PRACTICAL REACT WITH TYPESCRIPT

bouvet

https://tinyurl.com/practical-react

Setup

https://tinyurl.com/practical-react

https://github.com/rudfoss/practical-react-with-typescript

Our development environment

- Nx.dev powered repository configured as integrated monorepo
  - Code generators
  - Project dependency tracking
  - Task orchestration
- Visual Studio Code some custom extensions and configurations
- Linting using ESlint with custom rules from Nx and unicorn, auto-fix on save where possible
- Formatting using prettier with “some” EditorConfig, auto-format on save
- React front-end bundled with Vite (generated using @nx/react)
  - Vite dev server with hot-reloading
  - Testing using Jest and testing-library/react
  - End-to-end testing using Playwright
- NestJs backend API (generated using @nx/nest)
  - Auto-generated OpenAPI specification
  - Auto client-generation using NSwag (npm package + .NET 6+)

Agenda

1. What is React
2. Props, events and state
3. Lists and loops
4. Organizing code
5. Styling
6. Routing
7. Services / Contexts
8. Optimize rendering
9. Server communication
10. Building the application (a bunch of tasks)

Jump to references 🚀

bouvet

What is React?

> A JavaScript library for building user interfaces
>
> -reactjs.org

bouvet

Anatomy of React

The component

bouvet

Anatomy of React

```
function GreetPerson(props) {
  const userData = useContext(User)
  const [greeting, setGreeting] = useState("Hello there,")

  return (
    <div>
      <h1>{greeting} {userData.name}</h1>
      <input
        type="text"
        value={greeting}
        onChange={(event) => setGreeting(event.currentTarget.value)}
        disabled={props.disabled}
        />
    </div>
  )
}
```

Props

State

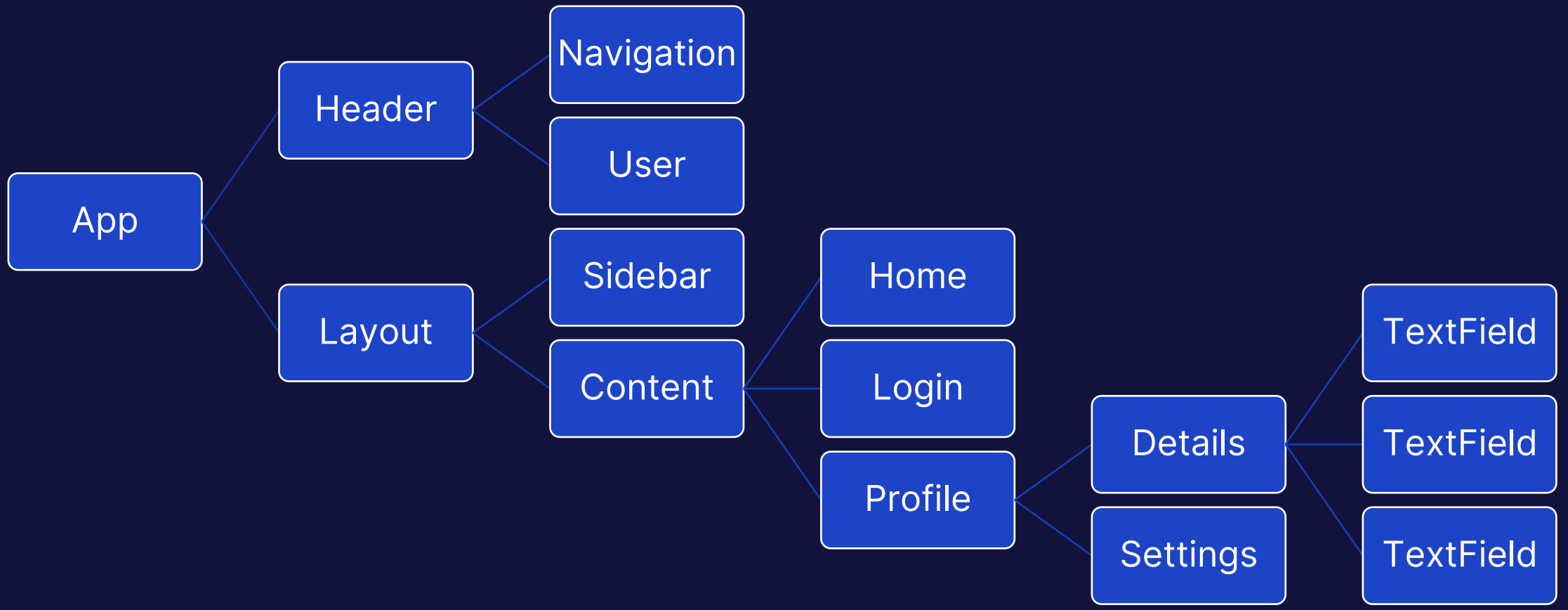
Context

JSX

bouvet

Anatomy of React

The component tree



bouvet

Props

- “Arguments” to a component.
- The component re-renders if the props change.
- Props are «packed» into an object and passed as the first argument to the component function.

```
<MyComponent foo="hey" bar={42} baz>Hello</MyComponent>
```

```
props = {
  foo: "Hey",
  bar: 42,
  baz: true,
  children: "Hello"
}
```

bouvet

Header

- Create a basic header with a <h1> title.
- Allow setting the header title from the “outside” using a “prop”.

bouvet

Events

- Events are actions triggered by the user (or browser)
- Register a function to act on the event.

```
const onButtonClicked = (event: MouseEvent<HTMLButtonElement>) => {
  const buttonText = event.currentTarget.textContent
  console.log(`${buttonText} clicked`)
}

return <button onClick={onButtonClicked}>Click me</button>
```

TextField

- Create a component where the user can enter a single line of text.
- Add a “prop” to define the label of the field.
- Clicking the label should put focus in the text field (accessibility).
- Add “prop” to disable the field.

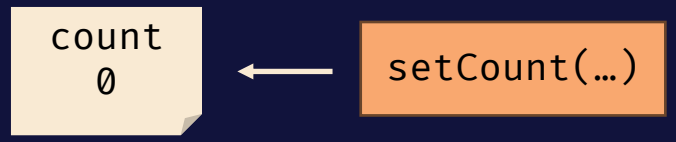
bouvet

State

- A “live” value the component can keep track of and update.
- “Setting” the value re-renders the component.

```
const [count, setCount] = useState(0)

return <button onClick={() => setCount(count + 1)}>{count}</button>
```



bouvet

Control header using text field

- Use the text entered in the text field to control the header text.
- How do we get the text of the text field over to the header?

bouvet

Hoisting state

- Lift the state “up” from a component to a parent.
- Allows sharing state between components.

<> PasswordField

- Create a component where the user can enter a password.
- Add a configurable label that focuses on the input when clicked.
- Add an optional “prop” for controlling the maximum length of the password.
- Add “prop” to disable the field.

<> CheckboxField

- Create a component where the use can check a box.
- Add a configurable label that focuses on the input when clicked.
- Add “prop” to disable the field.
- Ensure the field is reusable like the TextField.

<> LoginForm

- Create a form where the user must enter a username and password.
- Add a checkbox to show the password value.
- Add a button to log in. It should be disabled until there is any text in both the username and password fields.
- Add “onLogin” prop that takes a function which receives the username and password when the clicks the “Log in” button.
- Add prop to disable the entire form.

Lists

- Render lists of items using the same components.
- Must keep track of which components corresponds to which item.
- Rules of keys.

bouvet

<> StaticGroupTable

- Copy groups from the API and list them in a table with at least the id and display name.
- Allow moving groups up or down.
- Allow deleting groups.
- Bonus: Disable buttons that don’t make sense.

Tests

- Unit tests using Jest (or Vitest)+ testing-library/react
- End-to-end tests using Playwright

bouvet

Test

- Write basic unit tests for the <Header/> that verifies the provided text is rendered in an <h1> tag.
- Write an end-to-end test that verifies that the page loads and the app starts.

Organizing our code

- Apps vs libraries
  - An app can be built and deployed.
  - A library is used by one or more apps.
- Group libraries by domain
  - User components
  - Group components
  - Fields
  - UI
  - ++
- Utilize index files (barrel files) to control public vs private APIs.

<> ChoiceField

- Create a component that allows the user to select one item from a list of items.
- Place the component in the “fields” library.
- Provide a way to choose between radio buttons and a drop-down for selection.
- Provide a configurable label.
- Add prop to disable the field.

Styling

- Style-prop on elements
- CSS files
- CSS modules
- CSS preprocessors
  - SASS, LESS, PostCSS
- CSS-in-js
  - styled-components, emotion, linaria, griffel

Style header

- Add some spacing and a border to the header.

bouvet

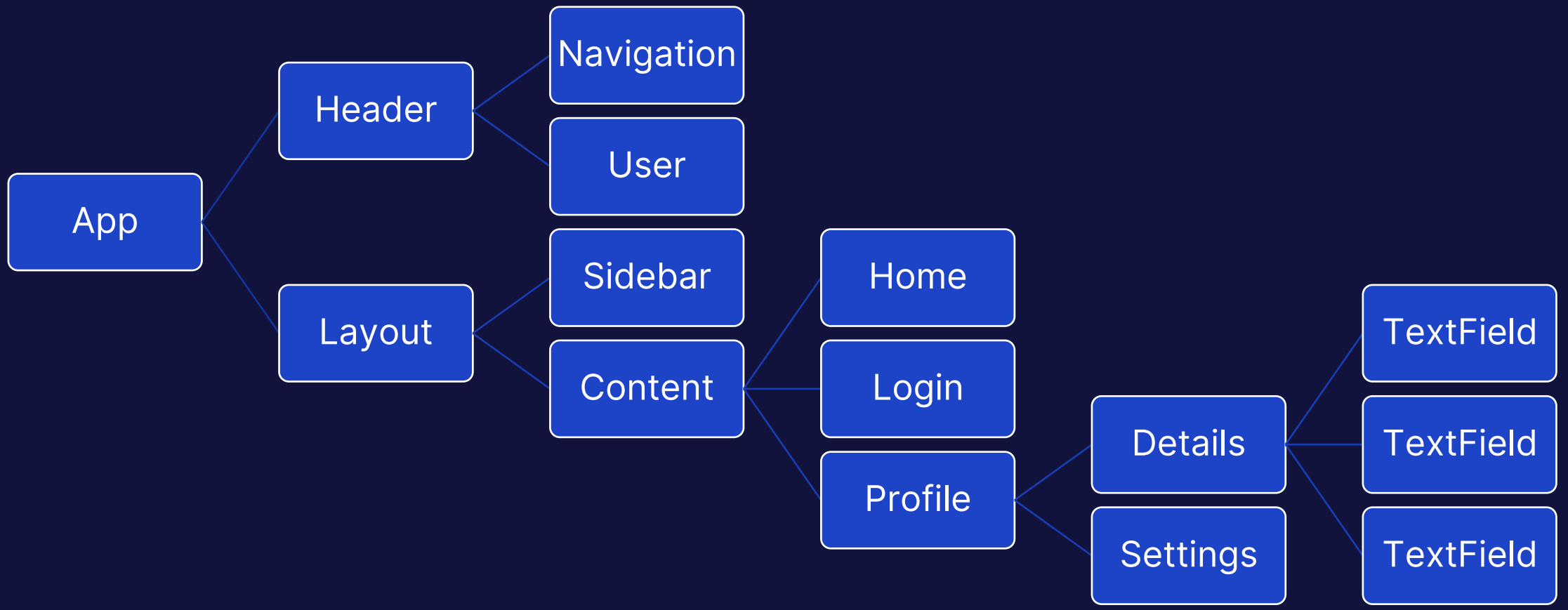
Style fields

- TextField/PasswordField
  - Move label above the input.
  - Add 16px top/bottom, 8px left/right margin around the entire field (label and input).
  - Use all available width for the input.
- ChoiceField
  - Move label above select.
  - Add the same padding as the TextField.
  - Add some spacing around each radio button choice.
  - Vertically center the radio button and the label next to each other.
- CheckboxField
  - Add the same padding as the TextField.
  - Vertically center the checkbox and the label next to each other.
  - Add some spacing between the checkbox and the label.

Routing

- Selectively render pieces of our application tree based on the users current path.
- Extract parameters from the path and use them to select what content to render.
- Utilize History API in the browser.

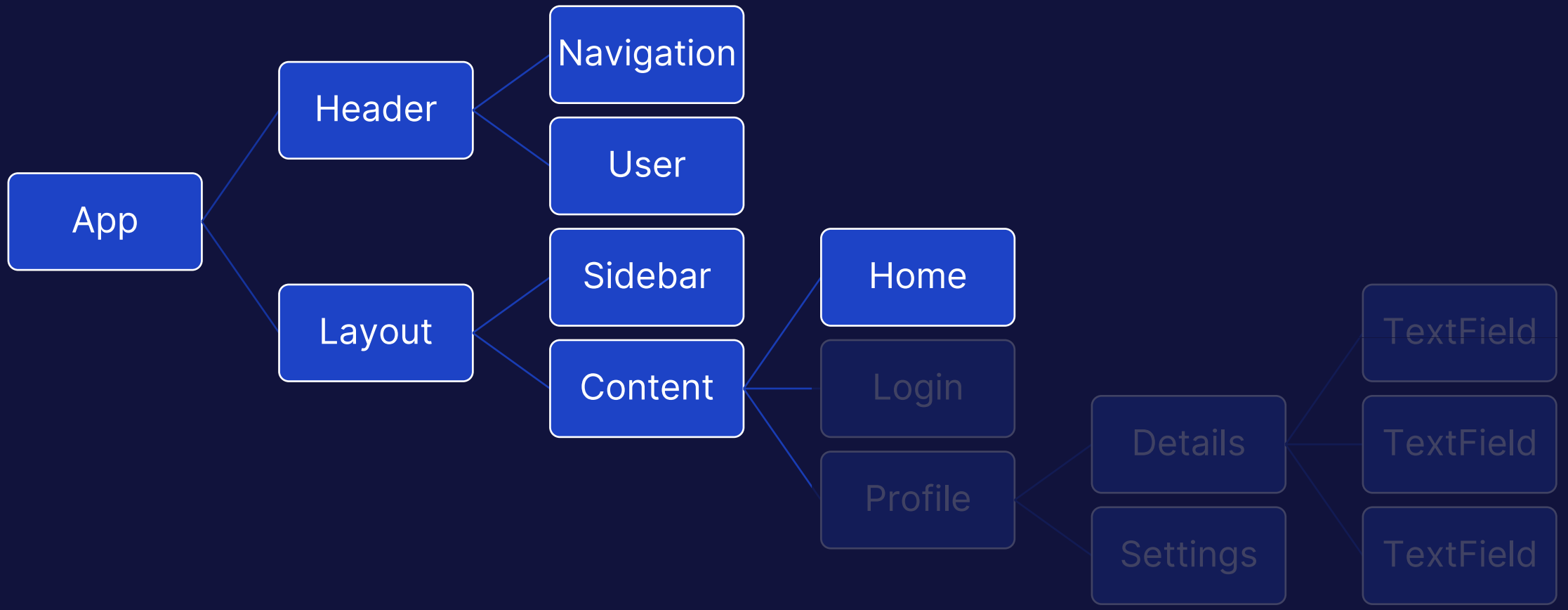
Routing



bouvet

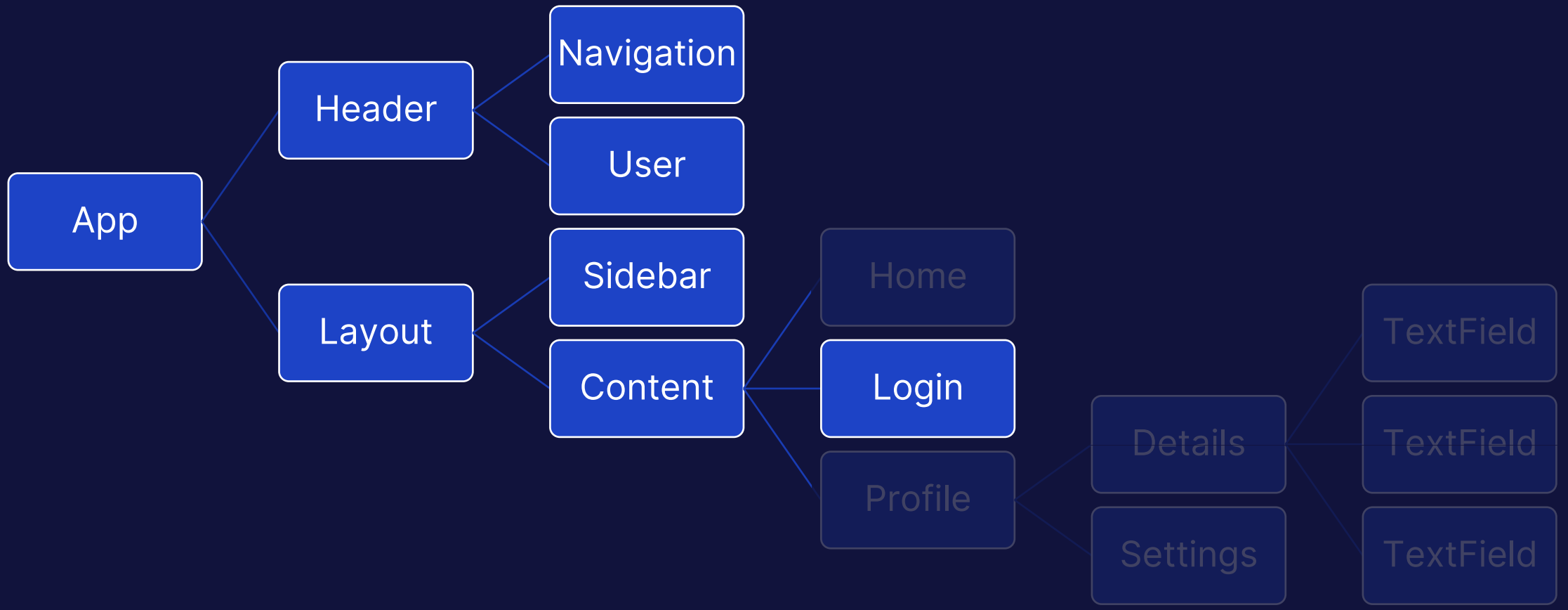
Routing

/home



Routing

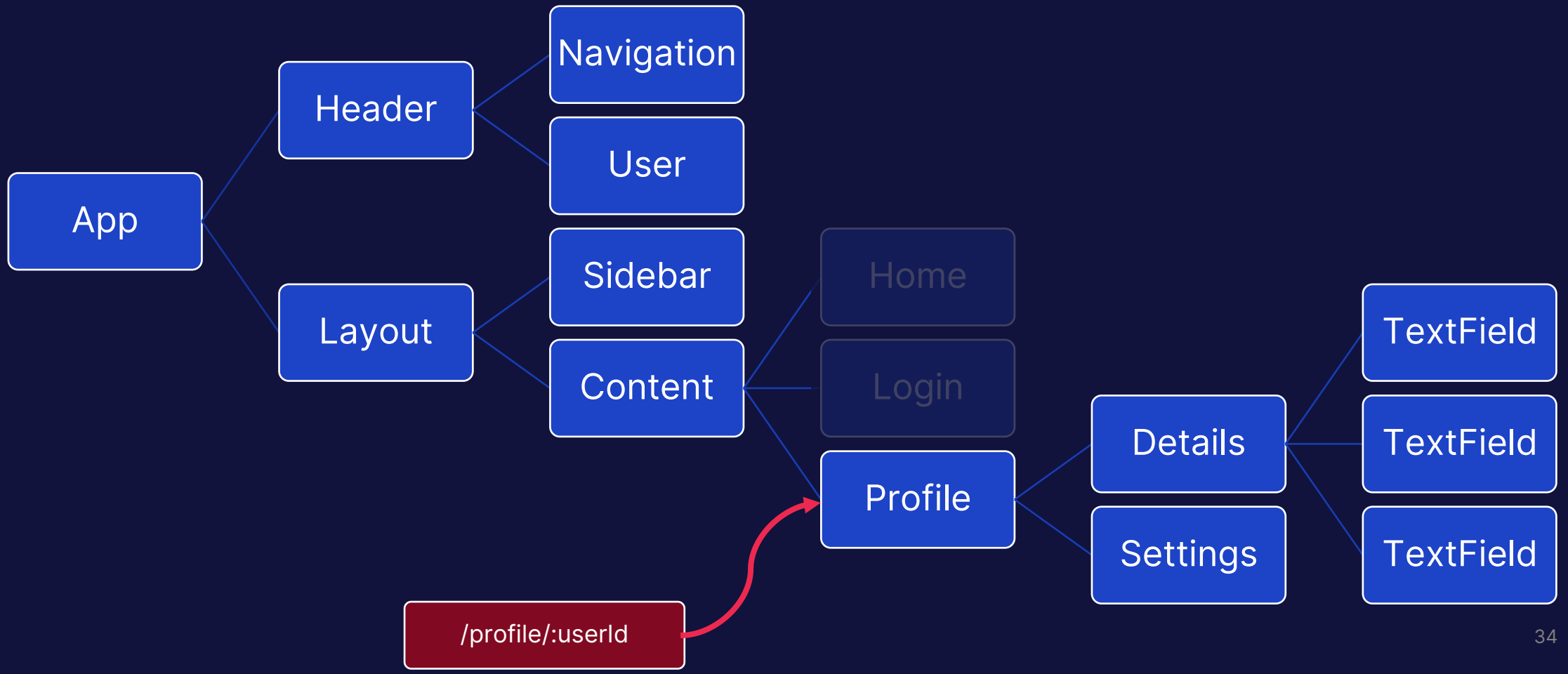
/login



bouvet

Routing with parameter

/profile/0e768eea-1c35-4024-8769-ef2dd62915e2



bouvet

Setting up routing

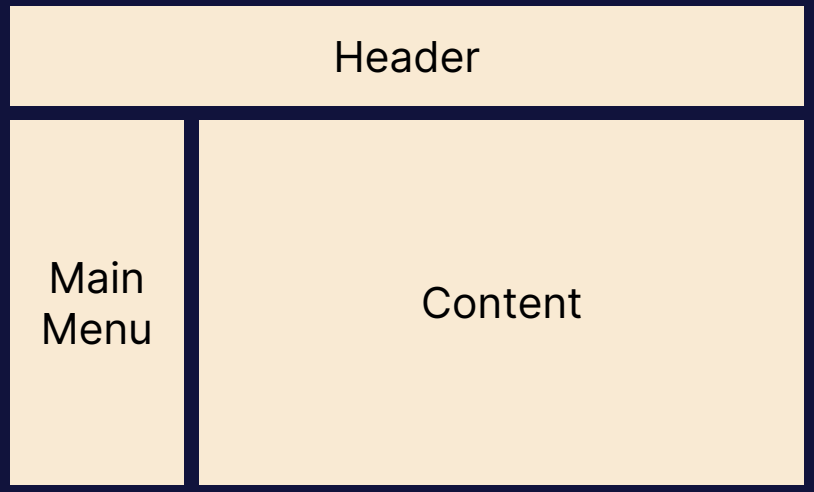
- `pnpm add react-router-dom`
- Define routes with pages
  - / -> Home Page
  - /users -> Users Page
- Provide routes
- Create error pages
- Navigation with links

Layouts

- Control the view surrounding the “route” component.

MainLayout

- Create a classic two-column layout with the header on top, navigation to the left and main content to the right.
- Use the layout for all pages in the application.



MainMenu

- Create a component that displays a list of main menu links for the application.
- Include links to pages and a Home link to the home page.
- Add the menu to the Home Page and each sub page.
- Highlight the link that is currently active.

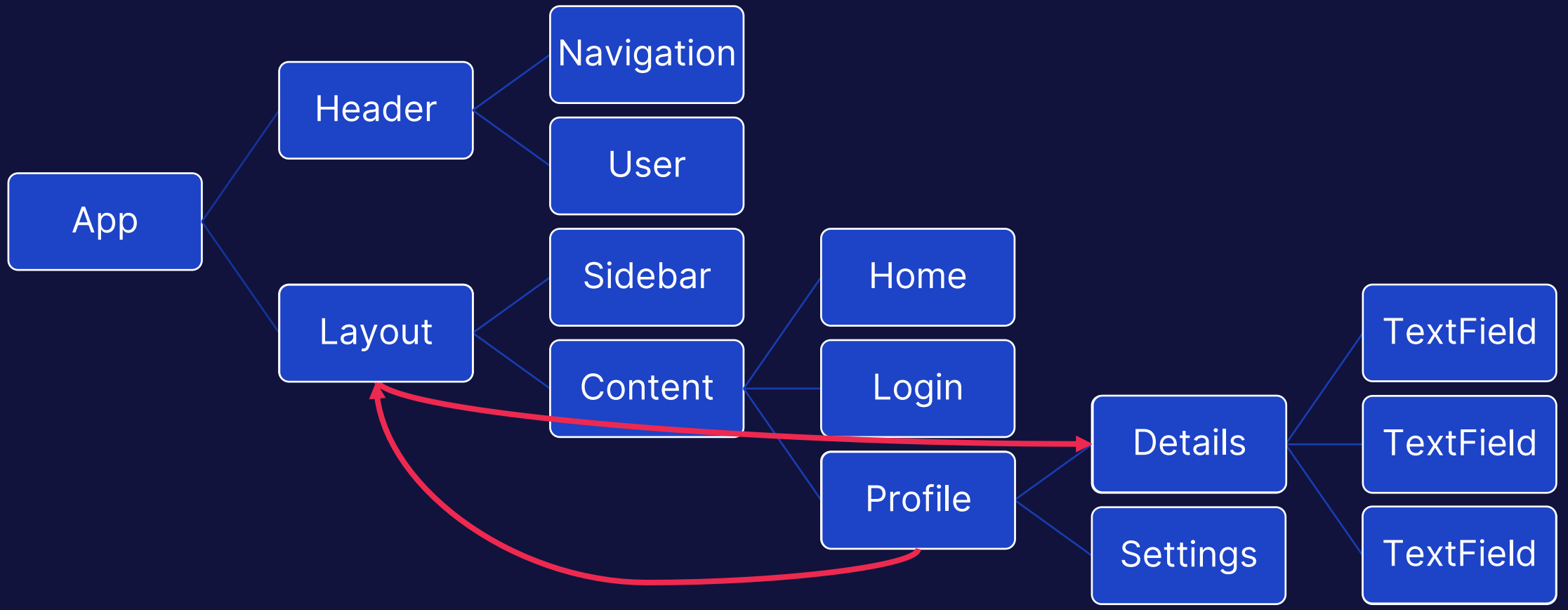
<> GroupsPage

- Create a page that displays the static groups list.
- Add a route for it at /groups
- Add a home link to the page.
- Add a link to the groups page on the home page.
- Add a parameter that takes a group id.
- Highlight the group in the list if the parameter is present and the group exists.

<> GroupDetailsPage

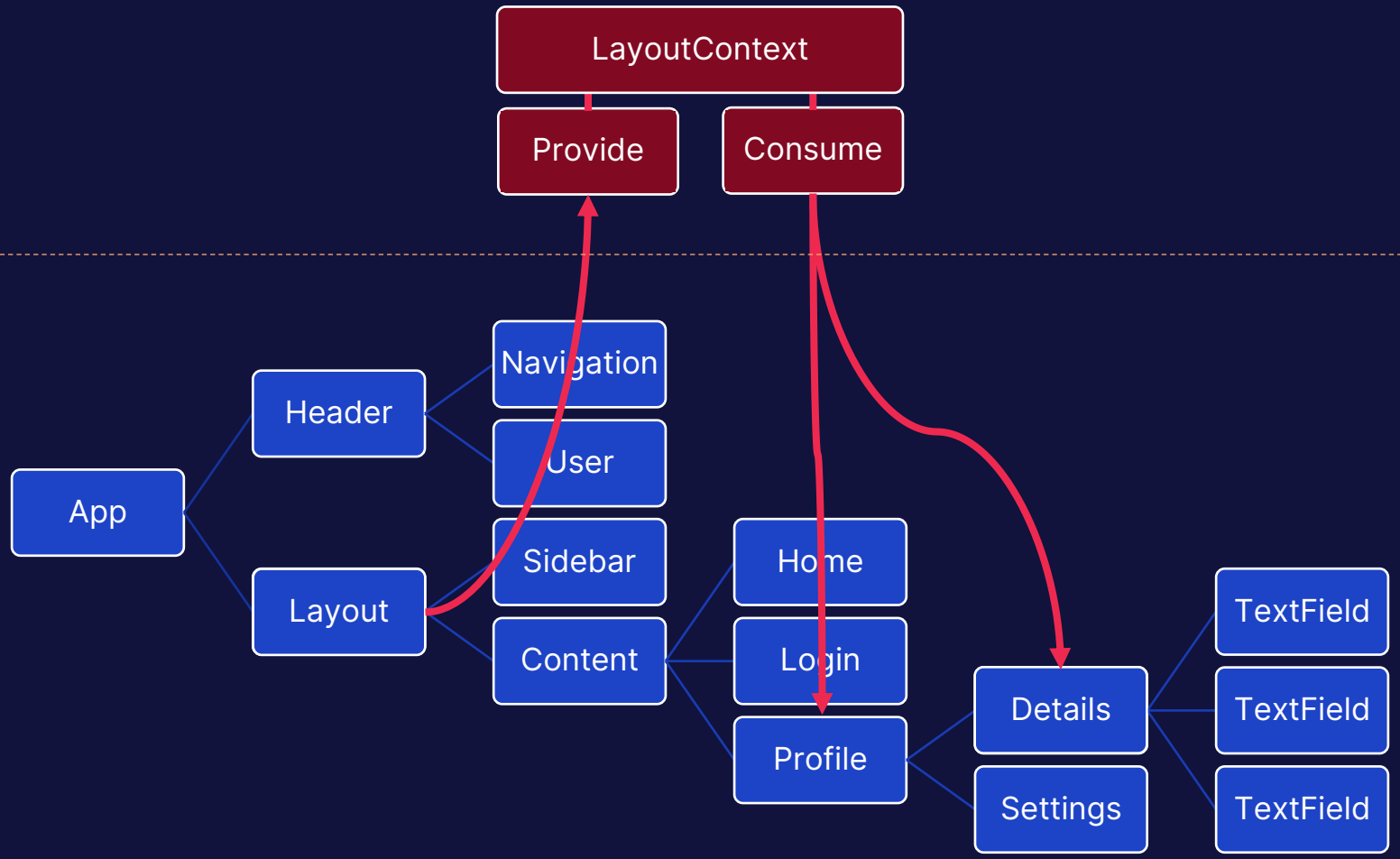
- Create a page that displays details about a single group.
- The id of the group to display should come from a URL parameter.
  - E.g.: /groups/abc123
- Add links to the id column of the static groups table that link to the details page for that specific group.

Anatomy of Context



bouvet

Anatomy of Context



bouvet

Services using contexts

- **Provide** (inject) state or functionality to the application tree.
- Manipulate shared state from nonadjacent components.
- Basically, just contexts with extra steps…

HeaderService

- Create a service that allows pages to set the header text in the header component.
- Create a custom hook “useHeading” to easily set the heading text once a page is displayed.

bouvet

<> FieldsService

- Create a service that controls whether any fields below it are enabled or disabled.
- Add a function that allows toggling the disabled state (without providing an explicit true/false flag).
- Add a checkbox to the home page that disables all fields. Make sure it can be deselected as well.
- Bonus: Do not require the service to be provided for individual fields to be used.

Optimize rendering

- Make sure to only run code that needs to run.
- Mark heavy code so that it only runs if values it depends on have changed (useMemo())
- Mark an entire component as “pure” so that it is only called if any of its props have changed (React.memo())
- Write immutable state changes.
- Use dev tools to detect render problems.

Immutability

- React works on the assumption that objects are immutable.
- An immutable object cannot change it can only be replaced.
- Optimizes for performance.

Code-splitting

- Reduce the size of the bundle that needs to be downloaded to start your app.
- Divide our bundle into discreet chunks (usually based on routes).

Server communication

- Get and set data on a remote server.
- Ensure the date on the client remains up to date.
- Show the user that data is being fetched and handle errors gracefully.
- Use types generate from the system that “owns” them.

Tanstack Query

- Client-side caching and invalidation.
- Query state and error handling.
- Retries and polling.
- Reuse data across components.
- TypeScript support ensures type-safe client code.

Tanstack Query

Two types of requests

Query

- Get data from a server with optional parameters.
- Runs as soon as a useQuery() hook is encountered.
- Read-only.
- Usually corresponds to HTTP verbs: GET.

Mutation

- Change data on the server with optional parameters.
- useMutation() hook runs only when explicitly requested.
- May invalidate locally cached data.
- Usually corresponds to HTTP verbs: POST, PUT, PATCH, DELETE.

ApiStats

- Create a component that displays statistics from the API.
- Create a page and route for it.

ApiHealth

- Create a component that shows health information from the API.
- Create a page and route for it.

Basic login

- Use the login form to log a user in and display the result.
- Disable the form while the user is being logged in.
- Implement a logout button that logs the user out. It should only be visible IF the user is previously logged in.
- Add a loading indicator that can be displayed while the login is in-flight.

Organizing queries and mutations

- Goal: Make it easy to “query” and “mutate” from our pages and components.
- Generalize and isolate queries and mutations.
- Downside: Opinionated and takes some time to get used to.

Data Service

One approach

- A combination of a service and custom hooks for working with queries and mutations.
- Use TkDodos recommeded pattern for holding queries.
- Use custom hooks to encapsulate mutations.
- Use a context to hold and provide queries.

bouvet

Handling session tokens

- Session tokens usually come from an OAuth flow or equivalent.
- They must usually be passed as a header to the back-end.
- There are many ways to do this with NSwag.
- We will be using the “base-class-method” with a static field.

authDataService

- Create a data service for the Auth and Authenticated User endpoints.
- Provide relevant queries from it.
- Create custom mutation-hooks where applicable.

<> Login using data service hooks

- Create a login page that uses the data service provided useLogin() and useLogout() hooks.

authService

- Create a service to manage authentication information.
- Provide helper functions for logging in, logging out and refreshing the session.
- If the user is authenticated provide all relevant user information:
  - Session
  - User
  - Roles
  - Groups

<> Login with services

- Create a new page where the user can log in.
- Use the data and client services to facilitate login.
- Display all user information using a query.

useEnsureFreshSession

- Create a custom hook that ensures the session is fresh when navigating between pages.
- Do nothing if the user is not authenticated.

bouvet

<> RequireRoles

- Create a component that only renders its children if the user is logged in and has one of a set of specified roles.
- If no roles are provided it should only require the user to be authenticated.
- Admins should have access to everything.

Building the application

- What remains now is using what we have learned to build out the application.
- We will most likely not be able to complete all these, but you can find example solutions in the solution/* branches.

<> ActiveSessionsPage

- Create a page where admins can view and cancel all active sessions.

<> usersDataService

- Create a data service for the Users endpoints.
- Provide relevant queries from it.
- Create custom mutation-hooks where applicable.

<> UserDetailsPage

- Create a page that displays details about a specific user from the server.
- It should receive the user id from a URL parameter to allow deep linking.
- It should show a list of all groups the user is a member of.
- It should show a list of all distinct roles the user has.

<> UsersPage

- Create a page that displays all users in the system in a table.
- Clicking the user id or display name should take you to the UserDetailsPage for that user.
- If the current user is a user admin add a delete button for each row.

<> EditUserPage

- Create a page with a form that allows you to edit an existing user.
- Allow admins and user admins to edit any user while regular users can only edit themselves. Guests should not be able to edit themselves.
- Validate the form client-side according to the rules described in the OpenAPI specification.

<> CreateUserPage

- Create a page with a form that allows you to create a user.
- Validate the form client-side according to the rules described in the OpenAPI specification.

<> groupsDataService

- Create a data service for the Groups endpoints.
- Provide relevant queries from it.
- Create custom mutation-hooks where applicable.

<> GroupDetailsPage

- Create a page that displays details about a specific group.
- It should receive the group id from a URL parameter to allow deep linking.

<> GroupsPage

- Create a page that displays all groups in the system in a table.
- Clicking the group id or name should take you to the GroupDetailsPage for that group.
- If the current user is a user admin add a delete button for each row.

<> EditGroupPage

- Create a page with a form that allows you to edit an existing group.
- Allow admins and user admins to edit any group. Others should not be able to edit at all.
- Validate the form client-side according to the rules described in the OpenAPI specification.

<> CreateGroupPage

- Create a page with a form that allows you to create a group.
- Validate the form client-side according to the rules described in the OpenAPI specification.

References

https://react.dev
React documentation

https://nx.dev/
The tool used to generate code and manage the monorepo we are working in

https://vitejs.dev/
Compiler and bundler for our front-end code.

https://reactrouter.com/
A robust router for react

https://griffel.js.org
Atomic-CSS-in-JS library with ahead-of-time compilation

https://emotion.sh
CSS-in-JS styling library

https://tanstack.com/query
Remote-state cache and orchestration library

- https://tkdodo.eu/blog/practical-react-query
  A comprehensive blog post about most of the features of Tanstack Query
- https://query.gg
  The official Tanstack Query course

https://github.com/pmndrs/zustand
Simple global state manager

https://prettier.io
An opinionated code formatter

https://eslint.org
Linting tool for enforcing coding standards

- https://github.com/sindresorhus/eslint-plugin-unicorn
  Extra linting rules

https://playwright.dev/
End-to-end testing using multiple browsers

https://github.com/RicoSuter/NSwag
Tool for generating TypeScript (and other) clients from OpenApi

https://www.mockaroo.com
Tool for generating test data

https://editorconfig.org/
IDE-agnostic formatting and style configurations

https://monorepo.tools/
An overview of what a monorepo is

MDN Web Docs (mozilla.org)
Reference documentation and tutorials for HTML, CSS, JavaScript and more