Web Dev 5

CS571: Building User Interfaces

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Today's Warmup

- Clone today's code to your machine.
  - Run the command `npm install` inside of the `starter` and `solution` folders.

Learning Objectives

1. Be able to memoize components to optimize web application performance.
2. Be able to write reusable logic in the form of custom React hooks.
3. Understand the bigger picture of a React application including build and deployment.

Memoization

Not memorization!

Memoization

Storing the result so you can use it next time instead of calculating the same thing again and again

what the frik is: memoization

`useCallback` to memoize functions

`useMemo` to memoize calculated values

`memo` to memoize components

Note: This will be going away in React 19!

`useCallback` Hook

Consider the following functional component...

```
function MyApp() {
  const myComplicatedFunction = () => {
    // ...
  }
  return <>
    <button onClick={myComplicatedFunction}>Click Me</button>
  </>
}
```

How many times do we *create* the function `myComplicatedFunction`? We do on *every render*!

`useCallback` Hook

`useCallback` is used to 'memoize' a callback function.

```
function MyApp() {
  const myComplicatedFunction = useCallback(() => {
    // ...
  }, []);
  return <>
    <button onClick={myComplicatedFunction}>Click Me</button>
  </>
}
```

Takes a callback function to 'memoize' and an optional list of dependencies (e.g. when to re-'memoize').

`useMemo` Hook

Same thing as `useCallback`, except memoizes the *value* of a *callback* rather than the *callback* itself.

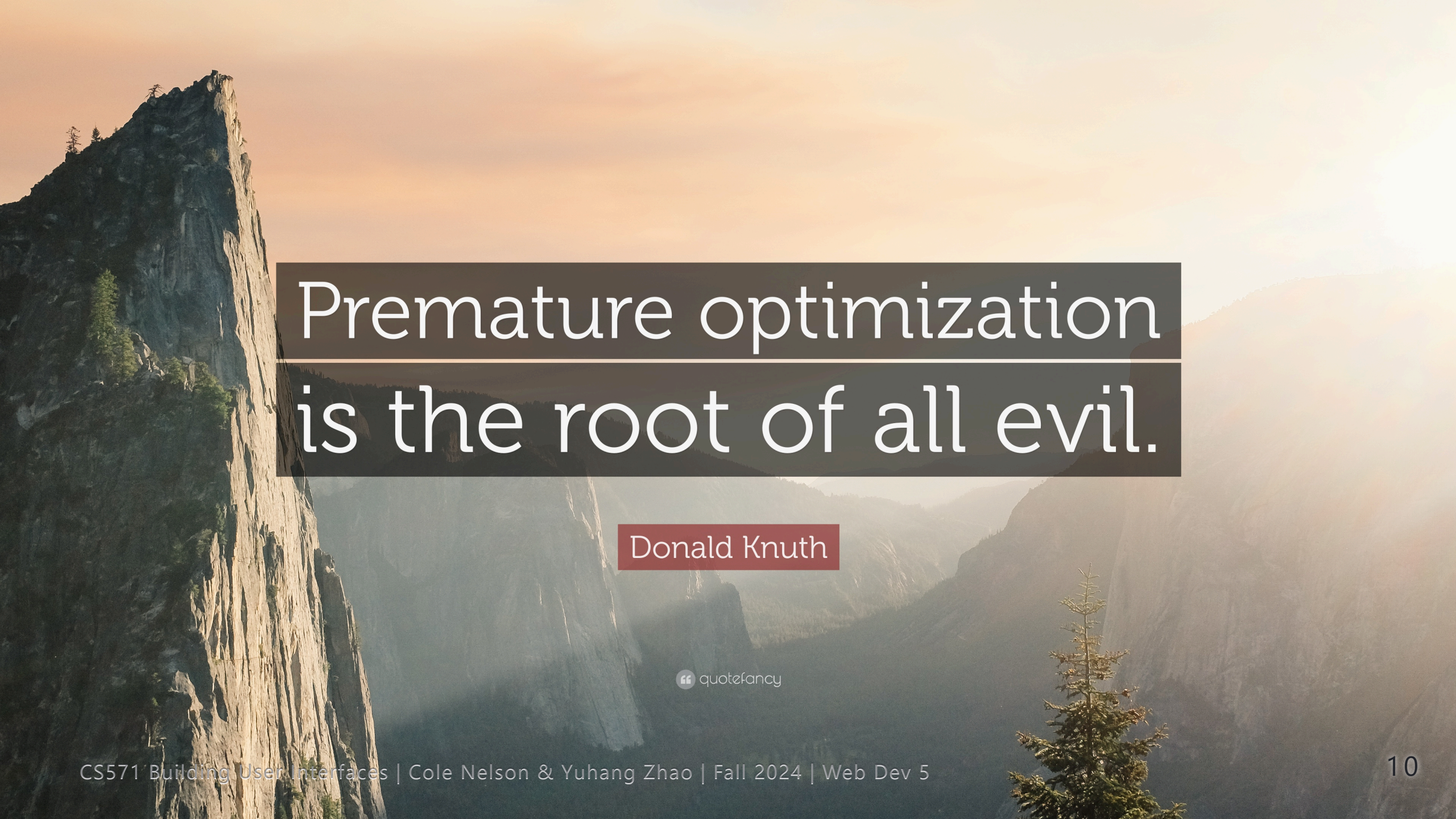
```
function MyApp() {
  const myComplicatedValue = useMemo(() => { /* Some complex call */}, []);

  return <>
    <p>{myComplicatedValue}</p>
  </>
}
```

`memo` -ized Components

Used for creating *purely functional* components. Given the same props, the function renders the same output.

```
//                      v--- Name of functional component!
export default memo(GroceryList, (prevProps, nextProps) => {
  return prevProps.apples === nextProps.apples &&
    prevProps.bananas === nextProps.bananas &&
    prevProps.coconuts === nextProps.coconuts;
})
```

See StackBlitz for `useCallback`, `useMemo`, and `memo`


Premature optimization is the root of all evil.
Donald Knuth
quotefancy

A Plea for Lean Software

Niklaus Wirth
ETH Zürich

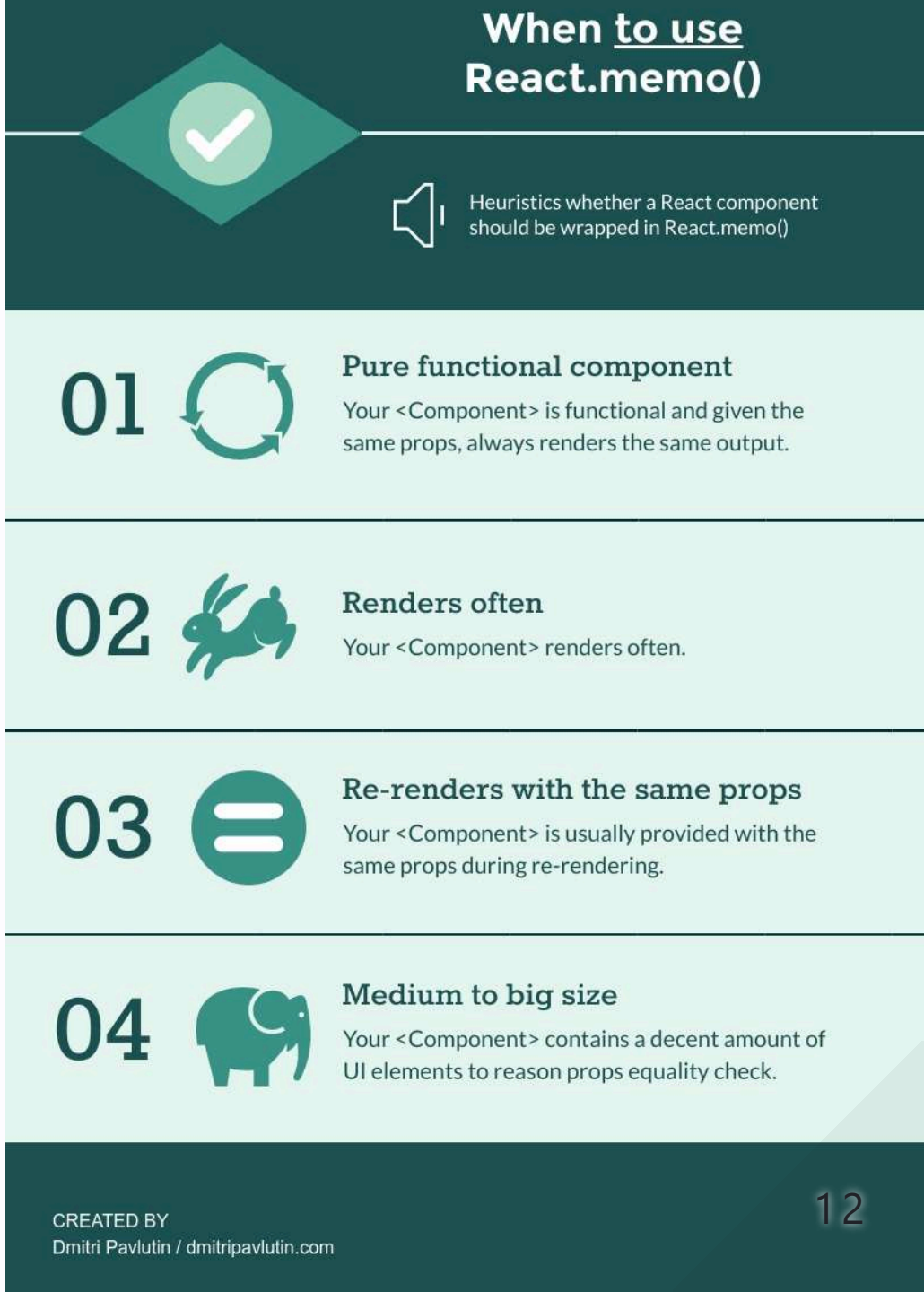
Memory requirements of today's workstations typically jump substantially—from several to many megabytes—whenever there's a new software release. When demand surpasses capacity, it's time to buy add-on memory. When the system has no more extensibility, it's time to buy a new, more powerful workstation. Do increased performance and functionality keep pace with the increased demand for resources? Mostly the answer is no.

About 25 years ago, an interactive text editor could be designed with as little as 8,000 bytes of storage. (Modern program editors request 100 times that much!) An operating system had to manage with 8,000 bytes, and a compiler had to fit into 32 Kbytes, whereas their modern descendants require megabytes. Has all this inflated software become any faster? On the contrary. Were it not for a thousand times faster hardware, modern software would be utterly unusable.

Finding a Balance

1. Given the same input, renders the same output.
2. Is rendered often.
3. Does not change often.
4. Is of substantial size.

Dmitri Pavlutin Blog Post



Your turn!

Expand on BadgerChat Mini from last week by optimizing the application with *memoization*.

Clone from here.

How Can We Reuse Logic?

Practicing **D**on't **R**epeat **Y**ourself (DRY)

Custom React Hooks

You can write your own custom hooks! These are just JavaScript functions that can use React's features!

- We use **custom components** to re-use **UI elements**.
- We use **custom hooks** to re-use **business logic**.

JSConf Talk

Let's Write a Custom Hook!

Writing reusable logic for persisting data.

StackBlitz Solution | Inspitation from WDS

Your turn!

Use this custom hook in BadgerChat Mini!

Congrats!

You are now a React Devloper! 🥳🎏🎉


Challenge Complete!
How Did We Get Here?

Developing Your Own App!

A lot of the starter code was given to you, but you can generate this yourself!

```
npm create vite@latest my-website -- --template react
cd my-website
npm install
npm run dev
```

This will get you started!

Vite Documentation

Developing Your Own App!

For Bootstrap, run...

```
npm install react-bootstrap bootstrap
```

But you'll also need to import and include a bootstrap stylesheet from the web...

React Bootstrap Documentation

Developing Your Own App!

In `main.jsx`, put...

```
import 'bootstrap/dist/css/bootstrap.min.css';
```

In `index.html`, put...

```
<link
  rel="stylesheet"
  href="https://cdn.jsdelivr.net/npm/bootstrap@5.3.2/dist/css/bootstrap.min.css"
  integrity="sha384-T3c6CoIi6uLrA9TneNEoa7RxnatzjcDSCmG1MXxSR1GAsXEV/Dwwykc2MPK8M2HN"
  crossorigin="anonymous" />
```

React Bootstrap Documentation

Developing Your Own App!

For React Router, run...

```
npm install react-router-dom
```

You'll also need to list a base in `vite.config.js`

```
base: "/myprojectpath"
```

Note: For GitHub Pages you'll need to use a `HashRouter` rather than a `BrowserRouter`. Why?

React Router Documentation

It's an illusion!

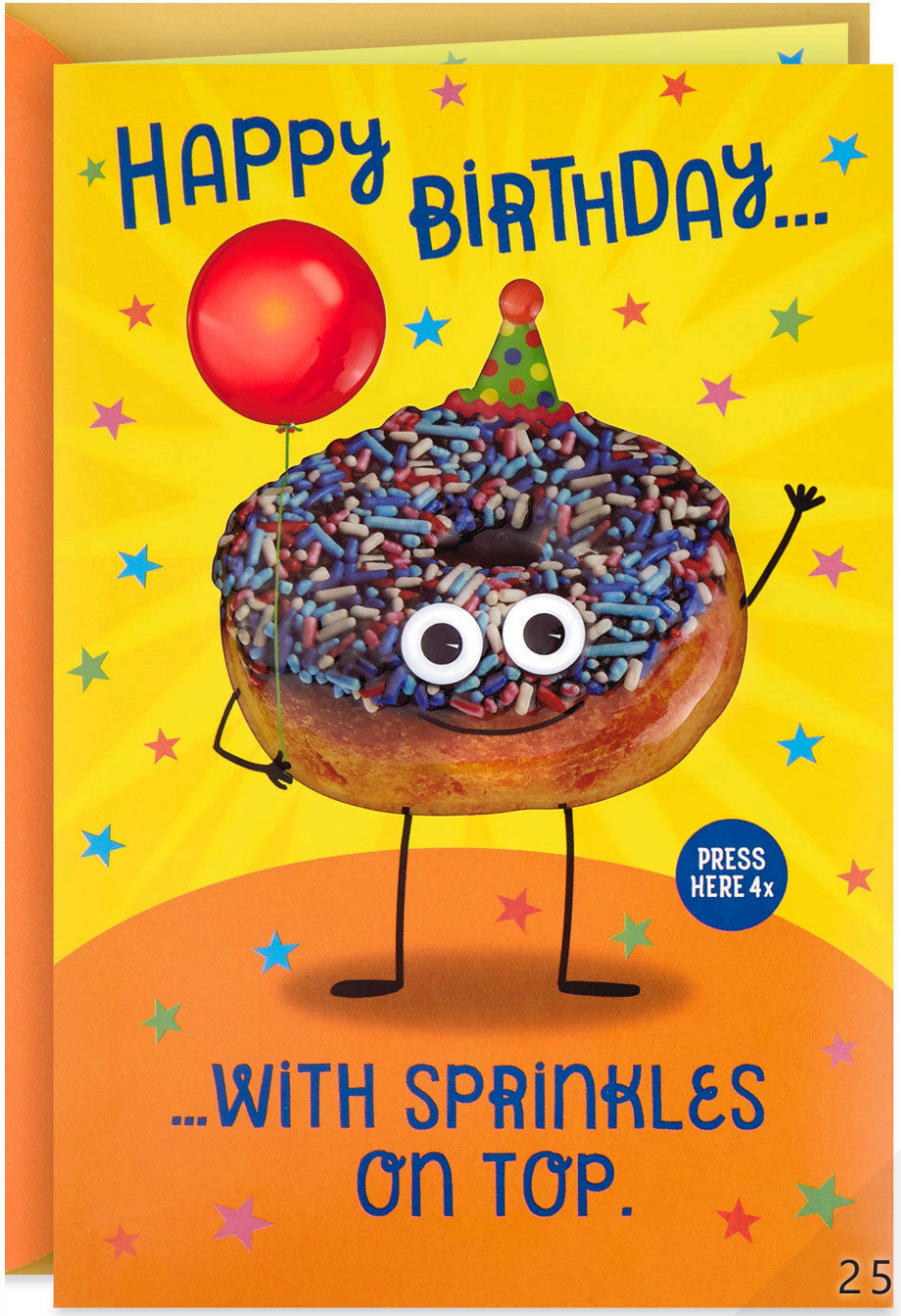
- ...of JSX
- ...of "multi-page"

The Dress

The Browser

However, we are constrained to what the browser can interpret...

- HTML
- CSS
- JS



So... is React an Exception?

Facebook is influential, but not *that* influential!

Reminder: JSX

This React component displays Hello World on the webpage using JSX.

```
function Welcome() {
  return <h1>Hello World!</h1>;
}
```

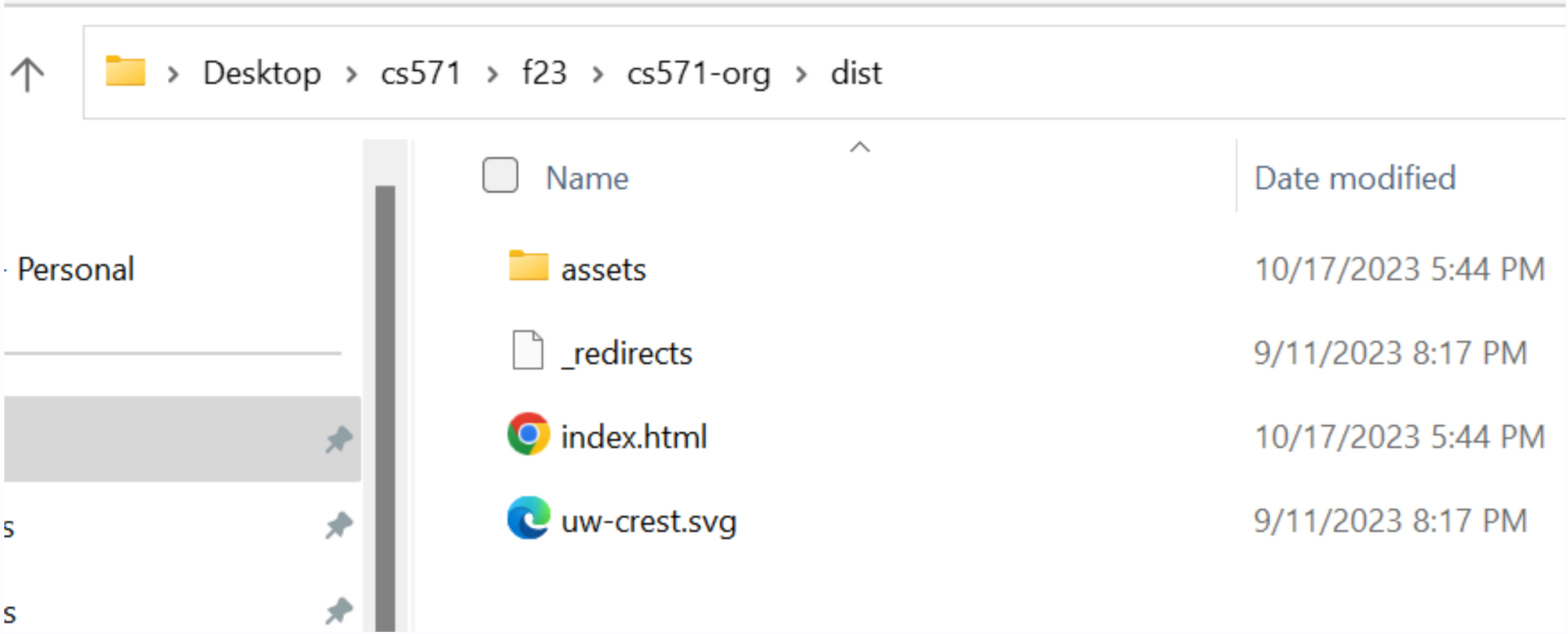
This is transpiled into JS, CSS, and HTML.

Delivery of React App

We don't deliver our JSX code, we deliver HTML, CSS, and JS generated via `npm run build`!

This creates our "build bundle"...

Notice only a single HTML file! It's all a JS illusion.



```
<!DOCTYPE html>
<html lang="en">
  <head>
    <meta charset="UTF-8" />
    <link
      rel="stylesheet"
      href="https://cdn.jsdelivr.net/npm/bootstrap@5.3.0/dist/css/bootstrap.min.css"
      integrity="sha384-9ndCyUaIbzAi2FUVXJi0CjmCapSmO7SnpJef0486qhLnuZ2cdeRhO02iuK6FUUVM"
      crossorigin="anonymous"
    />
    <link rel="icon" type="image/svg+xml" href="/uw-crest.svg" />
    <meta name="viewport" content="width=device-width, initial-scale=1.0" />
    <title>CS571</title>
    <script type="module" crossorigin src="/assets/index-10eed002.js"></script>
    <link rel="stylesheet" href="/assets/index-fe717832.css">
  </head>
  <body>
    <div id="root"></div>
  </body>
</html>
```

```
/*! For license information please see main.aae268c3.js.LICENSE.txt */
!function(){var e={694:function(e,t){var n;!function(){"use strict";var r={}.
hasOwnProperty;function l(){for(var e=[],t=0;t<arguments.length;t++){var n=arguments[t];
if(n){var a=typeof n;if("string"===a||"number"===a)e.push(n);else if(Array.isArray(n)){
if(n.length){var o=l.apply(null,n);o&&e.push(o)}}else if("object"===a)if(n.toString===
Object.prototype.toString)for(var u in n)r.call(n,u)&&n[u]&&e.push(u);else e.push(n.
toString())}}return e.join(" ")}e.exports?(l.default=l,e.exports=l):void 0===(n=function
(){return l}.apply(t,[]))||(e.exports=n)}()},618:function(e,t,n){var r;!function(){"use
strict";var l=!("undefined"===typeof window||!window.document||!window.document.
createElement),a={canUseDOM:l,canUseWorkers:"undefined"!==typeof Worker,
canUseEventListeners:l&&!(!window.addEventListener&&!window.attachEvent),canUseViewport:
l&&!!window.screen};void 0===(r=function(){return a}.call(t,n,t,e))||(e.exports=r)}()},
888:function(e,t,n){"use strict";var r=n(47);function l(){}function a(){}a.
resetWarningCache=l,e.exports=function(){function e(e,t,n,l,a,o){if(o!==r){var u=new
Error("Calling PropTypes validators directly is not supported by the `prop-types`
package. Use PropTypes.checkPropTypes() to call them. Read more at
http://fb.me/use-check-prop-types");throw u.name="Invariant Violation",u}}function t(){
return e}e.isRequired=e;var n={array:e,bigint:e,bool:e,func:e,number:e,object:e,string:e
,symbol:e,any:e,arrayOf:t,element:e,elementType:e,instanceOf:t,node:e,objectOf:t,oneOf:t
,oneOfType:t,shape:t,exact:t,checkPropTypes:a,resetWarningCache:l};return n.PropTypes=n,
n}},7:function(e,t,n){e.exports=n(888)()},47:function(e){"use strict";e.exports=
"SECRET_DO_NOT_PASS_THIS_OR_YOU_WILL_BE_FIRED"},463:function(e,t,n){"use strict";var r=n
(791),l=n(296);function a(e){for(var t=
```

Need more than an illusion?

1. Consider using a server-side rendering framework like next.js or Gatsby.
2. Host it yourself! Need a configuration like...

```
server {
  listen 80;

  location / {
    root   /usr/share/nginx/html; # where your build bundle lives!
    index  index.html
    try_files $uri $uri/ /index.html; # always bring them home :)
  }
}
```

Let's do a deployment!

... to GitHub Pages!

Concerns in Production...

- Reliability
- Performance
- Monitoring
- Business Value of Delivery
- Search Engine Optimization (SEO)

Reliability

Does our code work?

- Manual testing
- Automated testing
  - Jest
  - React Testing Library
- Static analysis
  - TypeScript: Used for type-checking
  - ESLint: Used for following best practice

Performance

Does our code work *well*?

- Be aware of the "bundle size"!
- Our code specifically...
  - Perf
  - Profiler
- Our code broadly...
  - Google Lighthouse
  - Chrome User Experience Report (CrUX)

Monitoring

Does our code *continue to* work well?

- Logging
  - *Not* `console.log`
  - Sentry
  - DataDog
- Cloud Tools
  - Cloud Monitoring Tools
  - DownDetector

Business Value of Delivery

- Core Questions
  - Are we making money? 
  - Are users making use of new features?
- Analysis Methods
  - A/B Testing
  - Customer Surveys
- Commercial Tools
  - Pendo

Search Engine Optimization (SEO)

The generated HTML doesn't have much in it!

What is a search engine crawler supposed to do?

Your Considerations?

These are by no means an exhaustive list!

Questions?