O'REILLY®

# From Local State to Global Control

September 2023

# Introduction

# About me

- Author

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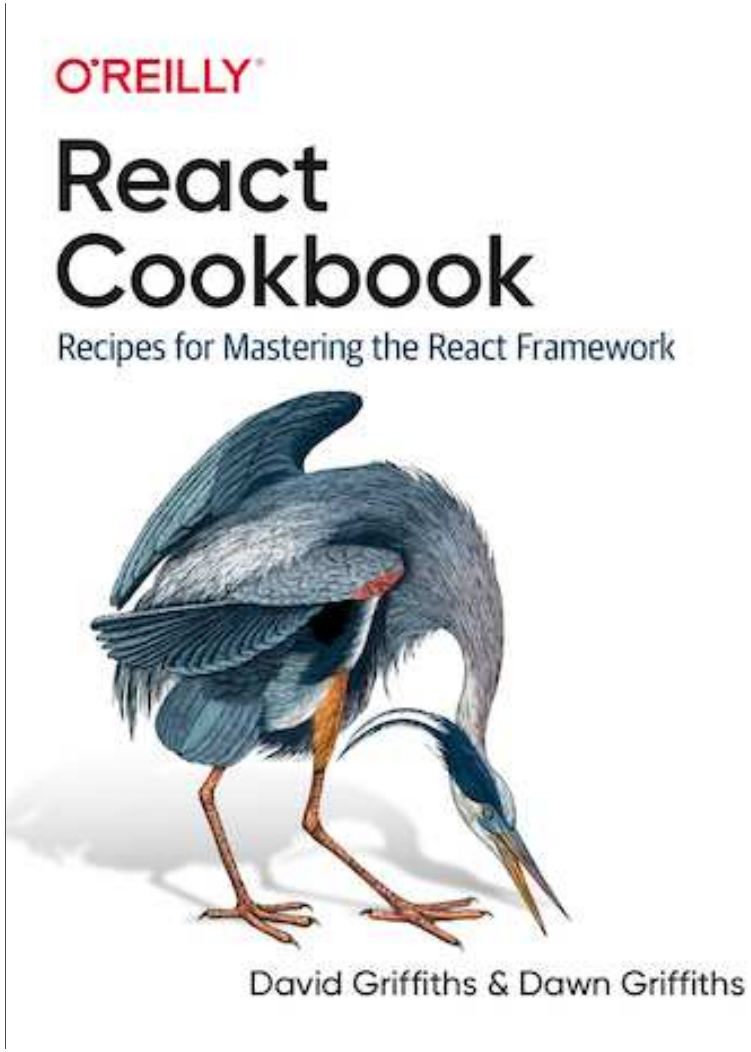
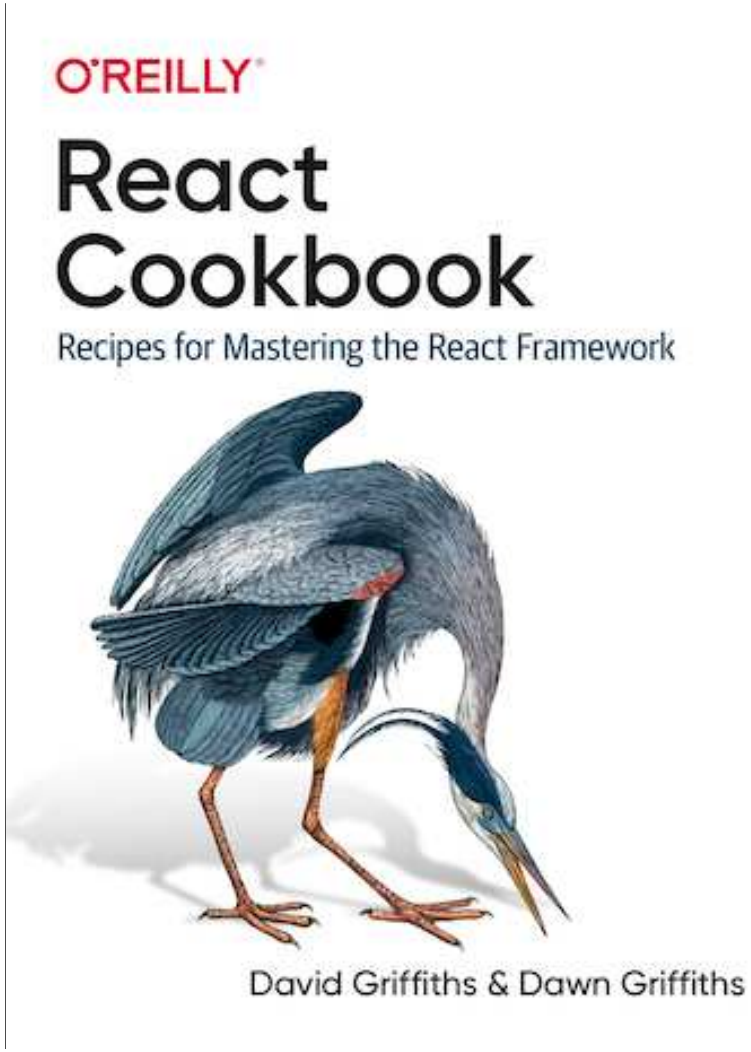


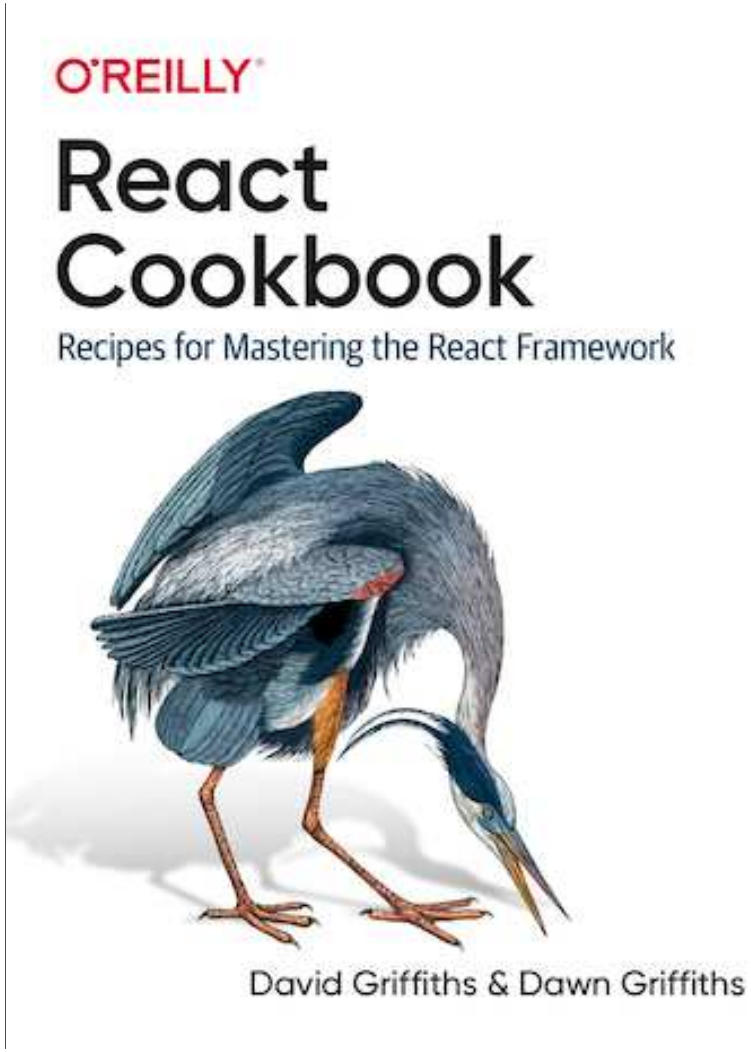
# About me

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



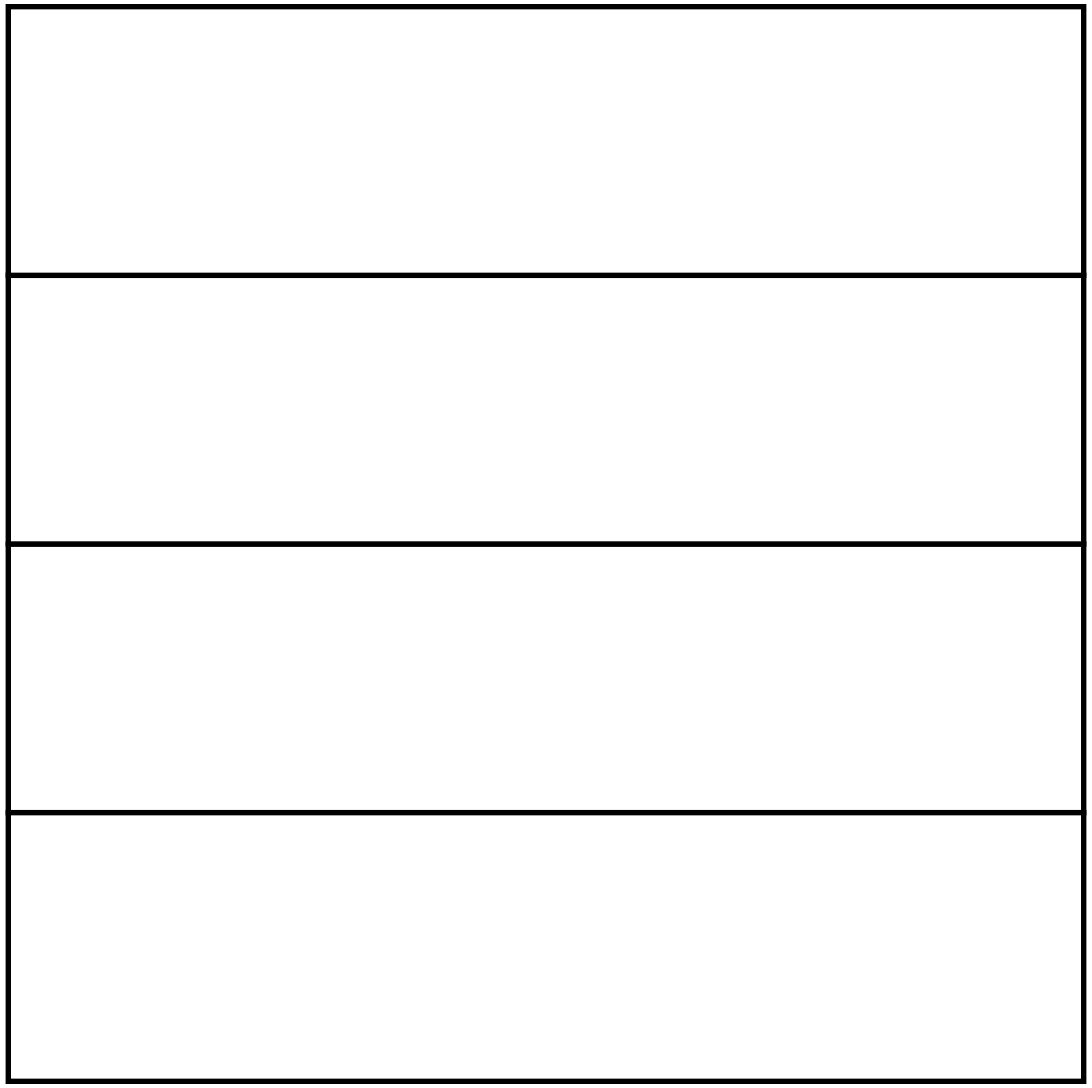
# About me

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

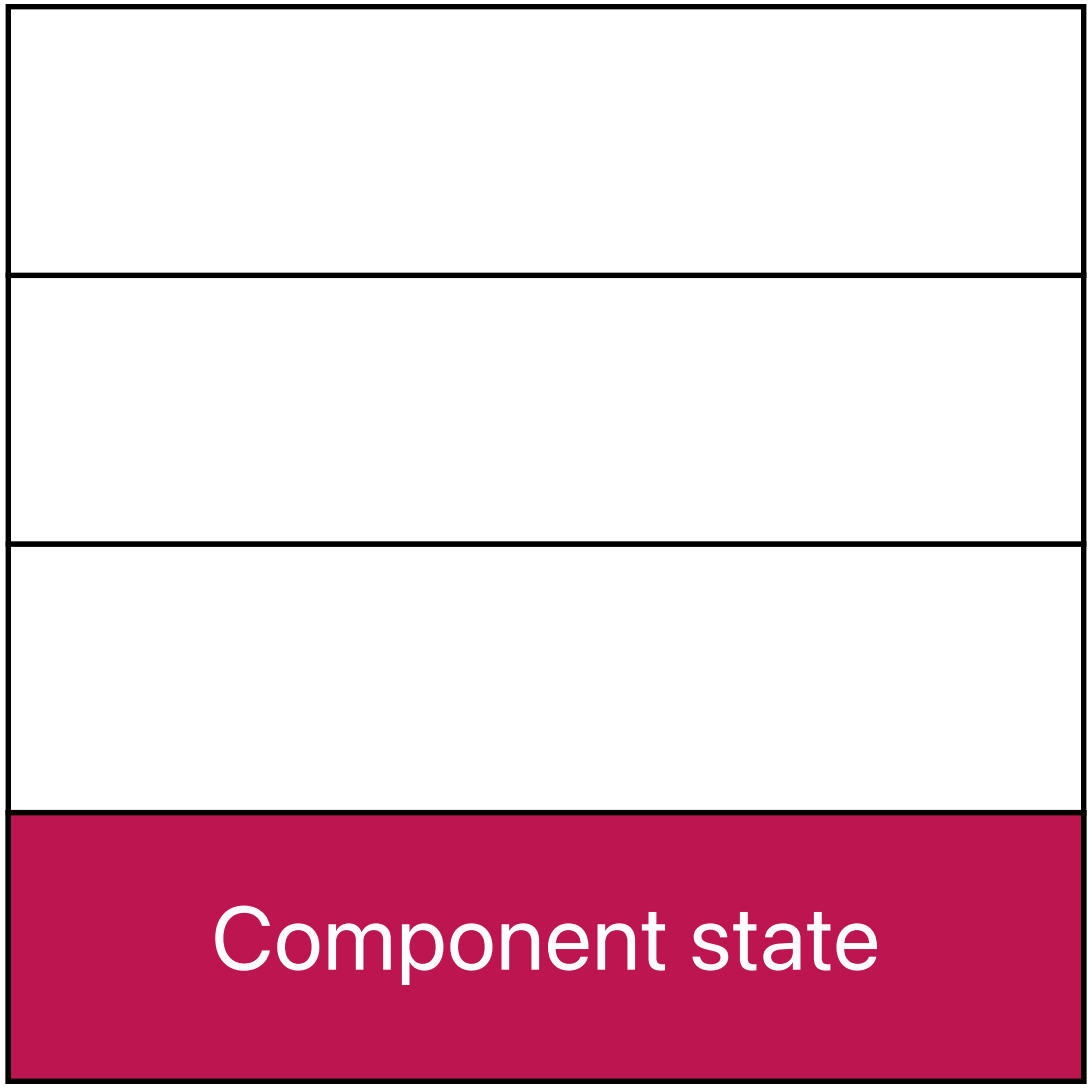


# Component state

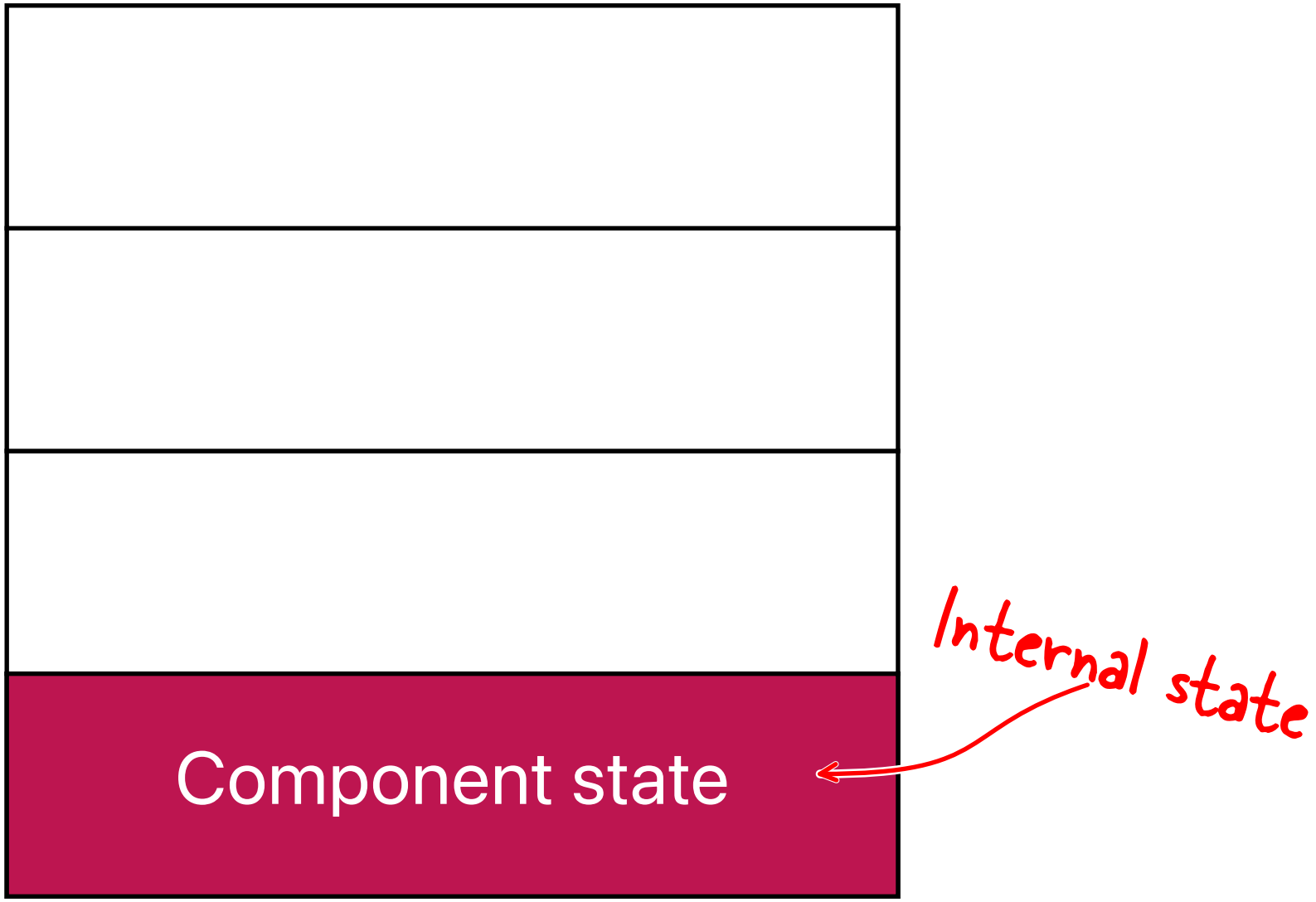
# Different levels of state



# Different levels of state



# Different levels of state



# Component state in React

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- React 'components' are generated using JavaScript functions

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- And components need to be able to remember things

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- React 'components' are generated using JavaScript functions
- And components need to be able to remember things
- But how do you give a function a 'memory'?

# Component state in React

- React 'components' are generated using JavaScript functions
- And components need to be able to remember things
- But how do you give a function a 'memory'?
- With `useState`

# 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)}
      />
</>
```

# Simplify code with custom hooks (recipe 3.4)

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- If you need a lot of code to manage a piece of state...

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- If you need a lot of code to manage a piece of state...
- ...use a custom hook

# Simplify code with custom hooks (recipe 3.4)

- If you need a lot of code to manage a piece of state...
- ...use a custom hook
- A custom hook is just a JavaScript function named `use...`

# The useClock custom hook

```
const time = useClock('HH:mm:ss')
```

# The useClock custom hook

```
const time = useClock('HH:mm:ss')
const date = useClock('MMMM DD, YYYY')
```

# The useClock custom hook

```
const time = useClock('HH:mm:ss')
const date = useClock('MMMM DD, YYYY')
const tickThreeSeconds = useClock(3000)
```

# The useClock custom hook: useClock.js

```
const useClock = (formatOrInterval) => {
}

export default useClock
```

# The useClock custom hook: useClock.js

```
const useClock = (formatOrInterval) => {
  const format = typeof formatOrInterval === 'string'
      ? formatOrInterval : 'YYYY-MM-DDTHH:mm:ss.SSS'
}

export default useClock
```

# The useClock custom hook: useClock.js

```
const useClock = (formatOrInterval) => {
  const format = typeof formatOrInterval === 'string'
      ? formatOrInterval : 'YYYY-MM-DDTHH:mm:ss.SSS'
  const interval = typeof formatOrInterval === 'number' ? formatOrInterval : 500
}

export default useClock
```

# The useClock custom hook: useClock.js

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

const useClock = (formatOrInterval) => {
  const format = typeof formatOrInterval === 'string'
      ? formatOrInterval : 'YYYY-MM-DDTHH:mm:ss.SSS'
  const interval = typeof formatOrInterval === 'number' ? formatOrInterval : 500
  const [response, setResponse] = useState(
    moment(new Date()).format(format)
  )

}

export default useClock
```

# The useClock custom hook: useClock.js

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

const useClock = (formatOrInterval) => {
  const format = typeof formatOrInterval === 'string'
      ? formatOrInterval : 'YYYY-MM-DDTHH:mm:ss.SSS'
  const interval = typeof formatOrInterval === 'number' ? formatOrInterval : 500
  const [response, setResponse] = useState(
    moment(new Date()).format(format)
  )

  useEffect(() => {
    const newTimer = setInterval(() => {
      setResponse(moment(new Date()).format(format))
    }, interval)
  }, [format, interval])
}

export default useClock
```

# The useClock custom hook: useClock.js

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

const useClock = (formatOrInterval) => {
  const format = typeof formatOrInterval === 'string'
      ? formatOrInterval : 'YYYY-MM-DDTHH:mm:ss.SSS'
  const interval = typeof formatOrInterval === 'number' ? formatOrInterval : 500
  const [response, setResponse] = useState(
    moment(new Date()).format(format)
  )

  useEffect(() => {
    const newTimer = setInterval(() => {
      setResponse(moment(new Date()).format(format))
    }, interval)

    return () => clearInterval(newTimer)
  }, [format, interval])
}

export default useClock
```

# The useClock custom hook: useClock.js

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

const useClock = (formatOrInterval) => {
  const format = typeof formatOrInterval === 'string'
      ? formatOrInterval : 'YYYY-MM-DDTHH:mm:ss.SSS'
  const interval = typeof formatOrInterval === 'number' ? formatOrInterval : 500
  const [response, setResponse] = useState(
    moment(new Date()).format(format)
  )

  useEffect(() => {
    const newTimer = setInterval(() => {
      setResponse(moment(new Date()).format(format))
    }, interval)

    return () => clearInterval(newTimer)
  }, [format, interval])

  return response
}

export default useClock
```

# Managing complex component state (recipe 3.1)

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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
```

# 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>
</>
```

# Make reducers "undo-able" (recipe 3.2)

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- Would be nice to allow a user to undo things
- Reducers make that simpler

# Make reducers "undo-able" (recipe 3.2)

- Would be nice to allow a user to undo things
- Reducers make that simpler
- You create a `useUndoReducer` hook

# Make reducer's "undo-able"

```
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'],
  })
```

# Make reducer's "undo-able"

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

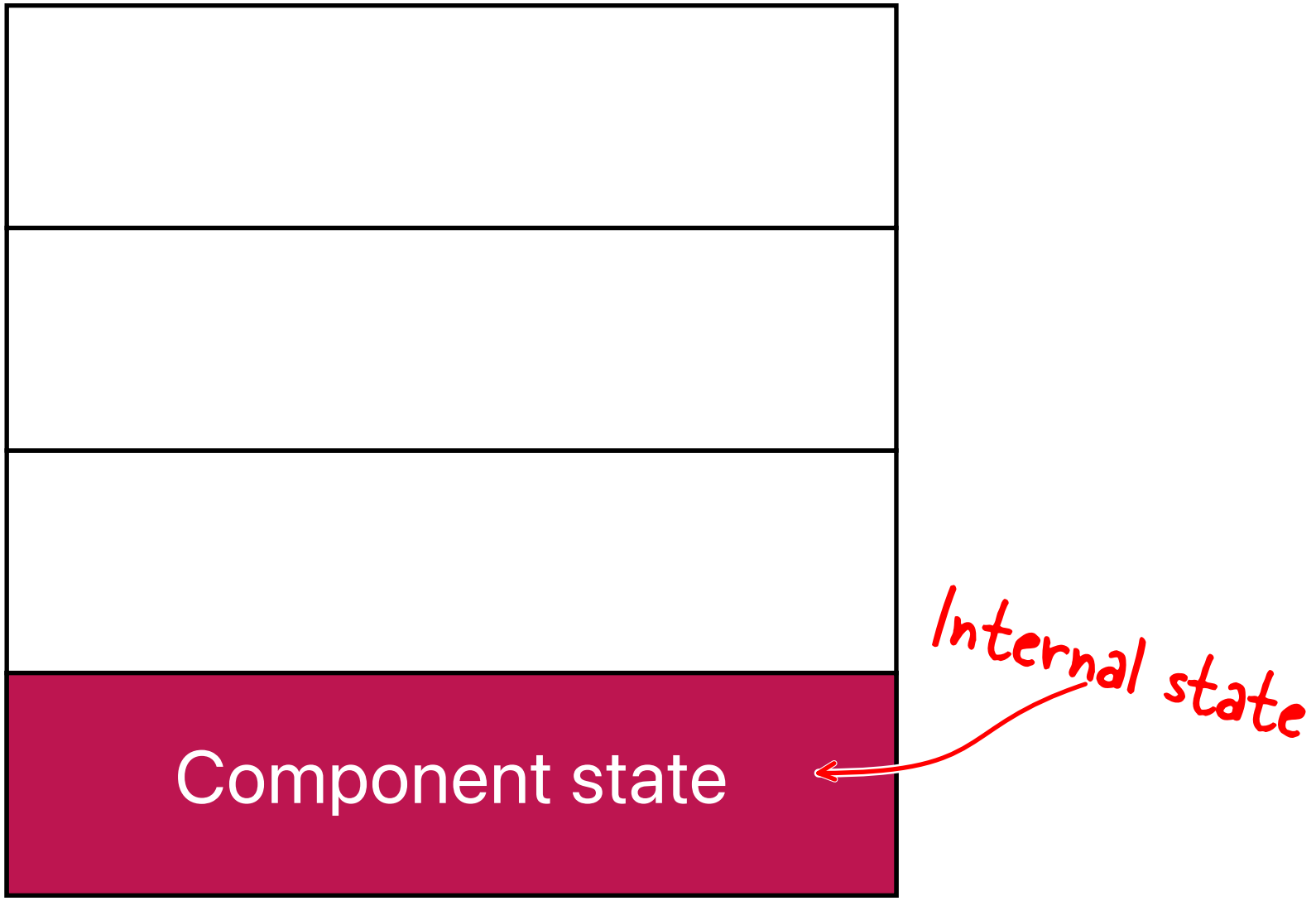
const Puzzle = () => {
  const [state, dispatch] = useUndoReducer(reducer, {
    items: ['4', '1', '2', '7', '6', '3', null, '5', '8'],
  })
....
```

# Make reducer's "undo-able"

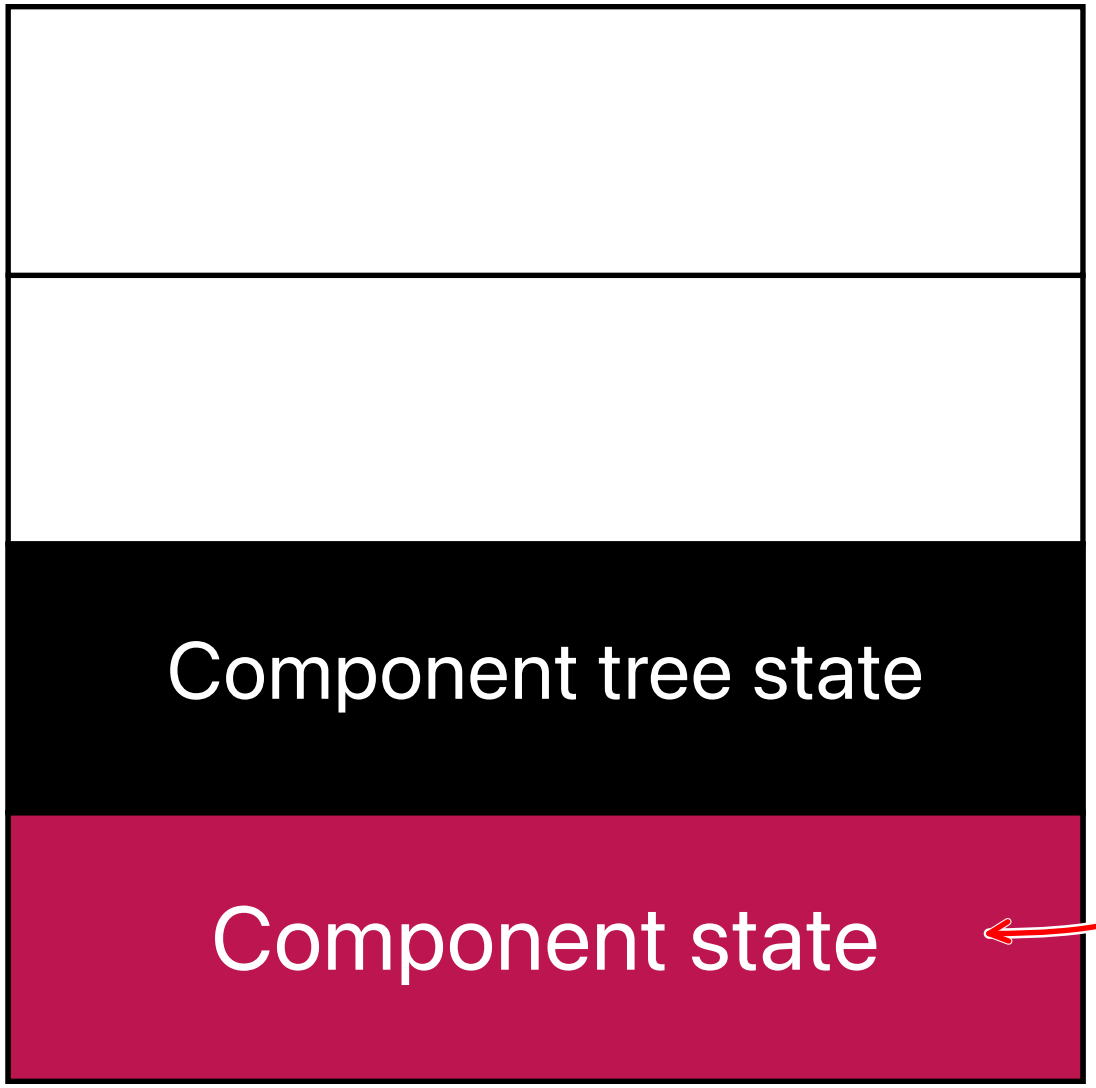
```
import reducer from './reducer'
import useUndoReducer from './useUndoReducer'

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

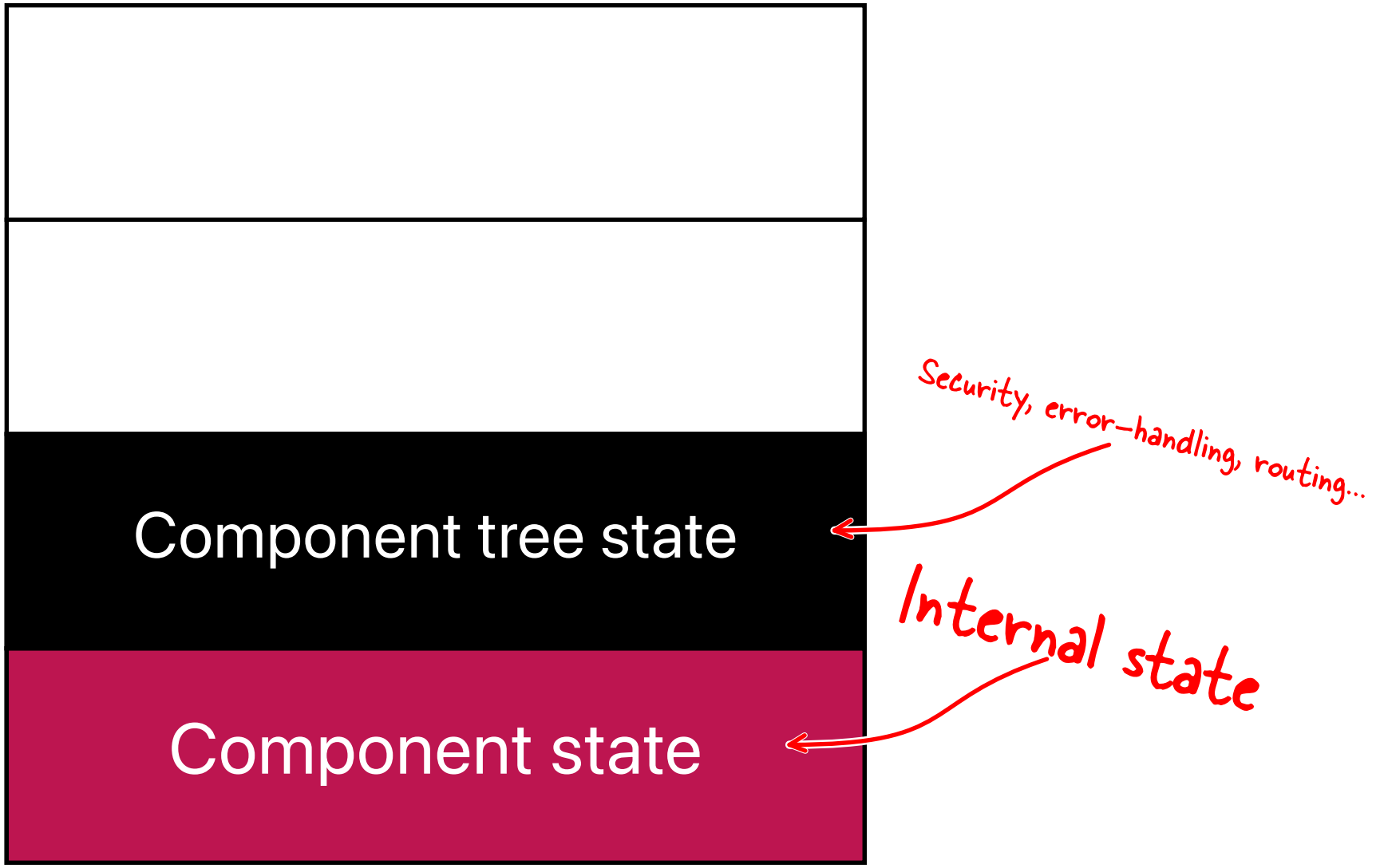
# Different levels of state



# Different levels of state



# Different levels of state



# 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>
  )
}
```

# Use the provider

```
import './App.css'
import SecurityProvider from './SecurityProvider'

function App() {
  return (
    <div className="App">
        <MyComponent/>
        <MyOtherComponent/>
    </div>
  )
}

export default App
```

# Use the provider

```
import './App.css'
import SecurityProvider from './SecurityProvider'

function App() {
  return (
    <div className="App">
      <SecurityProvider>
        <MyComponent/>
        <MyOtherComponent/>
      </SecurityProvider>
    </div>
  )
}

export default App
```

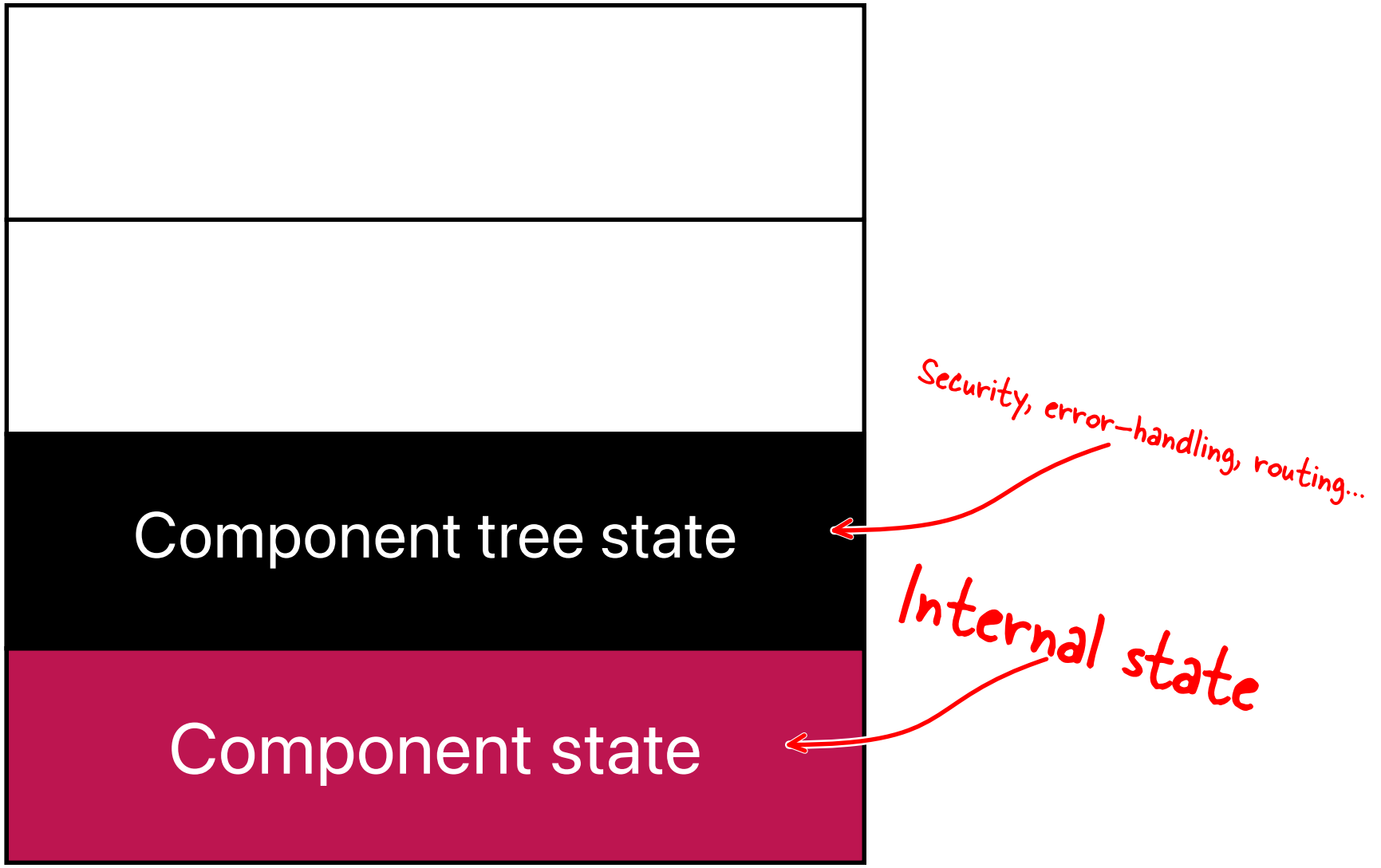
# Access security from the context MyComponent.js

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

# Access security from the context MyComponent.js

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

# Different levels of state



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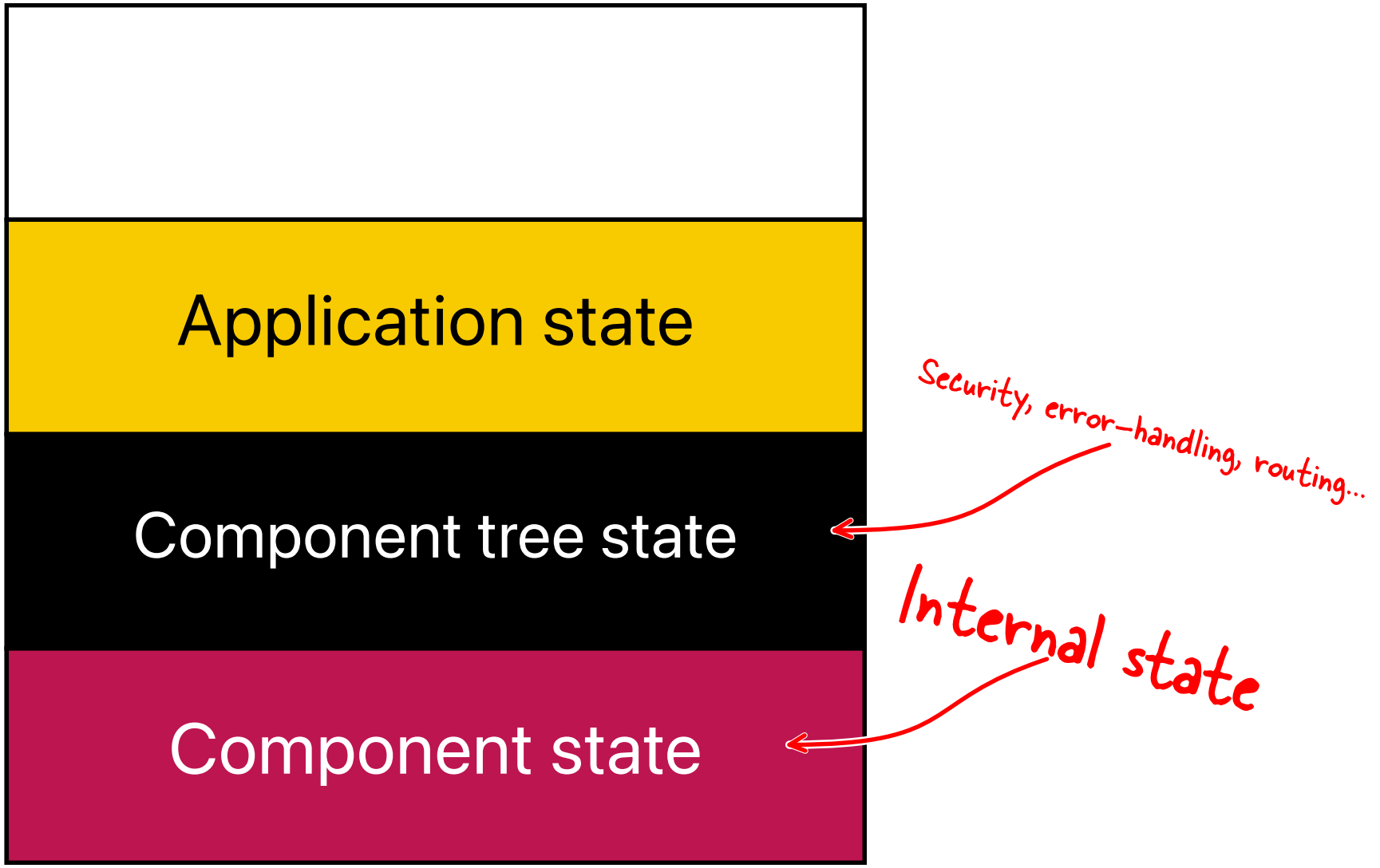
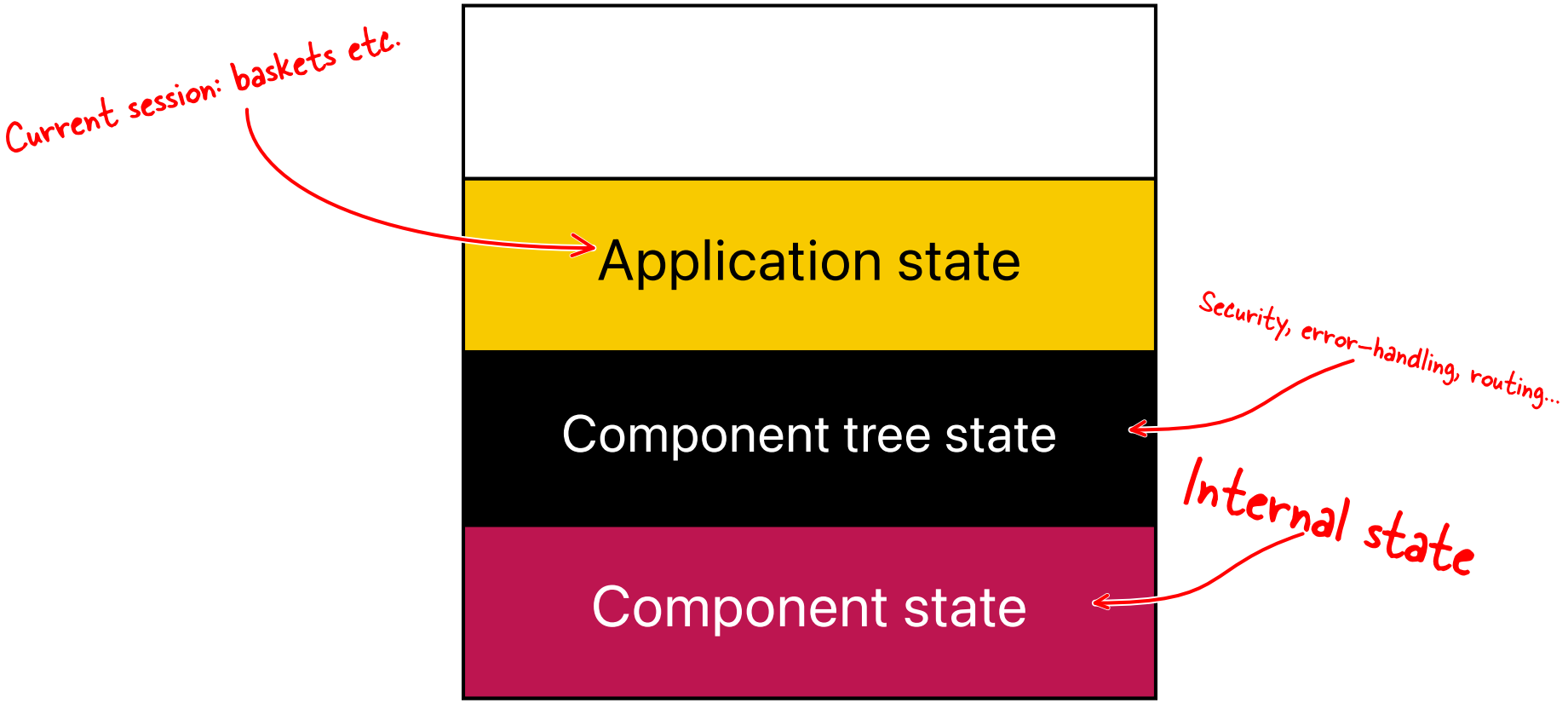


# Different levels of state



# Replace network calls with hooks (recipe 5.1)

# Code that talks to a server

# Code that talks to a server

- It's usually complex

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- It's normally asynchronous...

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- It's usually complex
- It's normally asynchronous...
- ...so it doesn't respond immediately

# Code that talks to a server

- It's usually complex
- It's normally asynchronous...
- ...so it doesn't respond immediately
- It can throw lots of errors

# Put horrible async code in a hook: useMessages.js

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

const useMessages = (forum) => {


}

export default useMessages
```

# Put horrible async code in a hook: useMessages.js

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

const useMessages = (forum) => {
  const [data, setData] = useState([])



}

export default useMessages
```

# Put horrible async code in a hook: useMessages.js

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

const useMessages = (forum) => {
  const [data, setData] = useState([])
  const [loading, setLoading] = useState(false)



}

export default useMessages
```

# Put horrible async code in a hook: useMessages.js

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

const useMessages = (forum) => {
  const [data, setData] = useState([])
  const [loading, setLoading] = useState(false)
  const [error, setError] = useState()



}

export default useMessages
```

# Put horrible async code in a hook: useMessages.js

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

const useMessages = (forum) => {
  const [data, setData] = useState([])
  const [loading, setLoading] = useState(false)
  const [error, setError] = useState()



  return { data, loading, error }
}

export default useMessages
```

# Put horrible async code in a hook: useMessages.js

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

const useMessages = (forum) => {
  const [data, setData] = useState([])
  const [loading, setLoading] = useState(false)
  const [error, setError] = useState()

  useEffect(() => {
      // Clever code to contact the server, and set
      // 'loading', 'data' or 'error' goes here
  }, [forum])

  return { data, loading, error }
}

export default useMessages
```

# Using the useMessages hook

```
const {
    data: messages,
    loading: messagesLoading,
    error: messagesError,
  } = useMessages(forum)
```

# Using the useMessages hook

```
const {
    data: messages,
    loading: messagesLoading,
    error: messagesError,
  } = useMessages(forum)

if (error) {
  return <p>Error! {error}</p>
}
```

# Using the useMessages hook

```
const {
    data: messages,
    loading: messagesLoading,
    error: messagesError,
  } = useMessages(forum)

if (error) {
  return <p>Error! {error}</p>
}

if (loading) {
  return <p>Loading...</p>
}
```

# Using the useMessages hook

```
const {
    data: messages,
    loading: messagesLoading,
    error: messagesError,
  } = useMessages(forum)

if (error) {
  return <p>Error! {error}</p>
}

if (loading) {
  return <p>Loading...</p>
}

return // the HTML for displaying messages goes here
```

# Synchronize data with the server (recipe 5.2)

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- You might have code that **reads** data from the server

# Synchronize data with the server (recipe 5.2)

- You might have code that **reads** data from the server
- And code that **updates** data from the server

# Synchronize data with the server (recipe 5.2)

- You might have code that **reads** data from the server
- And code that **updates** data from the server
- But how do you get your code to re-read data after you change it?

# Synchronize hooks with state counters

```
const {
    data: messages,
    loading: messagesLoading,
    error: messagesError,
  } = useMessages(forum)

const postMessage = (msg) => {
  // Very complicated code to post a message
}
```

# Synchronize hooks with state counters

```
const [stateVersion, setStateVersion] = useState(0)
const {
    data: messages,
    loading: messagesLoading,
    error: messagesError,
  } = useMessages(forum, stateVersion)

const create = (msg) => {
  // Very complicated code to post a message
  ....
  setStateVersion((v) => v + 1)
}
```

# Managing complex application state (recipe 3.6)

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- Application state can get very complex
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- We can do the same at the application level...

# Managing complex application state (recipe 3.6)

- Application state can get very complex
- We fixed complex state in components with reducers
- We can do the same at the application level...
- ...with 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

```
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/>
          <MyThirdComponent/>
      </Provider>
    </div>
  )
}

export default App
```

# Use the store from MyFirstComponent.js

```
const MyFirstComponent = () => {
  const dispatch = useDispatch()

  return (
    <div className="Boots">
      <h1>Boots</h1>
       <button
         onClick={() =>
           dispatch({ type: 'buy', payload: {name: 'Boots'} })
         }
       >
         Add to basket
       </button>
    </div>
  )
}
```

# Using Redux libraries

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

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- Can use middleware to sync Redux store with a server (recipe 3.6)
- Can use `redux-persist` to save the store in LocalStorage

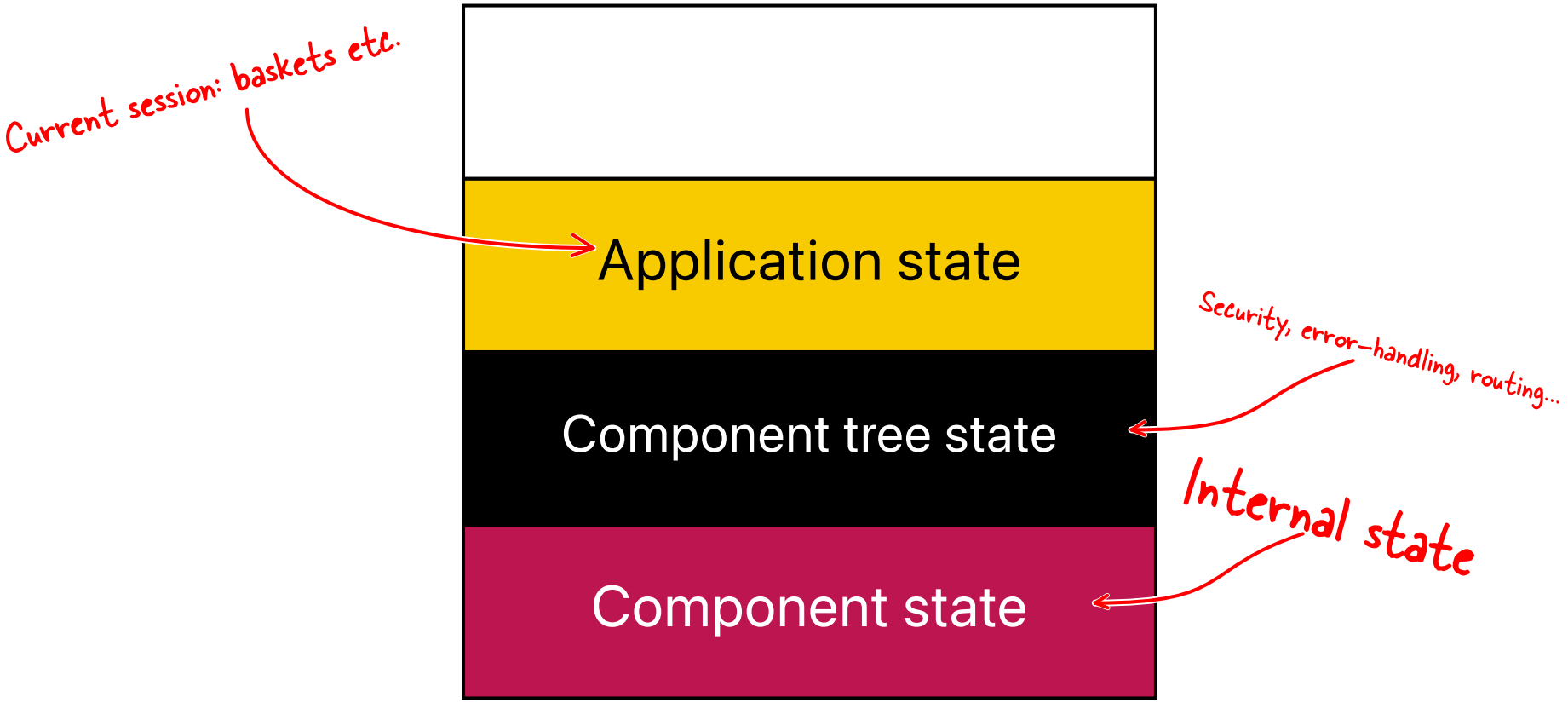
# Using Redux libraries

- 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)

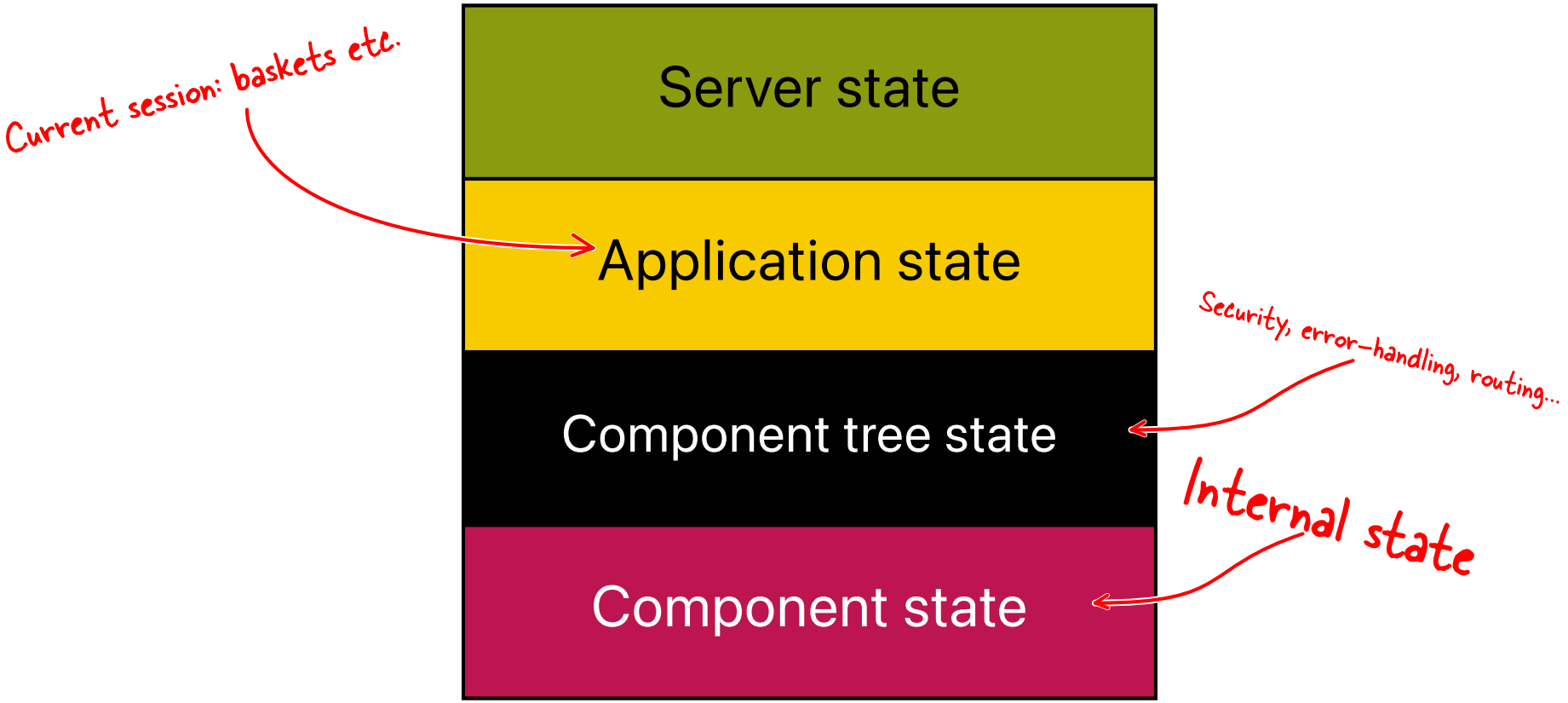
# Using Redux libraries

- 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)

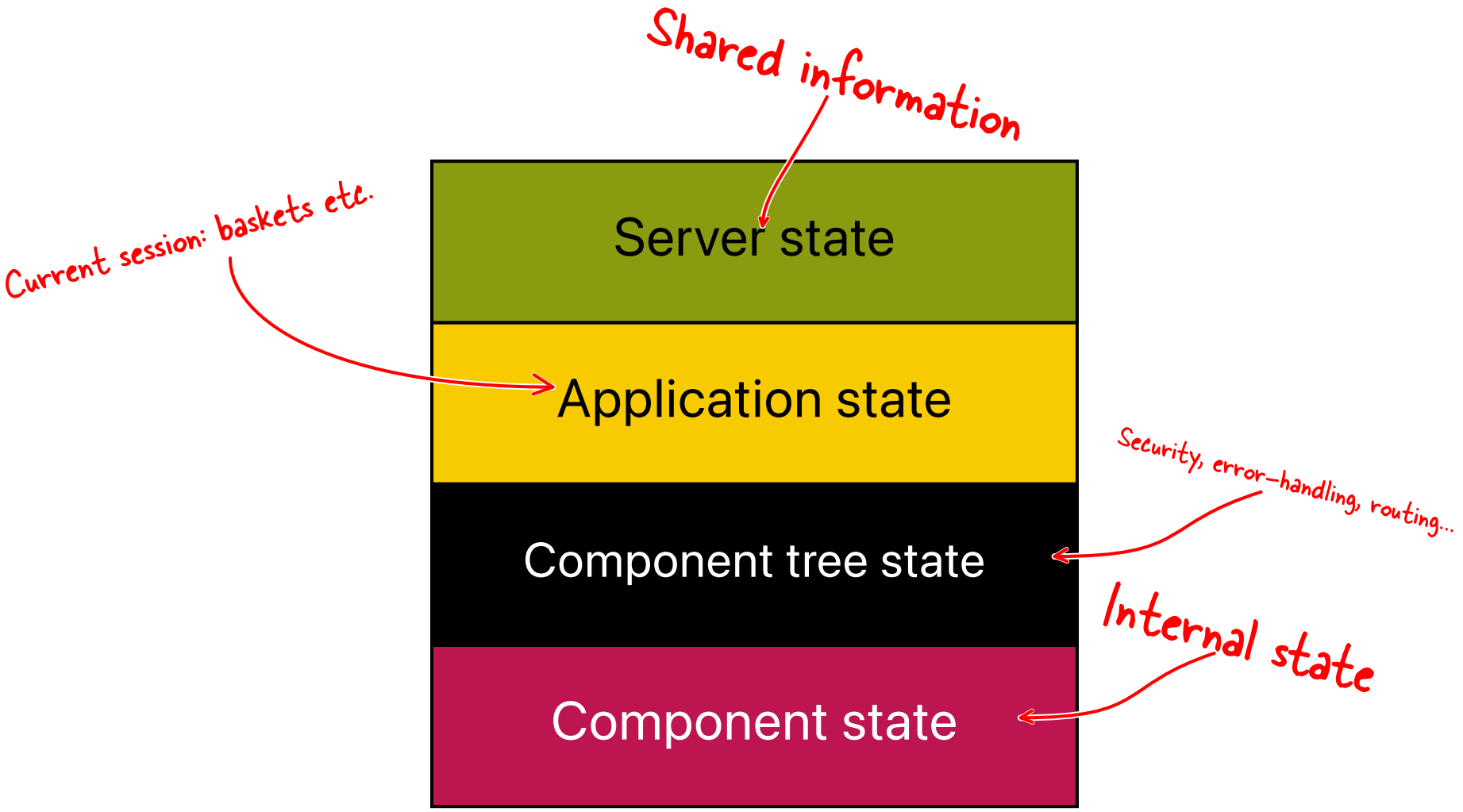
# Different levels of state



# Different levels of state



# Different levels of state



# Reading data when offline? (recipe 11.3)

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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?

# 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

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- 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')
);
```

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import React from 'react';
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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

```
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',
    })
);
```

# Sending data when offline? (recipe 11.6)

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- 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'
);
```

# Get the code!

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- All of the code from today:

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