Web Dev 3

CS571: Building User Interfaces

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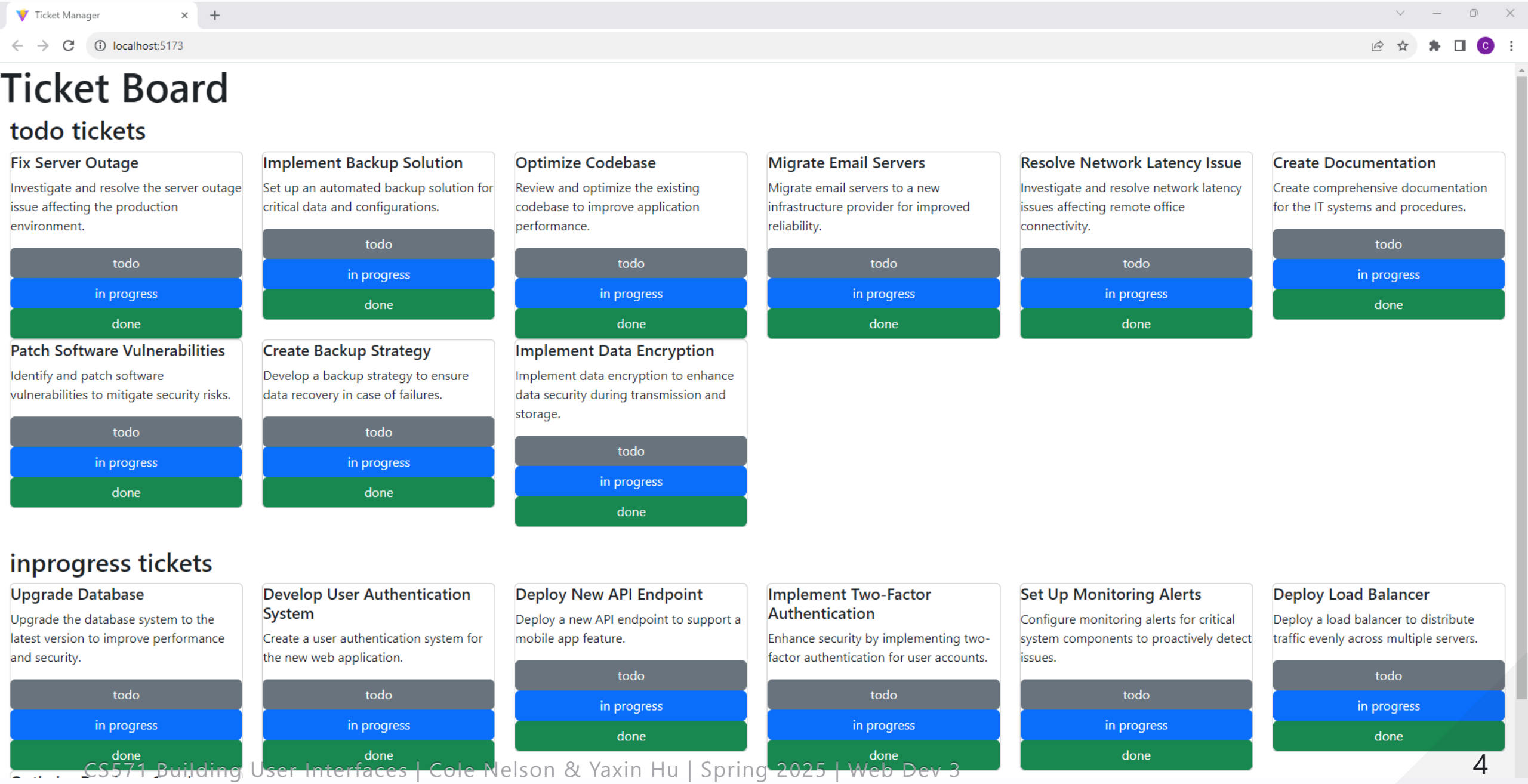
Before Lecture

- Clone today's code to your machine.
  - Run the command `npm install` inside of the `starter`, `solution`, and `alt-solution` folders.
- Complete your daily Wordle.
  - We'll be going through it in class.

React Essentials: Web Dev 1 & 2

A common workflow is...

1. Get some data from an API using `useEffect`
2. Save it to a state variable created using `useState`
3. Create many components, passing down `props`


Ticket Manager
localhost:5173
Ticket Board
todo tickets
Fix Server Outage
Investigate and resolve the server outage issue affecting the production environment.
todo
in progress
done
Implement Backup Solution
Set up an automated backup solution for critical data and configurations.
todo
in progress
done
Optimize Codebase
Review and optimize the existing codebase to improve application performance.
todo
in progress
done
Migrate Email Servers
Migrate email servers to a new infrastructure provider for improved reliability.
todo
in progress
done
Resolve Network Latency Issue
Investigate and resolve network latency issues affecting remote office connectivity.
todo
in progress
done
Create Documentation
Create comprehensive documentation for the IT systems and procedures.
todo
in progress
done
Patch Software Vulnerabilities
Identify and patch software vulnerabilities to mitigate security risks.
todo
in progress
done
Create Backup Strategy
Develop a backup strategy to ensure data recovery in case of failures.
todo
in progress
done
Implement Data Encryption
Implement data encryption to enhance data security during transmission and storage.
todo
in progress
done
inprogress tickets
Upgrade Database
Upgrade the database system to the latest version to improve performance and security.
todo
in progress
done
Develop User Authentication System
Create a user authentication system for the new web application.
todo
in progress
done
Deploy New API Endpoint
Deploy a new API endpoint to support a mobile app feature.
todo
in progress
done
Implement Two-Factor Authentication
Enhance security by implementing two-factor authentication for user accounts.
todo
in progress
done
Set Up Monitoring Alerts
Configure monitoring alerts for critical system components to proactively detect issues.
todo
in progress
done
Deploy Load Balancer
Deploy a load balancer to distribute traffic evenly across multiple servers.
todo
in progress
done

Your turn!

Inspect today's starter code!

Initially places the tickets in a "todo" column, add buttons to move the ticket to a different column (e.g. "inprogress" or "done")

https://cs571api.cs.wisc.edu/rest/s25/ice/tickets

Clone from here.

Uh-oh!

We need to talk back to our parent?

Learning Objectives

1. Be able to share state via...
   - Using callbacks
   - Using `useContext`
   - Using `sessionStorage` and `localStorage`
   - Using cookies and an API (next time!)
   - Other libraries (on your own!)...
2. Construct multi-page applications.

State Management

How do we talk back to our parent? How do siblings talk to each other?

- Using callbacks
- Using `useContext`
- Using `sessionStorage` and `localStorage`
- Using cookies and an API (next time!)
- Using third-party libraries like (on your own!)...
  - Redux, Recoil, MobX, XState

Passing Callbacks

The original way to do child-to-parent communication.

```
const TodoList = (props) => {
  const [items, setItems] = useState();

  const removeItem = (itemId) => {
    // Do Remove!
  }

  return <div>
    {
      items.map(it => <TodoItem key={it.id} {...it} remove={removeItem}/>)
    }
  </div>
}
```

Passing Callbacks

This callback function is then used in the *child* to mutate the *parent*.

```
const TodoItem = (props) => {

  const handleRemove = () => {
    alert("Removing TODO item!");
    props.remove(props.id);
  }

  return <Card>
    <h2>{props.name}</h2>
    <Button onClick={handleRemove}>Remove Task</Button>
  </Card>
}
```

Ticket Management

Move tickets from lane to lane via passing callbacks.

`useContext` Hook

A useful hook for managing state across web apps with large component hierarchies.

`useContext` Hook

Motivation: How can we effectively manage state for web apps with large component hierarchies?

```
- Spotify
  - SpotifyLandingPage
   - RecentSearches
     - AuthorCard
       - AuthorImage
       - AuthorName
```

Passing props down and down and down is known as "props-drilling" and is considered bad practice.

`useContext` Hook

Three steps to using context.

1. Create and export a context.
2. Provide the context with some value.
3. Use the context in a child component.

Often used in combination with `useState`.

`useContext` Hook

A context must be created and exported. Think of this like creating a data type!

```
const MyDataContext = createContext();
export default MyDataContext;
```

`useContext` Hook

A context must be provided to child component(s).

```
function ParentComponent() {
  const [data, setData] = useState(["Apples", "Oranges", "Bananas", "Grapes"]);
  return (
    <MyDataContext.Provider value={data}>
        <SomeChildComponent />
        <SomeOtherChildComponent />
    </MyDataContext.Provider>
  );
}
```

`useContext` Hook

The context can be used by any of child, grandchild, great-grandchild, etc. component(s).

```
function SomeChildComponent() {
  const data = useContext(MyDataContext);
  return (
    { /* Do something interesting with data here! */ }
  );
}
```

See StackBlitz

Ticket Management

Move tickets from lane to lane via context.

Local Storage V/s Session Storage V/s Cookies

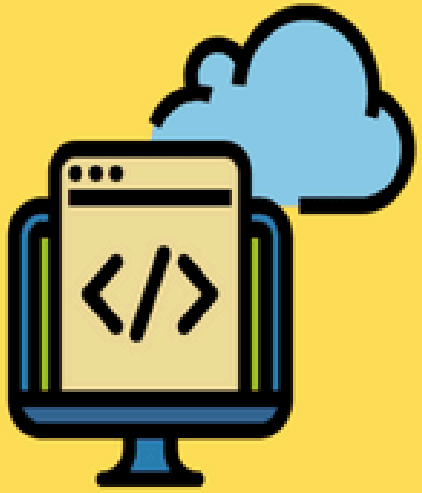


Image Source

Cookies vs. Session vs. Local

These exist in your browser! They will persist even after a page refresh.

- Wordle uses `sessionStorage` and `localStorage` to store game state.
- Facebook uses `cookies` to track you.
- Vanguard uses `cookies` to store temporary session/login credentials.

Criteria	Local Storage	Session Storage	Cookies
Storage Capacity	5-10 mb	5-10 mb	4 kb
Auto Expiry	No	Yes	Yes
Server Side Accessibility	No	No	Yes
Data Transfer HTTP Request	No	No	Yes
Data Persistence	Till manually deleted	Till browser tab is closed	As per expiry TTL set

Image Source

Cookies vs. Session vs. Local

Type	Notes
Cookies	Can be set programmatically, but typically set by server through a `Set-Cookie` header
Session	Set programmatically via `sessionStorage`, typically used with form data.
Local	Set programmatically via `localStorage`, typically used with long-lasting data.

Cookies vs. Session vs. Local

These are all just key-value pairs of *strings*! Can use `setItem` and `getItem` on both!

Type	Example
Session	`sessionStorage.setItem('name', 'Cole')`
Local	`localStorage.getItem('lastLogin')`

Let's Persist Some Data!

Using `sessionStorage` or `localStorage`.

StackBlitz Solution | Inspitation from WDS

`sessionStorage` and `localStorage`

Reminder: `sessionStorage` and `localStorage` only store *strings*! Use `JSON.parse` and `JSON.stringify`!

INCORRECT Way

```
sessionStorage.setItem('nums', [2, 6, 19])
const storedNums = sessionStorage.getItem('nums')
```

Correct Way

```
sessionStorage.setItem('nums', JSON.stringify([2, 6, 19]))
const storedNums = JSON.parse(sessionStorage.getItem('nums'))
```

`sessionStorage` and `localStorage`

Remember, `sessionStorage` and `localStorage` are *browser mechanisms* that exist *outside of React*.

They do not trigger re-renders.

Do you need to re-render? You will also need to change a state variable.

Third Party Libraries

Each have their own unique way of managing state. Examples include...

- Redux
- Recoil
- MobX
- XState

Note! These come and go. See flux.

Client Vs. Server-Side Storage

These are all examples of doing client-side storage.

What if we want to persist data long-term?

Server-side storage with `PUT`, `POST`, and `DELETE`!

We'll explore this next time.

Multi-Page Apps

Knowing how to do state management, how do we manage apps with many pages?

React is a *library*, not a *framework*!

This means that *batteries are not included*. You'll be choosing many of your own tools and libraries!

- **Layout & Design:** Bootstrap React-Bootstrap, Reactstrap, Material, Elemental, Semantic
- **Routing & Navigation:** React Router, React Navigation, React Location
- **State Management:** Redux, Recoil, MobX, XState

Navigation w/ React Router

See StackBlitz

Types of Routers

- `BrowserRouter` : What you typically think of!
- `MemoryRouter` : Same as `BrowserRouter` , but the path is hidden from the browser in memory! 🤫
- `HashRouter` : Support for deploying SPAs.
  - Use this if you are deploying to GitHub Pages!
- `StaticRouter` : Used for server-side rendering.
- `NativeRouter` : We'll use react-navigation instead!

Routing

Using a `Router`, `Routes`, and `Route`!

```
<BrowserRouter>
  <Routes>
    <Route path="/" element={<Layout />}>
      <Route index element={<Home />} />
      <Route path="about-us" element={<AboutUs />} />
      <Route path="other-info" element={<OtherInfo />} />
      <Route path="*" element={<Home />} />
    </Route>
  </Routes>
</BrowserRouter>
```

Browser `outlet`

`<Outlet/>` shows the component returned by the child route! e.g. in `Layout` we may see...

```
function Layout() {
  return (
    <>
      <Navbar bg="dark" variant="dark">
        { /* Some navigation links...*/ }
      </Navbar>
      <Outlet />
    </>
  );
}
```

Navigable Components

Notice how each route maps to a component.

```
function Home() {
  return <h2>Home</h2>
}
function AboutUs() {
  return <h2>About Us :)</h2>
}
function OtherInfo() {
  return <h2>Other Info!</h2>
}
```

`useNavigate` Hook

Useful for programmatic navigation!

```
export default function OtherInfo() {

  const navigate = useNavigate();

  const handleClick = () => {
    navigate('/home');
  }

  return <div>
    <h2>Other Info!</h2>
    <Button onClick={handleClick}>Back to Home</Button>
  </div>
}
```

Navigation

Navigation for a `BrowserRouter` is done via URLs.

```
<>
  <Navbar bg="dark" variant="dark">
    <Nav className="me-auto">
      <Nav.Link as={Link} to="/">Home</Nav.Link>
      <Nav.Link as={Link} to="/about-us">About Us</Nav.Link>
      <Nav.Link as={Link} to="/other-info">Other Info</Nav.Link>
    </Nav>
  </Navbar>
  <Outlet />
</>
```

HW5 Demo

Badger Buddies!

The Madison Cat Project

Questions?