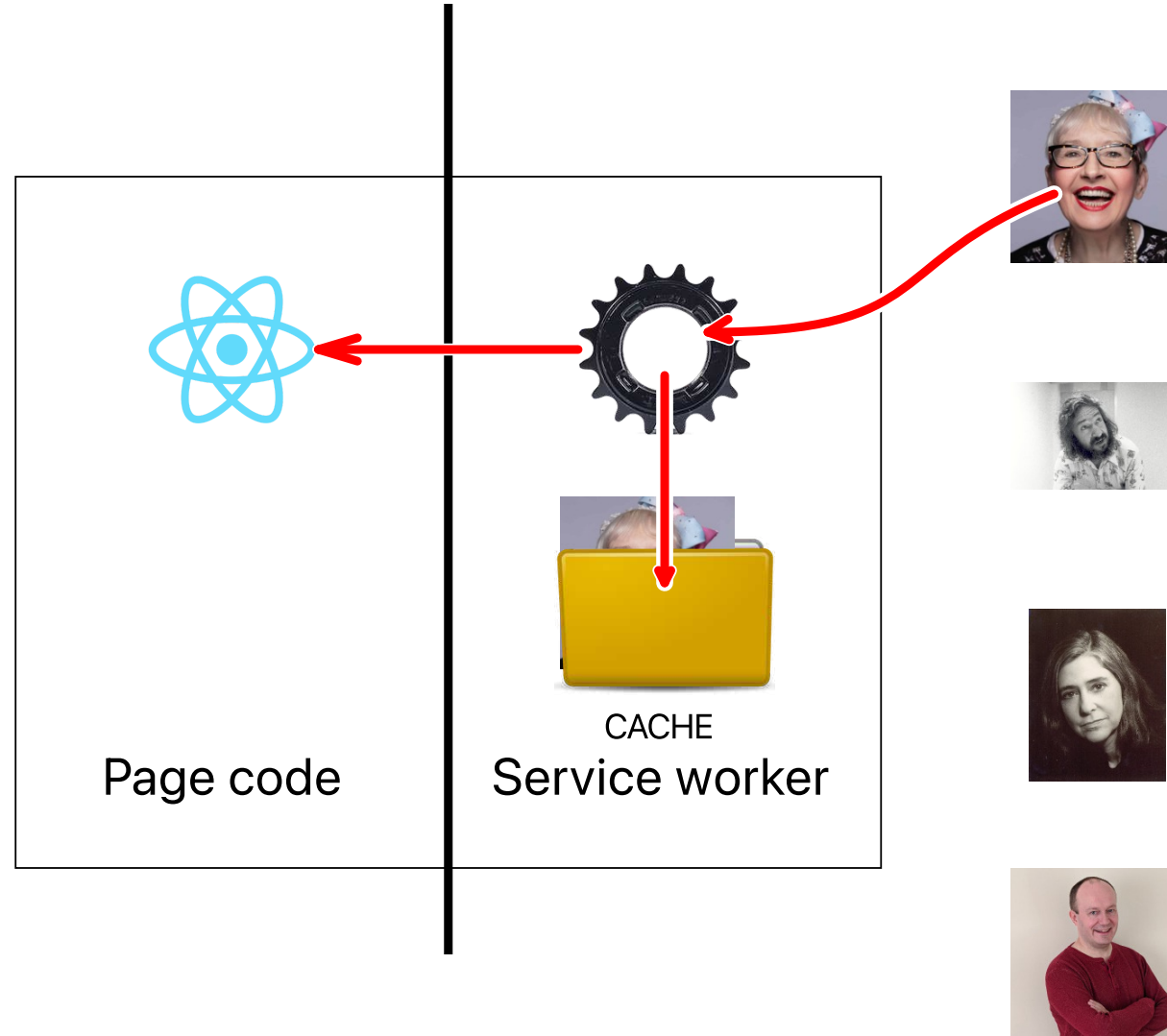
# StaleWhileRevalidate



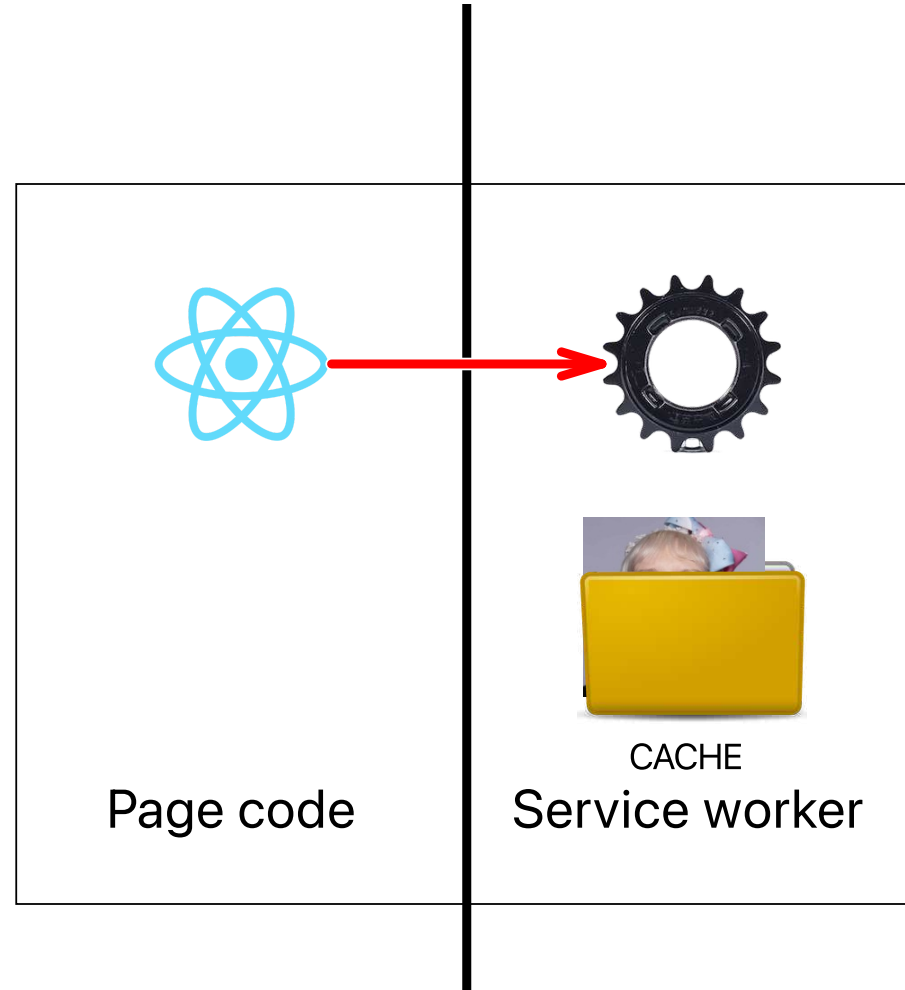
# StaleWhileRevalidate



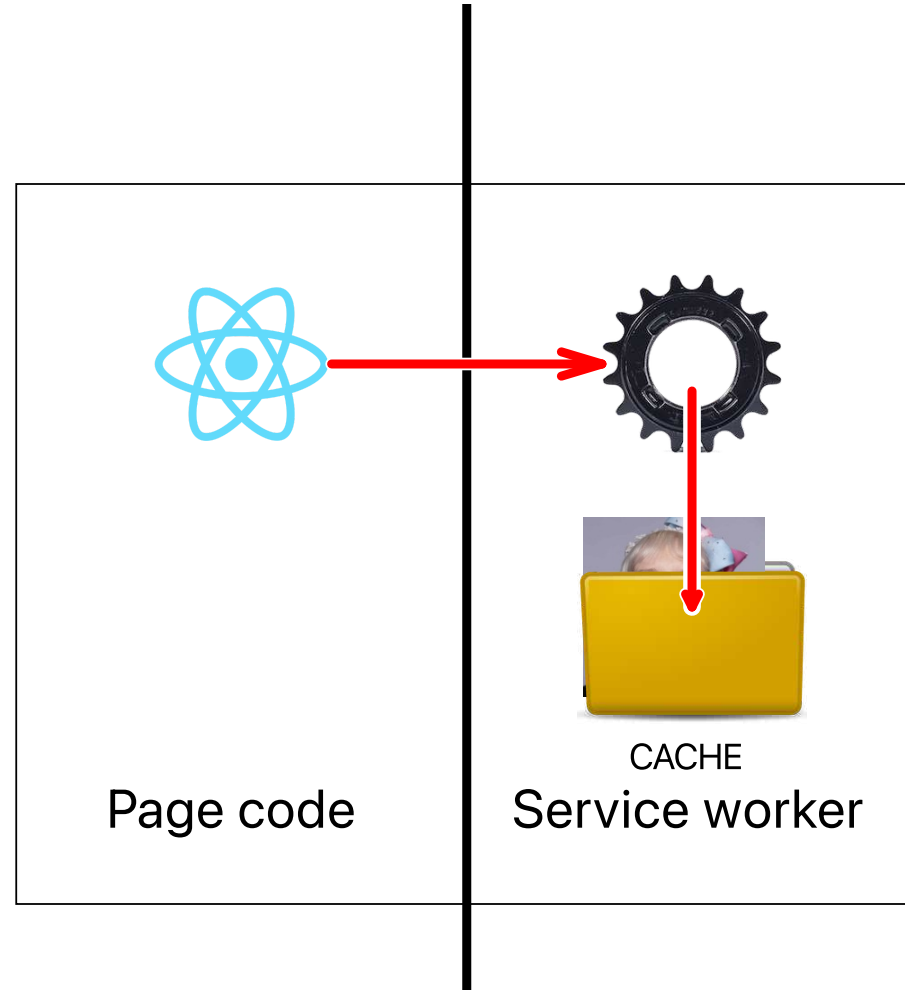
# StaleWhileRevalidate



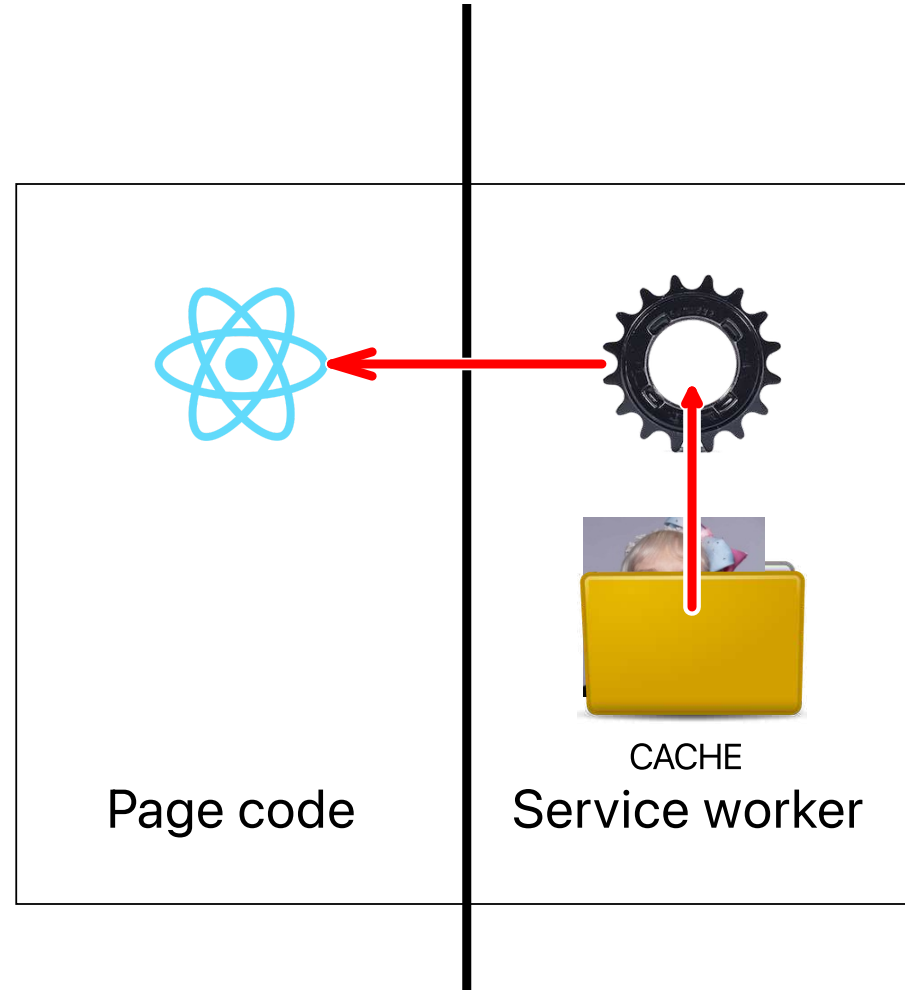
# StaleWhileRevalidate



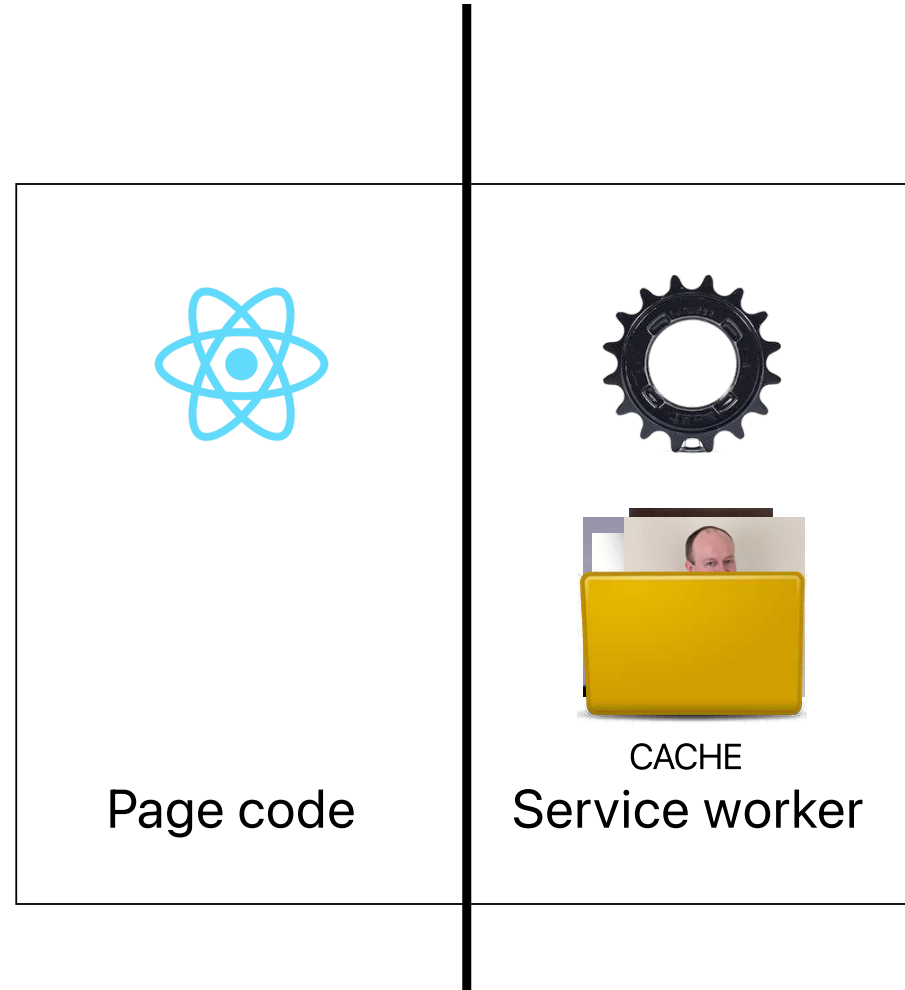
# StaleWhileRevalidate



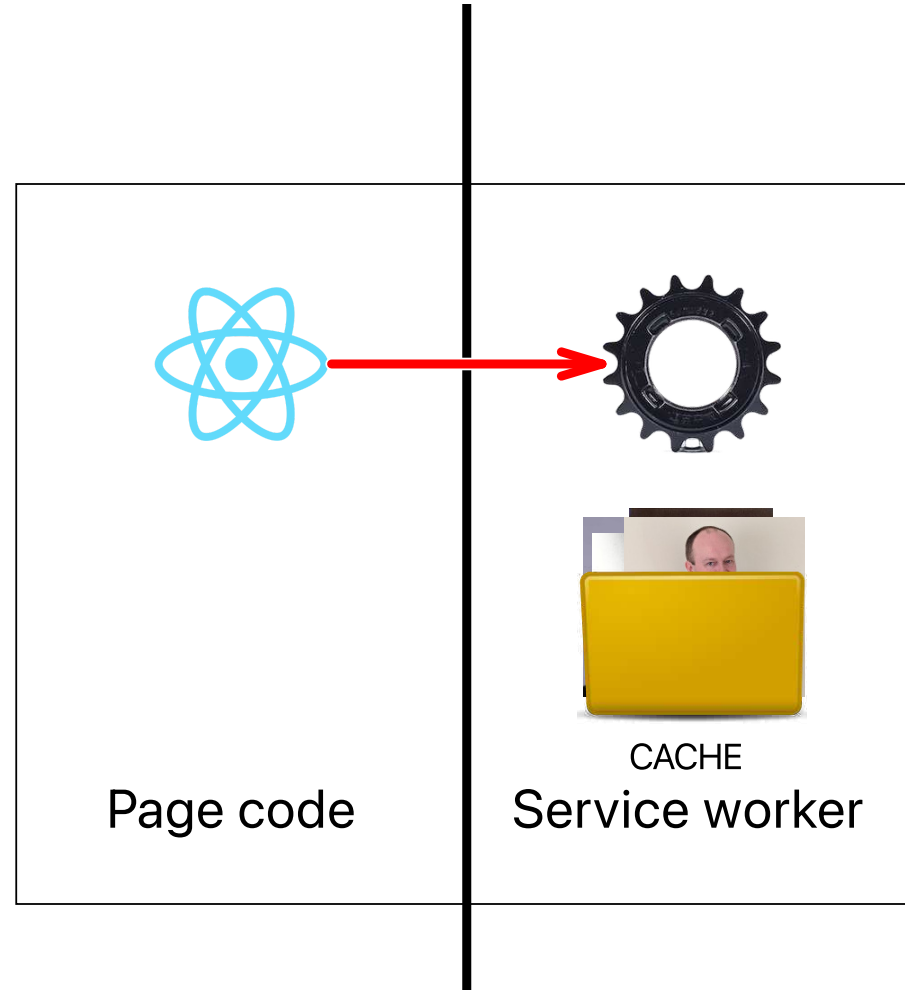
# StaleWhileRevalidate



# StaleWhileRevalidate

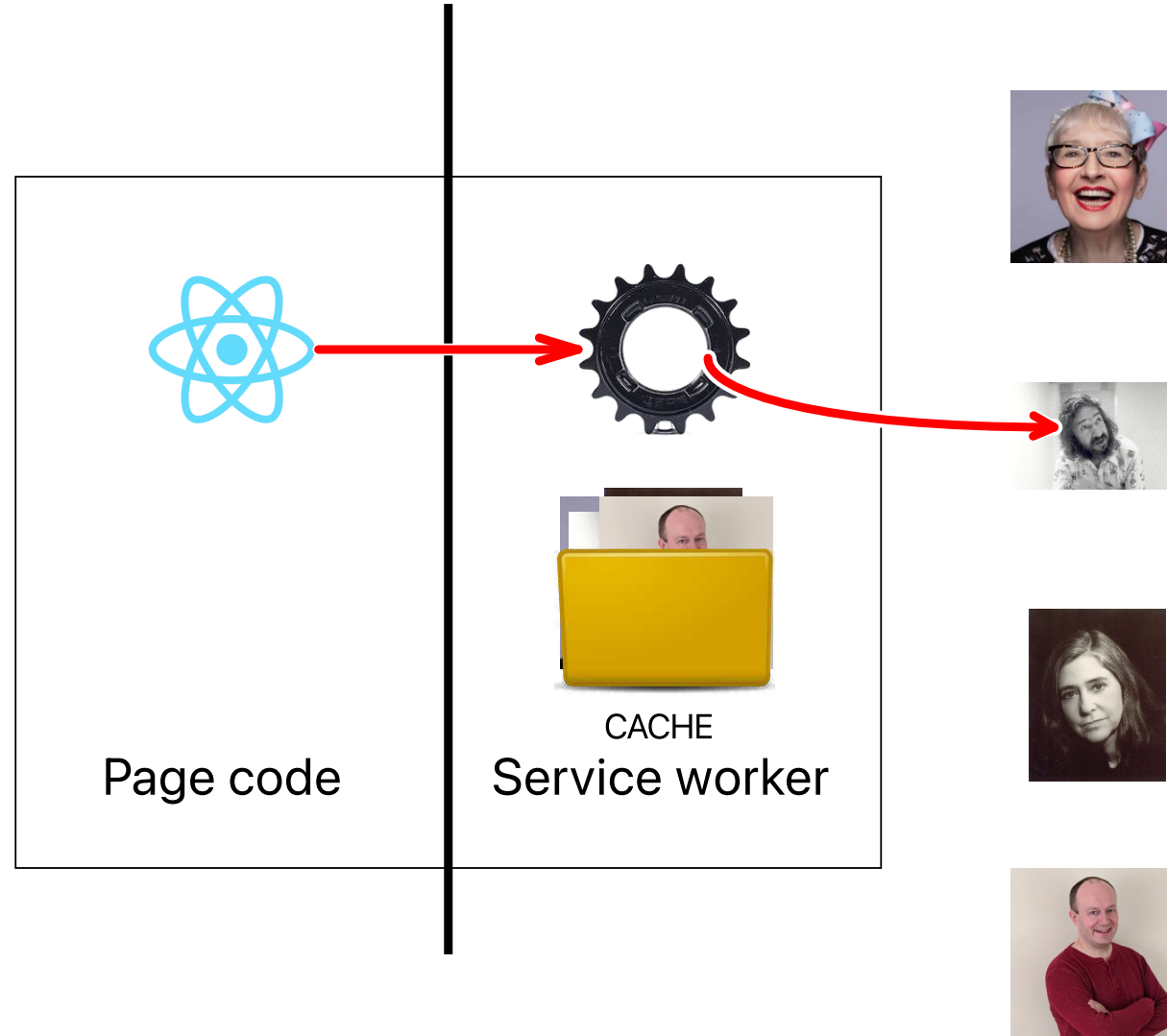


# StaleWhileRevalidate

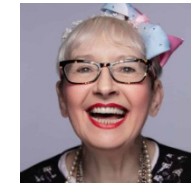
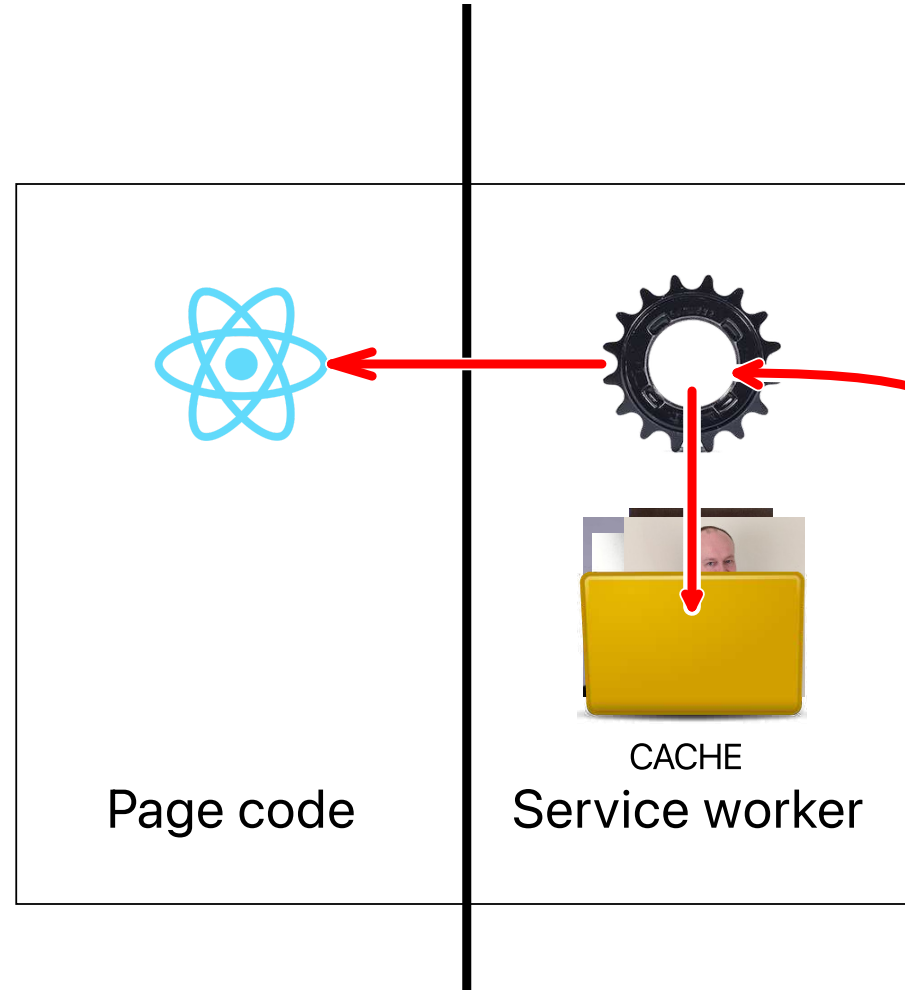




# StaleWhileRevalidate



# StaleWhileRevalidate





# Sending data when offline? (recipe 11.6)





# **Sending data when offline? (recipe 11.6)**



# **Sending data when offline? (recipe 11.6)**

- When people are offline they might want to do more than read



# 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



# 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

```
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'
);
```



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