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2023

React Router

Applications have more than one page...

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Outline

- Objective and problems
- A Solution, the React way: React Router



Full Stack React, chapter “Routing”

React Handbook, chapter “React Router”

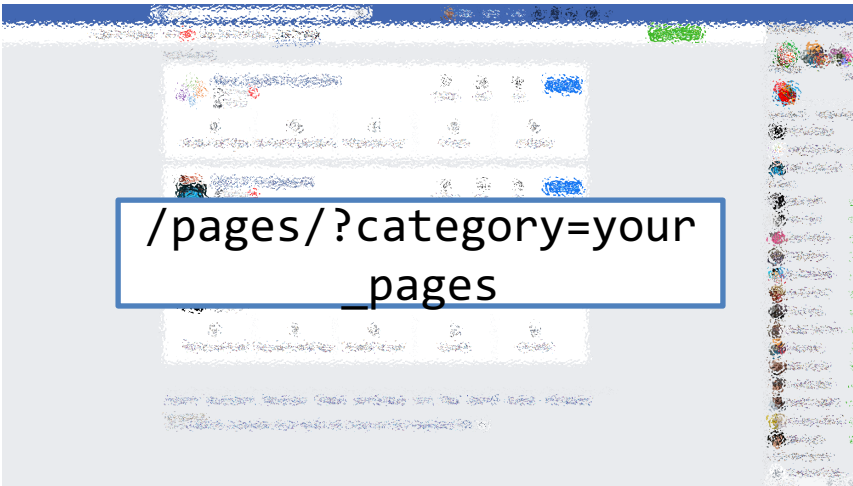
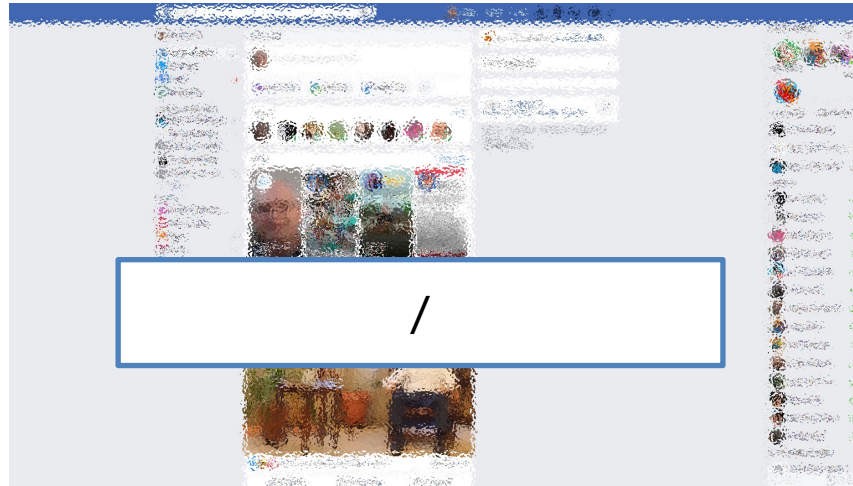
Multi-page Single Page Applications

OBJECTIVES AND PROBLEMS

Supporting Complex Web Applications

- Switching between many different page layouts
- Managing the flow of navigation across a set of “pages”
- Maintaining the default web navigation conventions (back, forward, bookmarks, ...)
- Allowing URLs to convey information
- Avoiding to re-load KBs of JavaScript at every page change
- Keeping the state across page changes
- ...

Example



- Different layout and contents
- Some common parts
- No “page reload”
- URL changes accordingly

Some Use Cases

- Main list / detail view
- Logged / Unlogged pages
- Sidebar navigation
- Modal content
- Main Contents vs. User Profile vs. Setting vs. ...

Using URLs for Navigation State

- URLs determine the *type* of the page or the *section* of the website
 - Changing page \Leftrightarrow Changing the URL
- URLs also *embed information* about the item IDs, referrers, categories, filters, etc.
- URLs can be shared/saved/bookmarked, and they are sufficient for rebuilding the whole exact page
 - Deep Linking
- Back and Forward buttons navigate the URL history

Example URLs on facebook.com:

/

/profile.name

/profile.name

/posts/12341232124
22123

/pagename

/pages/?category=y
our_pages

Using URLs for Navigation State

- URLs determine the *type* of the page or the *section* of the website
 - Changing page \Leftrightarrow Changing the URL
- URLs also *embed information* about the item IDs, referrers, ...
- URLs can be used to *embed information* about the item IDs, referrers, ...
 - Deep Linking
- Back and Forward Navigation

➤ With any URL, the React application will **always return the same page** (`index.html/index.js`) that will load and mount the same App

➤ The URL is queried by the App to customize the render

Example URLs on facebook.com:

/

/profile.name

/profile.name

/posts/12341232124
22123

/pagename

/pages/?category=y
our_pages



<https://reactrouter.com/>

<https://flaviocopes.com/react-router/>

<https://www.robinwieruch.de/react-router/>

Full Stack React, chapter “Routing”

React Handbook, chapter “React Router”

React as a REST Client

THE REACT ROUTER

React Router

- The problems associated with multi-page navigation and URL management are usually handled by *router* libraries
- A JavaScript Router manages
 - Modifying the location of the app (the URL)
 - Determining what React components to render at a given location
- In principle, whenever the user clicks on a new URL
 - We prevent the browser from fetching the next page
 - We instruct the React app to switch in & out components

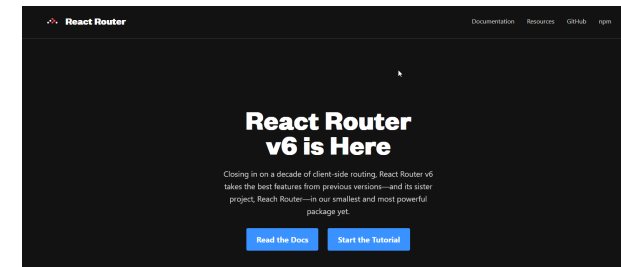
React Router

- React does not contain a specific router functionality
 - Different router libraries are available
 - The most frequently adopted is **react-router**
 - Now version 6.11
 - `npm install react-router-dom`
 - Will also install `react-router` as a dependency



<https://reactrouter.com/>

<https://github.com/remix-run/react-router>



- `react-router` contains most of the core functionality of React Router including the route matching algorithm and most of the core components and hooks
- `react-router-dom` includes everything from `react-router` and adds a few DOM-specific APIs, including `<BrowserRouter>`, `<HashRouter>`, and `<Link>`
- `react-router-native` includes everything from `react-router` and adds a few APIs that are specific to React Native, including `<NativeRouter>` and a native version of `<Link>`

Features

- Connects React app navigation with the browser's native navigation features
- Selectively shows components according to the current routes
 - Rules matching URL fragments
- Easy to integrate and understand; it uses normal React components
 - Links to new pages are handled by `<Link>`, `<NavLink>`, and `<Navigate>`
 - To determine what must be rendered we use `<Route>` and `<Routes>`
 - Defines hooks `useRoute`, `useNavigate`, `useSearchParams`
- The whole application is **wrapped** in a `<BrowserRouter>` container

Overview of React-Router

`<Router>`

```
<Link to="/">Home</Link>
<Link to="/about">About</Link>
<Link to="/dash">Dashboard</Link>
```

`</Router>`

`'/about'`

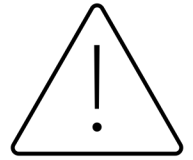


`<Router>`

```
<Routes>
  <Route path="/"
    element={<Home />} />
  <Route path="/about">
    element={<About />} />
  <Route path="/dashboard">
    element={<Dashboard />} />
</Routes>
```

`</Router>`

Routers



- Routers can be defined as **functions** or **components**
- Routers' functions are quite new in React Router (since version 6.4) and not yet fully supported in the entire React ecosystem
 - e.g., they do not work in React Native
- We will use *Router Components* in the course

In v6.4, new routers were introduced that support the new data APIs:

- `<BrowserRouter>`
- `<HashRouter>`
- `<MemoryRouter>`
- `<StaticRouter>`

The following routers do not support the data APIs:

- `<BrowserRouter>`
- `<MemoryRouter>`
- `<HashRouter>`
- `<NativeRouter>`
- `<StaticRouter>`

<Router>

- Different routers are available:
<BrowserRouter>, <HashRouter>, <StaticRouter>
- ➔ • **BrowserRouter** uses normal URLs and the HTML5 Location API
 - Recommended for modern browsers
 - Requires *some server configuration*
 - `import { BrowserRouter as Router } from 'react-router-dom' ;`
- **HashRouter** uses '#' in the URL
 - Compatible with older browsers
 - Requires no config on the server
 - **Not recommended**, unless for compatibility reasons
- Must wrap the entire App

<Router>

- Different routers are available:
<BrowserRouter>, <HashRouter>, <StaticRouter>

- 
- **BrowserRouter** uses normal URLs and the HTML5 Location API

- Recommended for modern browsers
- Requires *some server configuration*
- `import { BrowserRouter as Router`

- **HashRouter** uses '#' in the URL

- Compatible with older browsers
- Requires no config on the server
- **Not recommended**, unless for compatibility

- Must wrap the entire App

Not needed with the React Development Server.

When served as a static bundle, all paths must be mapped to index.html:

```
app.use(express.static('build'));

app.get('/*', function (req, res) {
  res.sendFile('build/index.html');
});
```

More on this -> next weeks!

<https://create-react-app.dev/docs/deployment/#serving-apps-with-client-side-routing>

Selective Render

- Alternative versions of a component content must be wrapped in `<Routes>`
 - Each alternative is represented by a `Route`
 - The route with the “most specific” match will be rendered
- Each `<Route>` specifies the URL path matching requirement
 - `path = '/fragment'` check if the URL matches the fragment
 - `element = {<JSXelement/>}` renders the specified JSX fragment if the path is *the best match*

```
<Router>
  <Routes>
    <Route path="/" element={<Home/>} />
    <Route path="/news" element={<NewsFeed/>} />
  </Routes>
</Router>
```


Route matching Methods

- **path** = string matched against the URL
- A path is made of different URL 'segments' (separated by /)
 - **Static** segment → e.g., users
 - **Dynamic** segment → e.g., :userId
 - **Star** segment → *
- Examples:
 - /users/:userId
 - /docs/*
 - /
 - /contact-us
- Options
 - **caseSensitive**: the match becomes case-sensitive (default: insensitive)
 - changing the default is not recommended



If the Location URL matches more than one route path, **the most specific one** is selected

Nesting Routes

- Routes may follow the layout hierarchy of the interface components
- It is possible to **nest** a `<Route>` **inside** another `<Route>` component
 - The paths will be **concatenated**
 - The parent `<Routes>` will browse, recursively, through all matching paths
 - **All** route elements in the **best matching path** will be rendered
- The matching children will be rendered inside the `<Outlet>` component in the parent's render tree
 - `<Outlet>` specifies “**where**” the matching children should be rendered
 -  If you forget `<Outlet>`, the children will *not* display

Example

```
function App() {  
  return (  
    <div>  
      <h1>Basic Example</h1>  
      <Routes>  
        <Route path="/" element={<Layout />}>  
          <Route path="about" element={<About />} />  
          <Route path="dashboard"  
            element={<Dashboard />} />  
        </Route>  
      </Routes>  
    </div>  
  );  
}
```

```
function Layout() {  
  return (  
    <div>  
      <nav>... main navigation menu ...</nav>  
      <hr />  
      <Outlet />  
    </div>  
  );  
}
```

```
function About() {  
  return (  
    <div>  
      <h2>About</h2>  
    </div>  
  );  
}
```

Special Routes (1/2)

- **Index** route
 - `<Route index element={<Home />} />`
 - A child route with **no path** that renders in the parent's outlet at the parent's URL
 - Use cases:
 - They match when a parent route matches but none of the other children match.
 - They are the default child route for a parent route.
 - They render when the user doesn't have clicked one of the items in a navigation list yet.

Special Routes (2/2)

- **Layout** route
 - A route without path will always be matched
 - Useful to “wrap” with a common layout its children’s routes
- **“No Match”** route
 - Special case: `path="*"`
 - Will match only when no other routes do

Example

```
function App() {
  return (
    <div>
      <h1>Basic Example</h1>
      <Routes>
        <Route path="/" element={<Layout />}>
          <Route index element={<Home />} />
          <Route path="about" element={<About />} />
          <Route path="dashboard" element={<Dashboard />} />
          <Route path="*" element={<NoMatch />} />
        </Route>
      </Routes>
    </div>
  );
}
```

```
function Layout() {
  return (
    <div>
      <nav>... main navigation menu ...</nav>
      <hr />
      <Outlet />
    </div>
  );
}
```

```
function Home() {
  return (
    <div>
      <h2>Home</h2>
    </div>
  );
}
```

Navigation

- Changing the location URL will re-render the Router, and all Routes will be evaluated
- Two options:
 - `<Link to= >` creates a router-aware hyperlink (activated by user clicks)
 - `useNavigate()` returns a function to trigger navigation (useful inside event handlers)

Navigation

- Changing the location URL will re-render the Router, and all Routes will be evaluated
- Two options:
 - `<Link to= >` creates a router-aware hyperlink (activated by user clicks)
 - `useNavigate()` returns a function to trigger navigation (useful inside event handlers)

⚠ Warning ⚠

Never use a “plain hyperlink” `<a>`

Never use a “form submission”
`<form action='...'>`

They will reload the whole application (and kill the current state)

Examples

```
function Home() {  
  return (  
    <div>  
      <h1>Home</h1>  
      <nav>  
        <Link to="/">Home</Link>  
        {" "  
        <Link to="about">About</Link>  
      </nav>  
    </div>  
  );  
}
```

```
function Invoices() {  
  const navigate = useNavigate();  
  return (  
    <div>  
      <NewInvoiceForm  
        onSubmit={(event) => {  
          const newInvoice = create(event.target);  
          navigate(`/invoices/${newInvoice.id}`);  
        }}  
      />  
    </div>  
  );  
}
```

All paths are relative,
unless they start with /

Active Navigation

- When creating menus or navigation elements, it is useful to see which item is the currently selected one
- `<NavLink>` behaves like `<Link>`, but knows whether it is “active”
 - It adds the “`active`” class to the rendered link (to be customized with CSS)
 - You may create a **callback** in `className={}` that receives the `isActive` status and decides which class to apply
 - You may create a **callback** in `style={}` that receives the `isActive` status and decides which CSS style(s) to apply

Dynamic Routes

- Routes may have **parametric** segments, with the **:name** syntax in the path specification
 - `<Route path="/post/:id" element={<Post/>} />`
 - The 'id' part will be available to the element through the **useParams()** hook

```
<Route  
  path="/post/:id"  
  element={<Post/>} />
```

```
function Post(props) {  
  const {id} = useParams();  
  ...  
}
```

Dynamic Routes

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 - `<Route path="/post/:id" element={<Post/>} />`
 - The 'id' part will be available to the element through the **useParams()** hook

```
<Route  
  path="/post/:id"  
  element={<Post
```

- useParams returns an object of key/value pairs of the dynamic params from the current URL that were matched by the `<Route path>`
- Child routes inherit all params from their parent routes

```
function Post(props) {  
  const {id} = useParams();  
  ...  
}
```


Example

```
function App() {  
  return (  
    <Routes>  
      <Route  
        path="/invoices/:invoiceId"  
        element={<Invoice />}  
      />  
    </Routes>  
  );  
}
```

Matches a URL like
`/invoices/1234`

```
function Invoice() {  
  let { invoiceId } = useParams();  
  return <h1>Invoice {invoiceId}</h1>;  
}
```

```
function Invoice() {  
  let params = useParams();  
  return <h1>Invoice {params.invoiceId}</h1>;  
}
```

Location State: Passing Information Among Pages

- When navigating, it is possible to **pass** some **information** to the next page, thanks to the `location.state` BOM attribute
 - Alternative to dynamic URLs
- The value may be retrieved with `useLocation()` on the next page
 - **Beware:** objects are serialized as strings, **avoid passing 'complex' objects** (e.g., `dayjs` objects)

```
const navigate = useNavigate() ;  
  
// go to URL and send information  
navigate( url, {state: userData} ) ;
```

```
<Link to={url}  
      state={userData} >  
  . . .  
</Link>
```



```
const location = useLocation();  
const userData = location.state;
```

Exploiting Search Parameters

- A URL may contain some “query search parameters”
 - /products?**sort=date&filter=valid**
- `useSearchParams()` allows you to read and modify the query string portion of the location
 - Returns the current version of the parameter, and a function to modify them
 - Behaves like `useState`

```
let [searchParams, setSearchParams] =  
useSearchParams();
```

- **searchParams** is a `URLSearchParams` object

<https://developer.mozilla.org/en-US/docs/Web/API/URL/searchParams>

You may access each parameter with

```
searchParams.get('date')
```

```
searchParams.get('filter')
```

- **setSearchParams** receives an object of { key: value } pairs that will replace the current parameters

Summary: react-router-dom

- Wrap app in `<BrowserRouter>`
- Routing and rendering:
 - `<Routes>`
 - `<Route path= element= />`
 - `<Outlet/>`
- Navigation:
 - `<Link to= >...</Link>`
 - `<NavLink to= >...</NavLink>`
 - `useNavigate()` or `<Navigate>`
- Parameters
 - `useParams()` for Dynamic Routes
 - `useSearchParams()` for URL query strings (after “?”)
 - `useLocation()` for retrieving location state (set by navigate)

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