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2025

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”

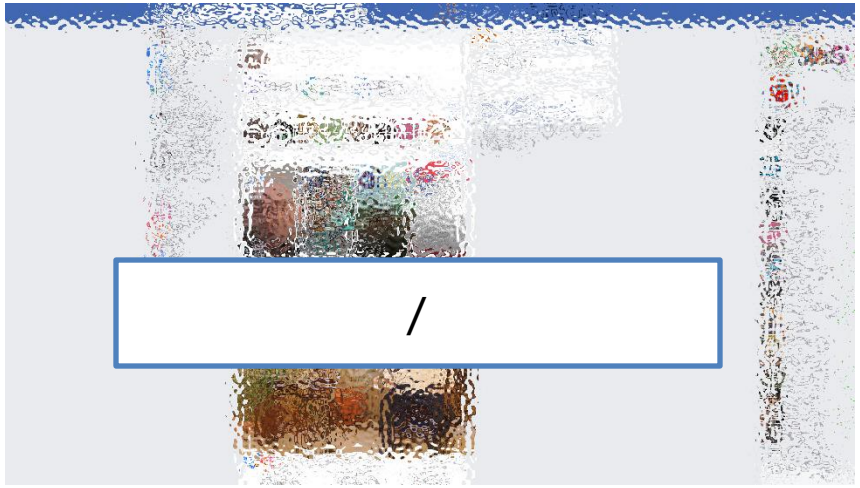
Multi-page Single Page Applications

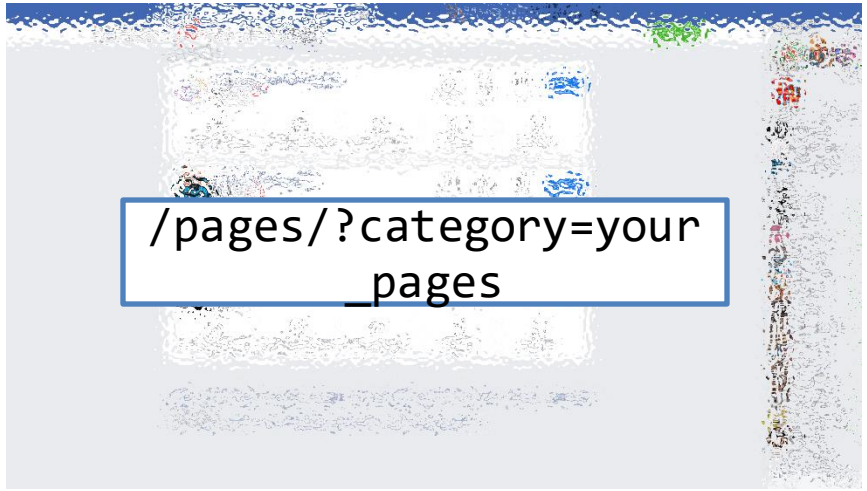
OBJECTIVES AND PROBLEMS

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 ⇆ 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/1234123212422123`

`/pagename`

`/pages/?category=your_pages`

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- Back and F

Special configuration:

- 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 content is then queried by the App to customize the render

Example URLs on facebook.com:

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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
- A commonly adopted one is **`react-router`**
  - Current version 7.x
  - `npm install` **`react-router`**

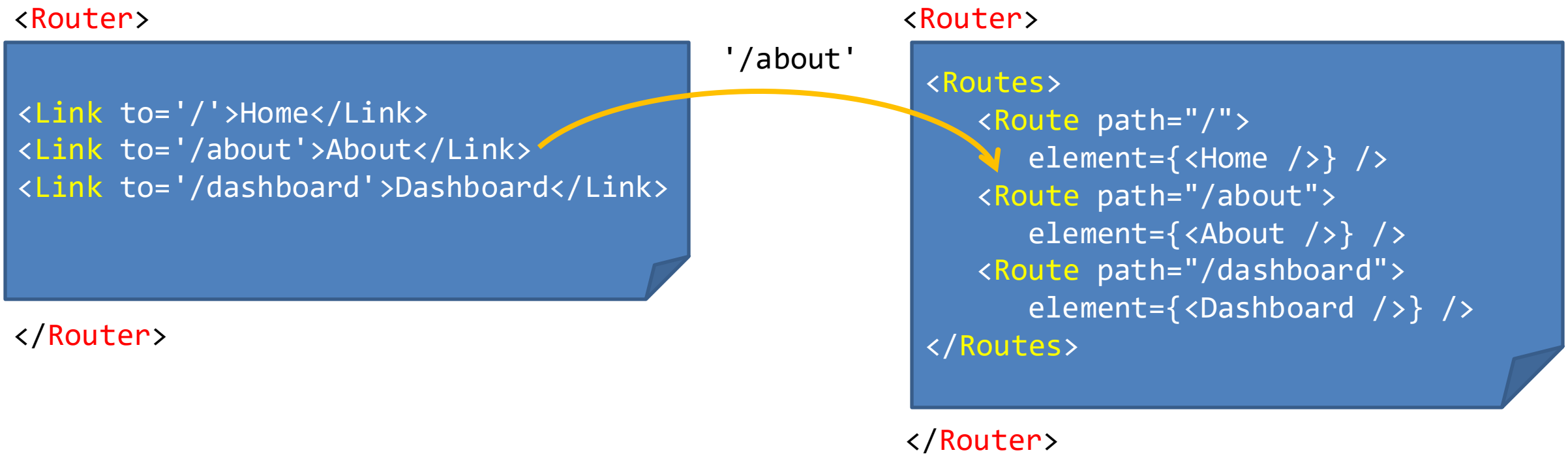
https://reactrouter.com/

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

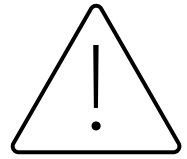
Features

- 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 `useNavigate`, `useParams`, `useSearchParams`
- The **whole** application is wrapped in a `<Router>`-like container

Overview of React Router



Routers



- Routers can be initialized in three ways, or “modes”
  1. Declarative
  2. Data
  3. Framework
- Features available in each mode are *additive*
  - moving from Declarative to Data to Framework adds more features at the cost of architectural control
- In the course, we will use the **Declarative** mode
  - enables basic routing features and fundamental APIs

Types of Routers in Declarative Mode

- `<BrowserRouter>` uses normal URLs and the HTML5 Location API
  - **Recommended** for modern browsers
  - Requires *some server configuration*
  - `import { BrowserRouter } from 'react-router' ;`
- `<HashRouter>` uses '#' in the URL
  - Compatible with older browsers
  - Requires no config on the server
  - Not recommended, unless for compatibility reasons

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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!

Wrapping <App> with a Router

Add the highlighted lines to `main.jsx`

```jsx
import { StrictMode } from 'react';
import { createRoot } from 'react-dom/client';
import { BrowserRouter } from 'react-router';
import App from './App.jsx';

createRoot(document.getElementById('root')).render(
  <StrictMode>
    <BrowserRouter>
      <App />
    </BrowserRouter>
  </StrictMode>,
)
```

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*

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

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

https://reactrouter.com/api/components/Outlet

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
  - It can be used for a “Not Found” page, for example

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 main 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 main 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" (without useActionState)
`<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/:i
  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 [params, setParams] = useSearchParams();`
  - params is a standard `URLSearchParams` object, https://developer.mozilla.org/en-US/docs/Web/API/URLSearchParams
  - setParams receives an object of { key: value } pairs that will replace the current parameters

Summary: `react-router`

- Wrap `main.jsx` 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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