Lab 5: Reusable React Components

This lab will cover everything you need to know in order to write efficient and reusable React components. It will cover the following topics:

- React patterns
- Structured React components
- Rendering nested components
- The React Context API
- The Apollo Consumer component

Lab Solution

Complete solution for this lab is available in the following directory:

```
cd ~/Desktop/react-graphql-course/labs/Lab05
```

Introducing React patterns

We will go over the most commonly used patterns that React offers, as follows:

- Controlled components
- Stateless functions
- Conditional rendering
- Rendering children

Controlled components

Let's start with uncontrolled input.

By definition, a component is uncontrolled whenever the value is not set by a property through React, but only saved and taken from the real browser DOM. The value of an input is then retrieved from a reference to the DOM Node, and is not managed and taken from React's component state.

The following code shows the post form where the user will be able to submit new posts. I have excluded the rendering logic for the complete feed, as it is not a part of the pattern that I want to show you:

```
import React, { Component } from 'react';
import gql from 'graphql-tag';
import { Mutation } from 'react-apollo';

const ADD_POST = gql`
  mutation addPost($post : PostInput!) {
    addPost(post : $post) {
    id
    text
    user {
      username
      avatar
    }
  }
}`;
```

```
export default class Feed extends Component {
  constructor(props) {
    super(props);
    this.textArea = React.createRef();
  }
  render() {
    const self = this;
    return (
      <div className="container">
        <div className="postForm">
          <Mutation mutation={ADD_POST}>
            {addPost => (
              <form onSubmit={e => {
                e.preventDefault();
                addPost({ variables: { post: { text:
                  self.textArea.current.value } } });
              }}>
                <textarea ref={this.textArea} placeholder="Write your
                  custom post!"/>
                <input type="submit" value="Submit" />
              </form>
            )}
          </Mutation>
        </div>
      </div>
    )
  }
}
```

In this example, you can see that we no longer have a state initializer, since the [textarea] value is stored within the real DOM Node, and not the application state.

Now, we need a component constructor. As we stated in Lab 1, you always need to run the [super] method inside of a constructor first.

Next, we run the [createRef] function provided by React. It prepares the variable to accept the DOM Node as a property. In earlier versions of React, you were required to use a callback to handle this on your own. From version 16.3 of React, the [createRef] function automates this process for you.

In the [render] method, the [ref] property fills in the reference that we just created with the DOM element.

Accessing the value of the DOM Node works by using the normal JavaScript DOM API. You can see this behavior when sending the [submit] event of our form. The value is extracted from the [self.textArea.current.value] field.

Stateless functions

We have written a lot of code where stateless functions can be used very easily; while doing so, we have also structured and improved the readability of our React application.

Beginning with the file structure, we will create a new folder for our new components (or stateless functions), as follows:

```
mkdir src/client/components
```

Many parts of our application need to be reworked. Create a new file for our first stateless function, as follows:

```
touch src/client/components/loading.js
```

Currently, we display a dull and boring [Loading...] message when our GraphQL requests are running. Let's change this by inserting the following code into the [loading.js] file:

```
import React from 'react';

export default ({color, size}) => {
  var style = {
    backgroundColor: '#6ca6fd',
    width: 40,
    height: 40,
  };

  if(typeof color !== typeof undefined) {
    style.color = color;
  }
  if(typeof size !== typeof undefined) {
    style.width = size;
    style.height = size;
  }

  return <div className="bouncer" style={style}></div>
}
```

In the preceding code, we are using a simple function in ES6 arrow notation. It is an easy and more concise syntax for defining functions. In the code, you can see that we are extracting the [color] and [size] fields from the properties that our function receives.

We are building a default [style] object that represents the basic styling for a loading spinner. You can pass the [color] and [size] separately, in order to adjust those settings.

Lastly, we are returning a simple [div] tag with the CSS style and the [bouncer] class.

What's missing here is the CSS styling. The code should look as follows; just add it to our [style.css] file:

```
.bouncer {
  margin: 20px auto;
  border-radius: 100%;
  -webkit-animation: bounce 1.0s infinite ease-in-out;
  animation: bounce 1.0s infinite ease-in-out;
}

@-webkit-keyframes bounce {
  0% {
    -webkit-transform: scale(0)
  }
  100% {
    -webkit-transform: scale(1.0);
    opacity: 0;
  }
}
```

```
@keyframes bounce {
  0% {
    -webkit-transform: scale(0);
    transform: scale(0);
  }
  100% {
    -webkit-transform: scale(1.0);
    transform: scale(1.0);
    opacity: 0;
  }
}
```

Like in the previous examples, we use CSS animations to display our loading spinner correctly, and to let it animate as pulsating.

We have now finished the stateless function. You should place it into the existing code, wherever a loading state exists.

First, import the new loading spinner to the top of your files, as follows:

```
import Loading from './components/loading';
```

You can then render the stateless function like any normal component, as follows:

```
if (loading) return <Loading />;
```

Start the server with [npm run server] and the front end with [npm run client]. You should now see a pulsating blue bubble where you inserted it. I have tested this inside of my posts feed, and it looks pretty good.

The advantage of stateless functions is that they are minimal and efficient functions, rendering smaller parts of our application. The approach perfectly integrates with React, and we can improve the code that we have written.

Conditional rendering

One important ability of React is rendering components or data conditionally. We will use this intensively in the next main features that we are going to implement.

Generally, you can accomplish conditional rendering by using the curly brace syntax. An example of an if statement is as follows:

```
render() {
  const { shouldRender } = this.state;

  return (
    <div className="conditional">
      {(shouldRender === true) && (
        <p>Successful conditional rendering!</p>
      )}
    </div>
  )
}
```

This code is the simplest example of conditional rendering. We have the [shouldRender] variable from the component state, and we use this as our condition. When the condition is true, the second part---which is our [Successful conditional rendering!] text---will also render. That is because we are using the [&&] characters. The text does not render if the condition is false.

You can replace the preceding condition with everything that you have in mind. It can be a complex condition, such as a function returning a Boolean value, or, just like in the preceding code, it can be a state variable.

You will see further examples in later steps and chapters in this course.

Rendering child components

In all of the code that we have written so far, we have directly written the markup like it is rendered to real HTML.

A great feature that React offers is the ability to pass children to other components. The parent component decides what is done with its children.

Something that we are still missing now is a good error message for our users. So, we will use this pattern to solve the issue.

Create an [error.js] file next to the [loading.js] file in the [components] folder, as follows:

```
import React, { Component } from 'react';

export default class Error extends Component {
  render() {
    const { children } = this.props;

    return (
      <div className="error message">
        {children}
      </div>
    );
  }
}
```

When passing children to another component, a new property, called [children], is added to the properties of the component. You specify [children] by writing normal React markup.

If you wanted to, you could perform actions, such as looping through each child. In our example, we render the children as usual, by using the curly braces and putting the [children] variable inside.

To start using the new [Error] component, you can simply import it. The markup for the new component is as follows:

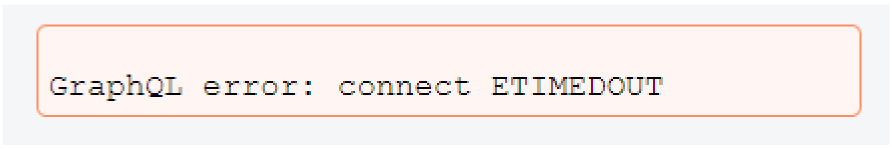
```
if (error) return <Error><p>{error.message}</p></Error>;
```

Add some CSS, and everything should be finished, as shown in the following code snippet:

```
.message {
  margin: 20px auto;
  padding: 5px;
  max-width: 400px;
}

.error.message {
  border-radius: 5px;
  background-color: #FFF7F5;
  border: 1px solid #FF9566;
  width: 100%;
}
```

A working result might look as follows:



GraphQL error: connect ETIMEDOUT

You can apply the stateless function pattern and the children pattern to many other use cases. Which one you use will depend on your specific scenario. In this case, you could also use a stateless function, rather than a React component.

Structuring our React application

We have already improved some things by using React patterns. You should do some homework and introduce those patterns wherever possible.

When writing applications, one key objective is to keep them modular and readable, but also as understandable as possible. It is always hard to tell when splitting code up is useful, and when it overcomplicates things. This is something that you will learn more and more about by writing as many applications and as much code as possible.

Let's begin to structure our application further.

The React file structure

We have already saved our [Loading] and [Error] components in the [components] folder. Still, there are many parts of our components that we did not save in separate files, to improve the readability of this course.

I will explain the most important solution for unreadable React code in one example. You can implement this on your own later, for all other parts of our application, as you should not read duplicate code.

Currently, we render the posts in our feed by mapping through all posts from the GraphQL response. There, we directly render the corresponding markup for all post items. Therefore, it is one big render function that does everything at once.

To make this a bit more intuitive, we should create a new [Post] component. Separating the components hugely improves the readability of our posts feed. Then, we can replace the return value from the loop with a new component, instead of real markup.

Instead of creating a [post.js] file in our [components] folder, we should first create another [post] folder, as follows:

```
mkdir src/client/components/post
```

The [Post] component consists of multiple tiny, nested components. A post is also a standalone GraphQL entity, making it logical to have a separate folder. We will store all related components in this folder.

Let's create those components. We will start with the post header, where the top part of a post item is defined. Create a new [header.js] file in the [components/post] folder, as follows:

```
import React from 'react';

export default ({post}) =>
  <div className="header">
    <img src={post.user.avatar} />
    <div>
      <h2>{post.user.username}</h2>
    </div>
  </div>
```

The [header] component is just a stateless function. As you can see, we are using a React pattern from the earlier pages of this lab. We are only rendering the data that we already have, and we are not storing any state here, so we are free to use a stateless function.

Up next is the post content, which represents the body of a post item. Add the following code inside of a new file, called [content.js]:

```
import React from 'react';

export default ({post}) =>
  <p className="content">
    {post.text}
  </p>
```

The code is pretty much the same as that of the post header. At later points, you will be free to introduce real React components or extended markup to those two files. It is entirely open to your implementation.

The main file is a new [index.js] file in the new [post] folder. It should look as follows:

```
import React, { Component } from 'react';
import PostHeader from './header';
import PostContent from './content';

export default class Post extends Component {
  render() {
    const { post } = this.props;

    return (
      <div className={"post " + (post.id < 0 ? "optimistic": "")}>
        <PostHeader post={post}/>
        <PostContent post={post}/>
      </div>
    )
  }
}
```

The preceding code represents a very basic component, but instead of directly using markup to render a complete post item (like before), we are using two further components for this, with [PostHeader] and [PostContent]. Both of the components receive the [post] as a property.

You can now use the new [Post] component in the feed list with ease. Just replace the old code inside the loop, as follows:

```
<Post key={post.id} post={post} />
```

The improvement is that all three of the components give you a clear overview at first glance. Inside of the loop, we return a post item. A post item consists of a header and body content.

Still, there is room for enhancement, because the posts feed list is cluttered.

Efficient Apollo React components

We have successfully replaced the post items in our feed with a React component, instead of raw markup.

A major part, which I dislike very much, is the Apollo [Query] component and [Mutation] component, and how we are using these at the moment directly inside the [render] method of our components. I will show you a quick workaround to make these components more readable.

Furthermore, the current solution does not allow us to reuse the query or mutation anywhere else. We would need to add duplicate code, just to send the same request again. A better way to structure the code would be to have separate files for the data layer and view layer of our client-side code.

As an example, we will fix those issues for [Feed.js] in the next section.

The Apollo Query component

We will start by implementing the [Query] component. You should be able to easily follow the instructions here, as all of the patterns and React basics should be clear by now:

1. Create a new [queries] folder inside of the [components] folder, as follows:

```
mkdir src/client/components/queries
```

2. The query that we want to remove from our view layer is the [postsFeed] query. You can define the naming conventions for this, but I would recommend using the [RootQuery] name as the filename, as long as it works. So, we should create a [postsFeed.js] file in the [queries] folder, and insert the following code:

```
export default class PostsFeedQuery extends Component {
  getVariables() {
    const { variables } = this.props;
    var query_variables = {
      page: 0,
      limit: 10
    };

    if (typeof variables !== typeof undefined) {
      if (typeof variables.page !== typeof undefined) {
        query_variables.page = variables.page;
      }
      if (typeof variables.limit !== typeof undefined) {
        query_variables.limit = variables.limit;
      }
    }

    return query_variables;
  }
  render() {
    const { children } = this.props;
    const variables = this.getVariables();

    return(
      <Query query={GET_POSTS} variables={variables}>
        {({ loading, error, data, fetchMore }) => {
          if (loading) return <Loading />;
          if (error) return <Error><p>{error.message}</p></Error>;

          const { postsFeed } = data;
          const { posts } = postsFeed;

          return React.Children.map(children, function(child) {
            return React.cloneElement(child, { posts, fetchMore });
          })
        }}
      </Query>
    )
  }
}
```

Do not forget to import all of the dependencies, such as the Apollo React client, the [Loading] and [Error] components, and parsing the [postsFeed] GraphQL query to the [GET_POSTS] variable with [graphql-tag]. If you do not remember how to do this, look inside of the implementation that we have in our [Feed] class at the moment.

For customization reasons, the component should be able to accept other variables, in case we want to adjust the number of parameters of our query. The [getVariables] function overwrites the default [query_variables] field with any parameter given to the component.

What's new in the preceding code is that we are using the **children pass-through** pattern of React. This pattern allows us to wrap the [PostsFeedQuery] component around many different custom components, and it allows us to use the query response inside of these children. That way, we keep a readable [render] method for our user-facing components and the data layer of our React application in a separate file.

We are using the [React.Children.map] function to loop through all of the provided children. By running the [React.cloneElement] method, we copy each element to a new rendered component. This enables us to pass further properties from the result of the GraphQL request initiated by the [Query] component. Each child receives the [posts] and the [fetchMore] function as a property.

3. Preparing our next component, we split the infinite scroll area into a second file. Place a [feedlist.js] into the [components/posts] folder, as follows:

```
import React, { Component } from 'react';
import InfiniteScroll from 'react-infinite-scroller';
import Post from './';

export default class FeedList extends Component {
  state = {
    page: 0,
    hasMore: true
  }
  loadMore = (fetchMore) => {
    const self = this;
    const { page } = this.state;
    fetchMore({
      variables: {
        page: page+1,
      },
      updateQuery(previousResult, { fetchMoreResult }) {
        if(!fetchMoreResult.postsFeed.posts.length) {
          self.setState({ hasMore: false });
          return previousResult;
        }
        self.setState({ page: page + 1 });
        const newData = {
          postsFeed: {
            __typename: 'PostFeed',
            posts: [
              ...previousResult.postsFeed.posts,
              ...fetchMoreResult.postsFeed.posts
            ]
          }
        };
        return newData;
      }
    });
  }
  render() {
    const self = this;
    const { posts, fetchMore } = this.props;
    const { hasMore } = this.state;
    return (
      <div className="feed">
        <InfiniteScroll
          loadMore={() => self.loadMore(fetchMore)}
          hasMore={hasMore}
          loader={<div className="loader" key={"loader"}>Loading
           ...</div>}
        >
          {posts.map((post, i) =>
            <Post key={post.id} post={post} />
          )}
        </InfiniteScroll>
      </div>
    );
  }
}
```

We only handle the infinite scroller of our feed here, which is also the only part where the result of the [PostsFeedQuery] is needed. The preceding code is much tidier than before (at least, inside of the [render] method).

We extract the [posts] and the [fetchMore] function passed from the [PostsFeedQuery] component. Like before, we render the [posts] as they are passed from the parent component inside of the infinite scroller. While scrolling, the infinite scroller executes the [loadMore] function, which runs the [fetchMore] function that is also received by the [PostsFeedQuery] component, in order to get the next posts in our pagination. The data-fetching and the rendering logic are separated from each other.

4. To use the [PostsFeedQuery] component, we can restructure our [Feed.js] a bit. Remove the [Query] tag from the markup, as well as the [page] and [hasMore] state variables.
5. Import the new components in the [Feed.js], as follows:

```
import FeedList from './components/post/feedlist';
import PostsFeedQuery from './components/queries/postsFeed';
```

6. Replace the [div] tag with the [feed] class name and our two new components, as follows:

```
<PostsFeedQuery>
  <FeedList />
</PostsFeedQuery>
```

This code allows the [Query] component to pass all of the required properties to the [FeedList] class.

The improvement that we implemented is that the post form is now rendered directly before the response of the query has arrived. Only the scroll component is rendered when the GraphQL request is finished. Although it is more of a coincidence, it is important to note that the form was previously not rendered until the response arrived.

If we wanted to, we could add multiple other components inside of the [PostsFeedQuery] tag. All children receive the response properties, as specified in our custom [Query] component. You can make changes to the [Query] class and add further fields at any time, and all of the corresponding files will receive the update.

Do the same for the chats to improve your skills in writing reusable React code. How deeply you separate the components into multiple, smaller parts will always be a design decision.

Next, we will look at the [Mutation] component, in order to submit new posts.

The Apollo Mutation component

A big part of our main [Feed.js] file still consists of rendering the real form markup and using the Apollo Mutation component to pass and execute the mutation within the form. We will now separate those parts:

1. Create a new folder for all your mutations, as follows:

```
mkdir src/client/components/mutations
```

2. Next, we want to outsource the mutation into a special file. To do so, create the [addPost.js] file, named after the GraphQL mutation itself. Insert the following code:

```
export default class AddPostMutation extends Component {
  state = {
    postContent: ''
  }
  changePostContent = (value) => {
    this.setState({postContent: value})
  }
  render() {
    const self = this;
    const { children, variables } = this.props;
    const { postContent } = this.state;

    return (
      <Mutation
```

```
        update = {(store, { data: { addPost } }) => {
          var query = {
            query: GET_POSTS,
          };
          if(typeof variables !== typeof undefined) {
            query.variables = variables;
          }
          const data = store.readQuery(query);
          data.postsFeed.posts.unshift(addPost);
          store.writeQuery({ ...query, data });
        }}
        optimisticResponse= {{
          __typename: "mutation",
          addPost: {
            __typename: "Post",
            text: postContent,
            id: -1,
            user: {
              __typename: "User",
              username: "Loading...",
              avatar: "/public/loading.gif"
            }
          }
        }}
        mutation={ADD_POST}>
          {addPost =>
            React.Children.map(children, function(child){
              return React.cloneElement(child, { addPost,
              postContent, changePostContent:
                self.changePostContent
              });
            })
          }
      </Mutation>
    )
  }
}
```

Please import all of the dependencies at the top, and parse both the GraphQL requests [ADD_POST] and the [GET_POSTS] query. The [postsFeed] query is required, because we read all posts from the cache by specifying the query in our [update] function which we introduced in the previous lab.

The solution is the same as it was for the [Query] component in the previous section. However, two things have changed, which will be explained next.

Our [AddPostMutation] class holds the real state of the form. To accomplish this, we hand over the [changePostContent] method to all child components. They execute this method by giving the text area value and setting the new state in the parent component, which is our custom [Mutation] component.

We do this because the [optimisticResponse] requires us to pass the current value, in order to simulate a positive response from our server. If we kept the state within our form, the [Mutation] component would not have access to it, and could not render the text in the optimistic response.

Instead of giving the result of the mutation to our underlying child components, we hand over the mutation method. The form runs this function upon submission.

It is important to mention that the component can take a [variables] property, which is then used to read the cached data. It must receive the same [variables] as the [Query] component to successfully read the data from the client's cache.

3. Going on, we should build a post form component that only handles the creation of new posts. Just call it [form.js], and place it inside of the post's [components] folder. The code must look like the following snippet:

```
import React, { Component } from 'react';

export default class PostForm extends Component {
  handlePostContentChange = (event) => {
    this.props.changePostContent(event.target.value);
  }
  render() {
    const self = this;
    const { addPost, postContent } = this.props;

    return (
      <div className="postForm">
        <form onSubmit={e => {
          e.preventDefault();
          addPost({ variables: { post: { text: postContent } }
            }).then(() => {
            self.props.changePostContent('');
          });
        }}>
          <textarea value={postContent} onChange=
           {self.handlePostContentChange} placeholder="Write your
            custom post!"/>
          <input type="submit" value="Submit" />
        </form>
      </div>
    )
  }
}
```

As you can see, again, we just copied the post form over to our new file. The [handlePostContentChange] does not directly call [setState], but executes the [changePostContent] received from the custom [Mutation] component that we just wrote. The same goes for the [addPost] method that we execute in the [onSubmit] event handler of the form.

4. Lastly, we finalize the [Feed.js] main file. It should look as follows:

```
import React, { Component } from 'react';
import PostsQuery from './components/queries/postsFeed';
import AddPostMutation from './components/mutations/addPost';
import FeedList from './components/post/feedlist';
import PostForm from './components/post/form';

export default class Feed extends Component {
  render() {
    const query_variables = { page: 0, limit: 10};

    return (
      <div className="container">
        <AddPostMutation variables={query_variables}>
          <PostForm />
        </AddPostMutation>
        <PostsQuery variables={query_variables}>
          <FeedList/>
        </PostsQuery>
      </div>
    )
  }
}
```

We have introduced the [variables] property to our custom query and [Mutation] components. We hardcode the [query_variables] and pass it to both components. The [variables] are used to read and update the data in the client's cache.

This is a vast improvement, in comparison to our old implementation. It was impossible to understand what was going to be rendered when we had the [Query] and [Mutation] component, and all of the markup, in just one big file. Now, you can immediately see that a mutation is given to a form, a query is run, and the result is handed over to a list, which renders the post items.

Every part is saved in a separate file, so you can edit each of them without affecting the other components. You can test all changes by starting the back end with [npm run server] and the front end with [npm run client].

The application is more stable and readable, and the new features are more comfortable to implement. However, there are still some areas for improvement. For example, we have the [postsFeed] GraphQL query defined in multiple files, and we parse it at multiple locations. A good alternative would be to store the queries together in one big file, or to store each of them in a separate file. Both solutions would allow us to edit the query at only one location, instead of editing multiple locations when just one query has changed. You can implement this on your own, as it is not very complicated.

Always keep an eye open for possible improvements to your application.

I recommend that you also make the equivalent changes to the chat entity, making the code more understandable. The following is a list of things that you should do:

- Split the mutations and queries from the [Chat.js] into separate files.
- Create a component for the chat panel.
- Create a component for the chat items in the chat panel.
- Create a component for the window bar at the bottom of the browser window.
- Create a component for the chat windows. A chat window consists of three very basic components:
  - A top bar component, handling the title, the closing function, and later bar actions.
  - A message feed, much like the one that we have for our posts. There are features that we have to implement first, such as reverse ordering and pagination.
  - An input component, making it possible to save the state to a [Mutation] component and send new messages. You can also handle other input formats, such as smileys, here. There are great packages that allow for the easy customization of input.
- Cut down the main [Chats.js] file to a minimum, loading only the wrapping subcomponents panel and the chat windows bar.

When you have finished all of these tasks, you can compare your results with the code provided in this course. While doing so, you may notice some parts where you can improve your code. There is nothing wrong with recommending ways to improve the code, so feel free to notify me if I could improve my code, too.

Extending Graphbook

Our social network is still a bit rough. Aside from the fact that we are still missing authentication, all of the features are pretty basic; writing and reading the posts and messages is nothing exceptional.

If you compare it to Facebook, there are many things that we need to do. Of course, we cannot rebuild Facebook in its totality, but the usual features should be there. From my point of view, we should cover the following features:

- Adding a drop-down menu to the posts, in order to allow for deleting or updating the content.
- Creating a global user object with the React Context API.
- Using Apollo Consumer as an alternative to the React Context API.
- Implementing a top bar as the first component rendered above all of the views. We can search for users in our database from a search bar, and we can show the logged-in user from the global user object.

We will begin by looking at the first feature.

The React context menu

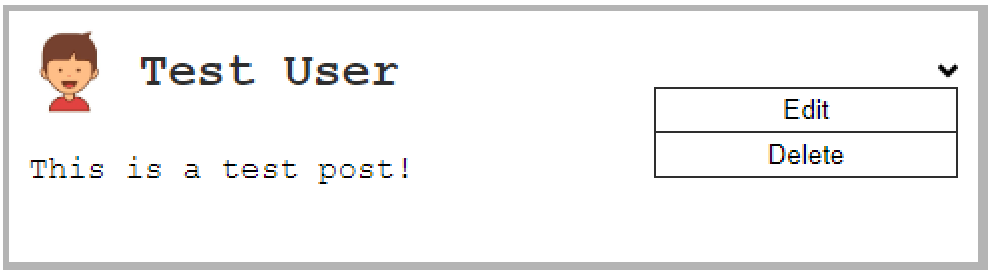
You should be able to write the React context menu pretty much on your own. All of the required React patterns have been explained, and implementing the mutations should be clear by now.

Before we begin, we will lay out the plan that we want to follow:

- Rendering a simple icon with [FontAwesome]
- Building React helper components
- Handling the [onClick] event and setting the correct component state
- Using the conditional rendering pattern to show the drop-down menu, if the component state is set correctly
- Adding buttons to the menu and binding mutations to them

Continue reading to find out how to get the job done.

The following is a preview screenshot, showing how the final implemented feature should look:



source: https://www.vecteezy.com/

We will now start with the first task of setting up [FontAwesome] for our project.

FontAwesome in React

As you may have noticed, we have not installed FontAwesome yet. Let's fix this with [npm]:

```
npm i --save @fortawesome/fontawesome-svg-core @fortawesome/free-solid-svg-icons
@fortawesome/free-brands-svg-icons @fortawesome/react-fontawesome
```

Graphbook relies on the preceding four packages to import the FontAwesome icons into our front end code.

ProTip

FontAwesome provides multiple configurations for use with React. The best, most production-ready approach is to import only the icons that we are explicitly going to use. For your next project or prototype, it might make sense to get started with the simplest approach. You can find all of the information on the official GitHub page, at https://github.com/FortAwesome/react-fontawesome#get-started.

Creating a separate file for FontAwesome will help us to have a clean import. Save the following code under the [fontawesome.js] file, inside of the [components] folder:

```
import { library } from '@fortawesome/fontawesome-svg-core';
import { faAngleDown } from '@fortawesome/free-solid-svg-icons';

library.add(faAngleDown);
```

First, we import the [library] object from the FontAwesome core package. For our specific use case, we only need one arrow image, called [angle-down]. Using the [library.add] function, we register this icon for later use.

ProTip

There are many versions of FontAwesome. In this course, we are using FontAwesome 5, with the free icons only. More premium icons can be bought on the official FontAwesome web page. You can find an overview of all of the icons, and a detailed description of each, in the icon gallery at https://fontawesome.com/icons?d=gallery.

The only place where we need this file is within our root [App.js] file. It ensures that all of our custom React components can display the imported icons. Add the following import statement to the top:

```
import './components/fontawesome';
```

No variable is required to save the exported methods, since there won't be any. We want to execute this file in our application only once.

When you reach the point when your application needs a complete set of icons, you can get all of the icons grouped directly from the [@fortawesome/free-brands-svg-icons] package, which we also installed.

Nevertheless, you could also import a [close] icon from FontAwesome and replace the simple [x] that we used for our chat window. This is not a part of this lab, but you should be able to handle it on your own.

Next, we are going to create a [Dropdown] helper component.

React helper components

Production-ready applications need to be polished as much as possible. Implementing reusable React components is one of the most important things to do.

You should notice that drop-down menus are a common topic when building client-side applications. They are global parts of the front end and appear everywhere throughout our components.

It would be best to separate the actual menu markup that we want to display from the code, which handles the event-binding and showing the menu.

I always call this kind of code in React **helper components**. They are not implementing any business logic, but give us the opportunity to reuse drop-down menus or other features wherever we want.

Logically, the first step is to create a new folder to store all of the helper components, as follows:

```
mkdir src/client/components/helpers
```

Create a new file, called [dropdown.js], as the helper component:

```
import React, { Component } from 'react';

export default class Dropdown extends Component {
  state = {
    show: false
  }
  handleClick = () => {
    const { show } = this.state;
    this.setState({show: !show});}
  render() {
    const { trigger, children } = this.props;
    const { show } = this.state;

    return(
      <div className="dropdown">
        <div>
          <div className="trigger" onClick={this.handleClick}>
            {trigger}
          </div>
          { show &&
            <div className="content">
              {children}
            </div>
          }
        </div>
      </div>
    )
  }
}
```

We do not require much code to write a drop-down component. It is also pretty efficient, since this works with nearly every scenario that you can think of.

We use basic event-handling in the preceding code. When the trigger [div] tag is clicked, we update the [show state] variable. Inside of the [div] trigger, we also render a property called [trigger]. A [trigger] can be anything from a regular text or HTML tag to a React component. It can be passed through the parent components, in order to customize the look of the drop-down component.

In addition to the [trigger] property, we are using two well-known React patterns:

- Conditional rendering, when the [show] variable is true
- Rendering children given by the parent component

This solution allows us to fill in the menu items that we want to render directly as children of the [Dropdown] component, which, as mentioned previously, is displayed after clicking on the trigger. In this case, the [show state] variable is true.

However, one thing is still not completely correct here. If you test the drop-down component by providing a simple text or icon as a trigger and another text as the content, you should see that the [Dropdown] only closes when clicking on the trigger again; it does not close when clicking anywhere else in our browser, outside of the drop-down menu.

This is one scenario where the React approach encounters problems. There is no DOM Node event, like [onClickOutside], so we cannot directly listen to the outside click events of any DOM Node, such as our drop-down menu. The conventional approach is to bind an event listener to the complete document. Clicking anywhere in our browser closes the drop-down menu.

ProTip

There are many cases when it might make sense to leave the React approach and use the DOM directly, through the standard JavaScript interface.

Read this article on *Medium* to get a better understanding: https://medium.com/@garrettmac/reactjs-how-to-safely-manipulate-the-dom-when-reactjs-cant-the-right-way-8a20928e8a6

Replace the [handleClick] method and add the [componentWillUnmount] React method, as follows:

```
componentWillUnmount() {
  document.removeEventListener('click', this.handleClick, true);
}
handleClick = () => {
  const { show } = this.state;

  this.setState({show: !show}, () => {
    if(!show) {
      document.addEventListener('click', this.handleClick);
    } else {
      document.removeEventListener('click', this.handleClick);
    }
  });
}
```

When clicking on the trigger button, we add the click event listener to the whole document with the [addEventListener] function of JavaScript. This way, the [handleClick] function is re-executed when clicking anywhere.

When clicking on the drop-down trigger, or anywhere in the DOM, the event listener is removed again, by using the [removeEventListener] function.

Do not forget to remove all of the manually created event listeners whenever a component is unmounted and removed from the DOM. Forgetting this can lead to many errors, since the [handleClick] method will no longer be available from the event listener that it tries to call.

As mentioned previously, this is the part where React fails at least a little bit, although it is not the fault of React. The DOM and JavaScript do not have the right abilities.

We can finally use our helper component and display the context menus for posts, but first, we need to prepare all of the menu items and components that we want to render.

The GraphQL updatePost mutation

A mutation is always located at two points in our code. One part is written inside of our GraphQL API in the back end, and the other one is written in our front end code.

We should start with the implementation on the back end side, as follows:

1. There is a new mutation that we need to insert into our schema, as follows:

```
updatePost (
  post: PostInput!
  postId: Int!
): Post
```

2. Once it is inside of our schema, the implementation to execute the mutation will follow. Copy the following code over to the [resolvers.js] file, in the [RootMutation] field:

```
updatePost(root, { post, postId }, context) {
  return Post.update({
    ...post,
  },
  {
    where: {
      id: postId
    }
  }).then((rows) => {
    if(rows[0] === 1) {
      logger.log({
        level: 'info',
        message: 'Post ' + postId + ' was updated',
      });

      return Post.findById(postId);
    }
  });
},
```

The only special thing here is that we need to specify which posts we want to update. This is done by having the [where] property inside of the function call. The first parameter of the [update] function receives the post that should be updated. Because we currently do not have authentication implemented yet, we cannot verify the user updating the post, but for our example, this is no problem.

When updating a post, we are required to fetch the post from our database again, in order to return the row. This is a limitation of Sequelize when working with MySQL server. If you are running Postgres, for example, you can remove this part and directly return the post, without a special, separate query.

We can now focus on the front end again.

Recall how we implemented the previous mutations; we always created reusable React components for them. We should do the same for the [update] mutation.

Create a new file, called [updatePost.js], inside of the [mutations] folder:

1. As always, you have to import all of the dependencies. They should be the same as in the other mutations. This includes the [GET_POSTS] query, because we are going to read and update the cached data stored behind this query.
2. Add the new [updatePost] mutation to the new file, as follows:

```
const UPDATE_POST = gql`
  mutation updatePost($post : PostInput!, $postId : Int!) {
    updatePost(post : $post, postId : $postId) {
      id
      text
    }
  }
`;
```

3. Create an [UpdatePostMutation] class, as follows:

```
export default class UpdatePostMutation extends Component {
  state = {
    postContent: this.props.post.text
  }
  changePostContent = (value) => {
    this.setState({postContent: value})
  }
}
```

As you can see, the [postContent] is not just an empty string, but is taken from the properties, because updating a post requires that the post already exists and so does the text of it.

4. A React component always needs a [render] method. This one is going to be a bit bigger:

```
render() {
  const self = this;
  const { children } = this.props;
  const { postContent } = this.state;

  const postId = this.props.post.id;
  const variables = { page: 0, limit: 10};

  return (
    <Mutation
      update = {(store, { data: { updatePost } }) => {
        var query = {
          query: GET_POSTS,
        };
        if(typeof variables !== typeof undefined) {
          query.variables = variables;
        }
        const data = store.readQuery(query);
        for(var i = 0; i < data.postsFeed.posts.length; i++) {
          if(data.postsFeed.posts[i].id === postId) {
            data.postsFeed.posts[i].text = updatePost.text;
            break;
          }
        }
        store.writeQuery({ ...query, data });
      }}
      optimisticResponse= {{
        __typename: "mutation",
        updatePost: {
          __typename: "Post",
          text: postContent,
        }
      }}
      mutation={UPDATE_POST}>
        {updatePost =>
          React.Children.map(children, function(child){
            return React.cloneElement(child, { updatePost,
            postContent, postId, changePostContent:
            self.changePostContent });
          })
        }
    </Mutation>
  )
}
```

There are some differences from the other mutations that we have implemented before. The changes are as follows:

- We read the children and post id from the component's properties. Furthermore, we extract the [postContent] state variable.
- We have hardcoded the variables. This is not a good approach, however. It would be better to receive this from the parent component, too, but for this example, it is fine.
- The [update] method now searches through the cache and reads and updates the post's text when a post with a matching id is found.
- All underlying children accept the [updatePost] method and the [postId].

This lab is all about reusable React components. To make use of our mutation, we need to have a form allowing us to edit a post. We will handle this within the [Post] component itself, because we want to edit the post in place, and do not want to open a modal or a specific [Edit] page. Go to your post's [index.js] file and exchange it with the new one, as follows:

```
import React, { Component } from 'react';
import PostHeader from './header';
import PostContent from './content';
import PostForm from './form';
import UpdatePostMutation from '../mutations/updatePost';

export default class Post extends Component {
  state = {
    editing: false
  }
  changeState = () => {
    const { editing } = this.state;
    this.setState({ editing: !editing });
  }
  render() {
    const { post } = this.props;
    const { editing } = this.state;
    return (
      <div className={"post " + (post.id < 0 ? "optimistic": "")}>
        <PostHeader post={post} changeState={this.changeState}/>
        {!editing && <PostContent post={post}/>}
        {editing &&
          <UpdatePostMutation post={post}>
            <PostForm changeState={this.changeState}/>
          </UpdatePostMutation>
        }
      </div>
    )
  }
}
```

We should quickly go over the changes, one by one, as follows:

- We are importing the [update] mutation that we just wrote at the top.
- We added an [editing] state variable. Based on this variable, we decide whether we show the normal [PostContent] component or our [PostForm].
- We are using conditional rendering based on the [editing] variable, in order to switch between the standard and update form.
- The [changeState] function lets us switch between both states.
- Our [PostHeader] and the [PostForm] receive the new function, allowing them to control its parent state.
- Our [PostForm] is wrapped inside of our mutation. The form then receives the mutation's [updatePost] function.

We already have a post form that we can reuse with some adjustments, as you can see in the following code snippet. To use our standard post submission form as an update form, we must make some small adjustments. Open and edit the [form.js] file, as follows:

```
import React, { Component } from 'react';

export default class PostForm extends Component {
  handlePostContentChange = (event) => {
    this.props.changePostContent(event.target.value);
  }
  render() {
    const self = this;
    const { addPost, updatePost, postContent, postId } = this.props;

    return (
      <div className="postForm">
        <form onSubmit={e => {
          e.preventDefault();

          if(typeof updatePost !== typeof undefined) {
            updatePost({ variables: { post: { text: postContent },
            postId } }).then(() => {
              self.props.changeState();
            });
          } else {
            addPost({ variables: { post: { text: postContent } }
            }).then(() => {
              self.props.changePostContent('');
            });
          }
        }}>
          <textarea value={postContent} onChange=
          {self.handlePostContentChange} placeholder="Write your custom
            post!"/>
          <input type="submit" value="Submit" />
        </form>
      </div>
    )
  }
}
```

We are reading the [updatePost] mutation from the component properties. If it is defined, we can assume that the parent component is our [UpdatePostMutation] component, so we can run the [updatePost] mutation with the [postContent] and [postId] variables. If not, we will just run the [addPost] mutation, like before.

The critical thing to note is that, upon finishing the request, we are running the [changeState] function, which switches our [Post] component back to the normal text mode, and also hides the form.

Where did it all begin? We wanted to have a context menu that allowed us to update the post.

Go to your post [header] file. The header is a great place to insert the drop-down component, as follows:

```
import React from 'react';
import Dropdown from '../helpers/dropdown';
import { FontAwesomeIcon } from '@fortawesome/react-fontawesome';

export default ({post, changeState}) =>
  <div className="header">
    <img src={post.user.avatar} />
    <div>
      <h2>{post.user.username}</h2>
    </div>
    <Dropdown trigger={<FontAwesomeIcon icon="angle-down" />}>
      <button onClick={changeState}>Edit</button>
    </Dropdown>
  </div>
```

FontAwesome is useful now. The drop-down trigger is displayed in the same row as the username.

Our drop-down component receives a [trigger] component, which is just a FontAwesome icon. Furthermore, the only child that our drop-down component has, for now, is a simple button. When it is clicked, it changes the parent [Post] component's editing state and makes the update post form visible, instead of the normal post content.

Nothing works without the magic of CSS. All of the CSS takes up a lot of space, so you should look it up in the official Git repository of this book. If you have added the new CSS, you should be able to see a small icon on the right-hand border of each post. Clicking on it makes a small drop-down menu visible, including the 'Edit' button, as shown at the beginning of this section. The user is now able to make in-place edits of posts with the post update form.

Something that we have not spoken about is user rights. At the moment, the user can edit everybody's posts, even if the user is not the author of the post. That is a problem that we will look into in the next lab, when we have implemented authentication.

The Apollo deletePost mutation

A basic drop-down menu, with one item, is there. We should add a second menu item to complete the drop-down menu.

This task is something that you can do as homework, in your own time. All of the techniques to get a [delete] mutation running have been explained.

For historical reasons, I want to cover the full CRUD workflow. After this lab, you will be able to handle pretty advanced CRUD operations with Apollo, GraphQL, and React.

Just follow my instructions to get the [delete] action working:

1. Edit the GraphQL schema. The [deletePost] mutation needs to go inside of the [RootMutation] object. The new [Response] type serves as a return value, as deleted posts cannot be returned because they do not exist. Note that we only need the [postId] parameter, and do not send the complete post:

```
type Response {
  success: Boolean
}

deletePost (
  postId: Int!
): Response
```

2. Add the missing GraphQL resolver function. The code is pretty much the same as from the update resolver, except that only a number is returned by the [destroy] method of Sequelize, not an array. It represents the number of deleted rows. We return an object with the [success] field. This field indicates whether our front end should throw an error:

```
deletePost(root, { postId }, context) {
  return Post.destroy({
    where: {
      id: postId
    }
  }).then(function(rows){
    if(rows === 1){
      logger.log({
        level: 'info',
        message: 'Post ' + postId + 'was deleted',
      });
      return {
        success: true
      };
    }
    return {
      success: false
    };
  }, function(err){
    logger.log({
      level: 'error',
      message: err.message,
    });
  });
},
```

In short, our GraphQL API is now able to accept the [deletePost] mutation. We do not verify which user sends this mutation so for our example posts be deleted by anyone.

The next step is to create the [DeletePostMutation] component. Always ensure that you name your components uniquely, and in a self-explanatory manner. Let's start by implementing the [deletePost] mutation for the client, as follows:

1. Create the [deletePost.js] file within the [mutations] folder.
2. Just like with the [update] mutation, require all dependencies.
3. Add the new [deletePost] mutation, as follows:

```
const DELETE_POST = gql`
  mutation deletePost($postId : Int!) {
    deletePost(postId : $postId) {
      success
    }
  }
`;
```

4. Lastly, insert the new component's code:

```
export default class DeletePostMutation extends Component {
  render() {
    const { children } = this.props;
    const postId = this.props.post.id;
    const variables = { page: 0, limit: 10};

    return (
     <Mutation
      update = {(store, { data: { deletePost: { success } } }) => {
          if(success) {
            var query = {
              query: GET_POSTS,
            };
            if(typeof variables !== typeof undefined) {
              query.variables = variables;
            }
            const data = store.readQuery(query);
            for(var i = 0; i < data.postsFeed.posts.length; i++) {
              if(data.postsFeed.posts[i].id === postId) {
                break;
              }
            }
            data.postsFeed.posts.splice(i, 1);
            store.writeQuery({ ...query, data });
          }
        }}
        mutation={DELETE_POST}>
          {deletePost =>
            React.Children.map(children, function(child){
              return React.cloneElement(child, { deletePost, postId
               });
            })
          }
      </Mutation>
    )
  }
}
```

We are saving a lot of code. There is no state that we are saving inside of the component, and no [optimisticReponse]. I have removed the optimistic update for the UI, since it is not intuitive if the requests fail. This would make your post disappear and reappear again.

The [update] routine searches for the post from the cache and removes it by splicing the array and saving the edited array again. We should add the new item to the drop-down menu now.

Again, our drop-down menu needs a new item. Follow these instructions to add it:

1. Open the [header.js] file and import the following mutation:

```
import DeletePostMutation from '../mutations/deletePost';
```

2. Instead of directly adding the new button to our header, we will create another stateless function, as follows:

```
const DeleteButton = ({deletePost, postId}) =>
  <button onClick={() => {
    deletePost({ variables: { postId } })
  }}>
    Delete
  </button>
```

Comparing the preceding code to our post form, the button needs to trigger the delete mutation. The form component did this via its props, so we are doing it here, too. There is no real difference, but now you can see how to handle such issues with stateless functions.

3. Insert both the mutation and the delete button into the [header] function, below the 'Edit' button, as follows:

```
<DeletePostMutation post={post}>
  <DeleteButton />
</DeletePostMutation>
```

You have now seen two approaches to sending mutations, as follows:

- Our form initiates the [update] mutation. The form is made visible from a drop-down component, which is a child component of the header of our leading [Post] component.
- The [delete] mutation is sent directly upon clicking the button within the drop-down menu.

I expect that you are now prepared for advanced scenarios, where communication between multiple components on different layers is required. Consequently, when starting the server and client you should be presented with the preview image that I gave you when starting this section.

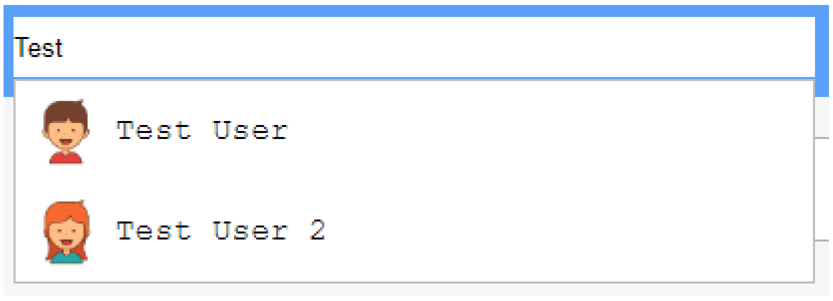
To get some more practice, we will repeat this for another use case in the next section.

The React application bar

In contrast with Facebook, we do not have an outstanding application bar. It is fixed to always stay at the top of the browser window, above all parts of the Graphbook. You will be able to search for other users, see notifications, and see the logged-in user inside of the application bar, after going through this section.

The first thing that we will implement is the simple search for users and the information about the logged-in user. We will begin with the search component, because it is really complex.

The following screenshot shows a preview of what we are going to build:



source: https://www.vecteezy.com/

It looks pretty basic, but what we are doing here is binding the [onChange] event of an input and re-fetching the query every time the value changes. Logically, this rerenders the search list in accordance with the responses from our GraphQL API.

Starting with the API, we need to introduce a new entity.

Just like with our [postsFeed] query, we will set up pagination from the beginning, because later, we might want to offer more advanced functionalities, such as loading more items while scrolling through the search list.

Edit the GraphQL schema and fill in the new [RootQuery] and type, as follows:

```
type UsersSearch {
  users: [User]
}

usersSearch(page: Int, limit: Int, text: String!): UsersSearch
```

The [UsersSearch] type expects one special parameter, which is the search text. Without the text parameter, the request would not make much sense. You should remember the [page] and [limit] parameters from the [postsFeed] pagination.

Furthermore, the [resolver] function looks pretty much the same as the [postsFeed] resolver function. You can add the following code straight into the [resolvers.js] file, as follows:

```
usersSearch(root, { page, limit, text }, context) {
  if(text.length < 3) {
    return {
      users: []
    };
  }
  var skip = 0;
  if(page && limit) {
    skip = page * limit;
  }
  var query = {
    order: [['createdAt', 'DESC']],
    offset: skip,
  };
  if(limit) {
    query.limit = limit;
  }
  query.where = {
    username: {
      [Op.like]: '%' + text + '%'
    }
  };
  return {
    users: User.findAll(query)
  };
},
```

You should note that the first condition asks whether the provided text is larger than three characters. We do this to avoid sending too many unnecessary queries to our database. Searching for every user where the username consists of just one or two characters would result in providing us with nearly every user. Of course, this could have been done on the front end, too, but various clients could use our API, so we need to make sure that the back end makes this small improvement as well.

We send the [query] object to our database through Sequelize. The code works pretty much like the [postsFeed] resolver function from before, except that we are using a Sequelize operator. We want to find every user where the username includes the entered text, without specifying whether it is at the start, middle, or end of the name. Consequently, we will use the [Op.like] operator, which Sequelize parses into a pure SQL [LIKE] query, giving us the results we want. The [%] is used in MySQL to represent an unspecified number of characters. To enable this operator, we must import the [sequelize] package and extract the [Op] object from it, as follows:

```
import Sequelize from 'sequelize';
const Op = Sequelize.Op;
```

Going further, we can implement the client-side code as follows:

1. Create a file called [searchQuery.js] within the [queries] folder. We are creating a separate query component file for reusability reasons.
2. Import all of the dependencies, and parse the new GraphQL query with the [graphql-tag] package. Note that we have three parameters. The [text] field is a required property for the [variables] that we send with our GraphQL request:

```
import React, { Component } from 'react';
import { Query } from 'react-apollo';
import Loading from '../loading';
import Error from '../error';
import gql from 'graphql-tag';

const GET_USERS = gql`
  query usersSearch($page: Int, $limit: Int, $text: String!) {
    usersSearch(page: $page, limit: $limit, text: $text) {
      users {
        id
        avatar
        username
      }
    }
  }
`;
```

3. Paste in the [UsersSearchQuery] class, as shown in the following code. In comparison to the [PostsFeedQuery] class, I have added the text property to the variables and handed over the [refetch] method to all subsequent children:

```
export default class UsersSearchQuery extends Component {
  getVariables() {
    const { variables } = this.props;
    var query_variables = {
      page: 0,
      limit: 5,
      text: ''
    };
    if (typeof variables !== typeof undefined) {
      if (typeof variables.page !== typeof undefined) {
        query_variables.page = variables.page;
      }
      if (typeof variables.limit !== typeof undefined) {
        query_variables.limit = variables.limit;
      }
      if (typeof variables.text !== typeof undefined) {
        query_variables.text = variables.text;
      }
    }
    return query_variables;
  }
  render() {
    const { children } = this.props;
    const variables = this.getVariables();
    const skip = (variables.text.length < 3);
    return(
      <Query query={GET_USERS} variables={variables} skip={skip}>
        {({ loading, error, data, fetchMore, refetch }) => {
          if (loading || error || typeof data === typeof undefined)
          return null;

          const { usersSearch } = data;
          const { users } = usersSearch;
          return React.Children.map(children, function(child){
            return React.cloneElement(child, { users, fetchMore,
            variables, refetch });
          });
        }}
      </Query>
    )
  }
}
```

As mentioned previously, we only want to send the query when the entered text is equal to or longer than three characters. Here, we use the [skip] property of the Apollo query component. If the [skip] parameter is set to true, the execution of the GraphQL request is skipped.

4. Continuing with our plan, we will create the application bar in a separate file. Create a new folder, called [bar], below the [components] folder and the [index.js] file. Fill it in with the following code:

```
import React, { Component } from 'react';
import SearchBar from './search';

export default class Bar extends Component {
  render() {
    return (
      <div className="topbar">
        <div className="inner">
          <SearchBar/>
        </div>
      </div>
    );
  }
}
```

This file works as a wrapper for all of the components we want to render in the application bar; it does not implement any custom logic. We have already imported the [SearchBar] component which we must create.

5. The [SearchBar] class lives inside of a separate file. Just create a [search.js] file in the [bar] folder, as follows:

```
import React, { Component } from 'react';
import UsersSearchQuery from '../queries/searchQuery';
import SearchList from './searchList';

export default class SearchBar extends Component {
  state = {
    text: ''
  }
  changeText = (event) => {
    this.setState({text: event.target.value});
  }
  render() {
    const { text } = this.state;
    return (
      <div className="search">
        <input type="text" onChange={this.changeText} value={text}
        />
        <UsersSearchQuery variables={{text}}>
          <SearchList />
        </UsersSearchQuery>
      </div>
    );
  }
}
```

We are storing the current input value inside of a state variable, called [text]. Every time the text is changed, the [UsersSearchQuery] component is rerendered with the new [text] property. Inside of the query component, the value is merged into the variables and sent with a GraphQL request. The result is then handed over to the [SearchList] component, which is a child of the [UsersSearchQuery] class.

6. Next, we will implement the [SearchList]. This behaves like the posts feed, but only renders something if a response is given with at least one user. The list is displayed as a drop-down menu and is hidden whenever the browser window is clicked on. Create a file called [searchList.js] inside of the [bar] folder, with the following code:

```
import React, { Component } from 'react';
export default class SearchList extends Component {
  closeList = () => {
    this.setState({showList: false});
  }
  state = {
    showList: this.checkLength(this.props.users),
  }
  componentWillReceiveProps(props) {
    this.showList(props.users);
  }
  checkLength(users) {
    if(users.length > 0) {
      document.addEventListener('click', this.closeList);
      return true;
    } else {
      return false;
    }
  }
  showList(users) {
    if(this.checkLength(users)) {
      this.setState({showList: true});
    } else {
      this.closeList();
    }
  }
  componentWillUnmount() {
    document.removeEventListener('click', this.closeList);
  }
  render() {
    const { users } = this.props;
    const { showList } = this.state;
    return (
      showList &&
        <div className="result">
          {users.map((user, i) =>
            <div key={user.id} className="user">
              <img src={user.avatar} />
              <span>{user.username}</span>
            </div>
          )}
        </div>
      )
    }
  }
```

We are using the [componentWillReceiveProps] function here, which is executed whenever the parent component sets new properties on the current one. In this case, we check whether the properties include at least one user, and then set the state accordingly, in order to make the drop-down menu visible. The drop-down menu is hidden when clicked on, or when an empty result is given. The users come directly from the [UsersSearchQuery] component.

There are just two things to do now, as follows:

1. You should copy the CSS from the official GitHub repository of this lab in order to get the correct styling; or, you can do it on your own
2. You need to import the bar wrapper component inside of the [App] class and render it between React Helmet and the news feed

The first feature of our application bar is now complete.

Let's continue and take a look at React's Context API, the Apollo Consumer feature, and how to store data globally in our React front end.

The React Context API versus Apollo Consumer

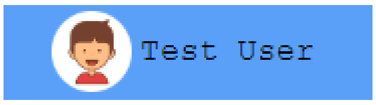
There are two ways to handle global variables in the stack that we are using at the moment. These are the new React Context API and the Apollo Consumer functionality.

From version 16.3 of React, there is a new Context API that allows you to define global providers offering data through deeply nested components. These components do not require your application to hand over the data through many components, from the top to the bottom of the React tree. Instead, it uses so-called consumers and providers. These are useful when you set up the user object at a global point of your application, and you can access it from anywhere. In earlier versions of React, you needed to pass the property down from component to component to get it to the correct component at the bottom of the React component tree.

An alternative approach to the React Context API is the Apollo Consumer. It is a specific implementation for Apollo. The React Context API is a general way of doing things, for Apollo or anything else that you can imagine.

The great thing about the Apollo Consumer is that it enables you to access the Apollo cache and use it as data storage. Using the Apollo Consumer saves you from handling all of the data, but you are also not required to implement the provider itself; you can consume the data wherever you want.

Both of the approaches will result in the following output:



source: https://www.vecteezy.com/

The best option is to show you the two alternatives right away, so that you can identify your preferred method.

The React Context API

We will start with the React method for storing and accessing global data in your front end.

To get started, create a folder called [context] below the [components] folder. In that folder, create a [user.js] file, where we can set up the Context API.

We will go over every step, one by one, as follows:

- As always, we need to import all of the dependencies. Furthermore, we will set up a new empty context. The [createContext] function will return one provider and consumer to use throughout the application, as follows:

```
import React, { Component, createContext } from 'react';
const { Provider, Consumer } = createContext();
```

- Now, we want to use the provider. The best option here is to create a special [UserProvider] component. Later, when we have authentication, we can adjust it to do the GraphQL query, and then share the resultant data in our front end. For now, we will stick with fake data. Insert the following code:

```
export class UserProvider extends Component {
  render() {
    const { children } = this.props;
    const user = {
      username: "Test User",
      avatar: "/uploads/avatar1.png"
    };
    return (
      <Provider value={user}>
        {children}
      </Provider>
    );
  }
}
```

- In the preceding code, we render the [Provider] component from Apollo and wrap all of the children in it. There is a [Consumer] component that reads from the [Provider]. We will set up a special [UserConsumer] component that takes care of passing the data to the underlying components by cloning them with React's [cloneElement] function:

```
export class UserConsumer extends Component {
  render() {
    const { children } = this.props;
    return (
      <Consumer>
        {user => React.Children.map(children, function(child){
          return React.cloneElement(child, { user });
        })}
      </Consumer>
    )
  }
}
```

We will export both classes directly under their names.

We need to introduce the provider at an early point in our code base. The best approach is to import the [UserProvider] in the [App.js] file, as follows:

```
import { UserProvider } from './components/context/user';
```

Use the provider as follows, and wrap it around all essential components:

```
<UserProvider>
  <Bar />
  <Feed />
  <Chats />
</UserProvider>
```

Everywhere in the [Bar], [Feed], and [Chats] components, we can now read from the provider.

As stated previously, we want to show the logged-in user, with their name, inside the application.

The component using the data is the [UserBar]. We need to create a [user.js] file inside of the [bar] folder. We could also have written the [UserBar] class as a stateless function, but we might need to extend this component in a later lab. Insert the following code:

```
import React, { Component } from 'react';
export default class UserBar extends Component {
  render() {
    const { user } = this.props;
    if(!user) return null;
    return (
      <div className="user">
        <img src={user.avatar} />
        <span>{user.username}</span>
      </div>
    );
  }
}
```

For the moment, we render a simple user container inside of the application bar, from the data of the [user] object.

To get the user data into the [UserBar] component, we need to use the [UserConsumer] component, of course.

Open the [index.js] file for the top bar and add the following code to the [render] method, next to the [SearchBar] component:

```
<UserConsumer>
  <UserBar />
</UserConsumer>
```

Obviously, you need to import both of the components at the top of the file, as follows:

```
import UserBar from './user';
import { UserConsumer } from '../context/user';
```

You have now successfully configured and used the React Context API to save and read data globally.

The solution that we have is a general approach that will work for all scenarios that you can think of, including Apollo. Nevertheless, we should cover the solution offered by Apollo itself.

Apollo Consumer

Nearly all of the code that we have written can stay as it was in the previous section. We just need to remove the [UserProvider] from the [App] class, because it is not needed anymore for the Apollo Consumer.

Open up the [user.js] in the [context] folder and replace the contents with the following code:

```
import React, { Component } from 'react';
import { ApolloConsumer } from 'react-apollo';

export class UserConsumer extends Component {
  render() {
    const { children } = this.props;
    return (
      <ApolloConsumer>
        {client => {
          // Use client.readQuery to get the current logged in user.
          const user = {
            username: "Test User",
            avatar: "/uploads/avatar1.png"
          };
          return React.Children.map(children, function(child){
            return React.cloneElement(child, { user });
          });
        }}
      </ApolloConsumer>
    )
  }
}
```

As you can see, we import the [ApolloConsumer] from the [react-apollo] package. This package enables us to get access to the Apollo Client that we set up in Lab 4, *Integrating React into the Back end with Apollo*.

The problem we have here is that we do not have a [CurrentUser] query, which would respond with the logged-in user from the GraphQL; so, we are not able to run the [readQuery] function. You would typically run the query against the internal cache of Apollo, and be able to get the user object easily. Once we have implemented authentication, we will fix this problem.

For now, we will return the same fake object as we did with the React Context API. The Apollo Client replaces the [Provider] that we used with the React Context API.

Let's get started with the configuration for React Styleguidist.

Setting up React Styleguidist

React Styleguidist and our application rely on webpack. Just follow these instructions to get a working copy of it:

1. Install React Styleguidist using [npm], as follows:

```
npm install --save-dev react-styleguidist
```

2. Usually, the folder structure is expected to be [src/components], but we have a [client] folder between the [src] and [components] folder. So, we must configure React Styleguidist to let it understand our folder structure. Create a [styleguide.config.js] in the root folder of the project to configure it, as follows:

```
const path = require('path')
module.exports = {
  components: 'src/client/components/**/*.js',
  require: [
    path.join(__dirname, 'assets/css/style.css')
  ]
  webpackConfig: require('./webpack.client.config')
}
```

We export an object containing all of the information needed for React Styleguidist. In addition to specifying the [components] path, we also require our main CSS style file. You will see why this can be useful later in this lab. We must define the [webpackConfig] option, because our [config] file has a custom name that is not found automatically.

Styleguidist provides two ways to view the documentation. One is to build the documentation statically, in production mode, with this command:

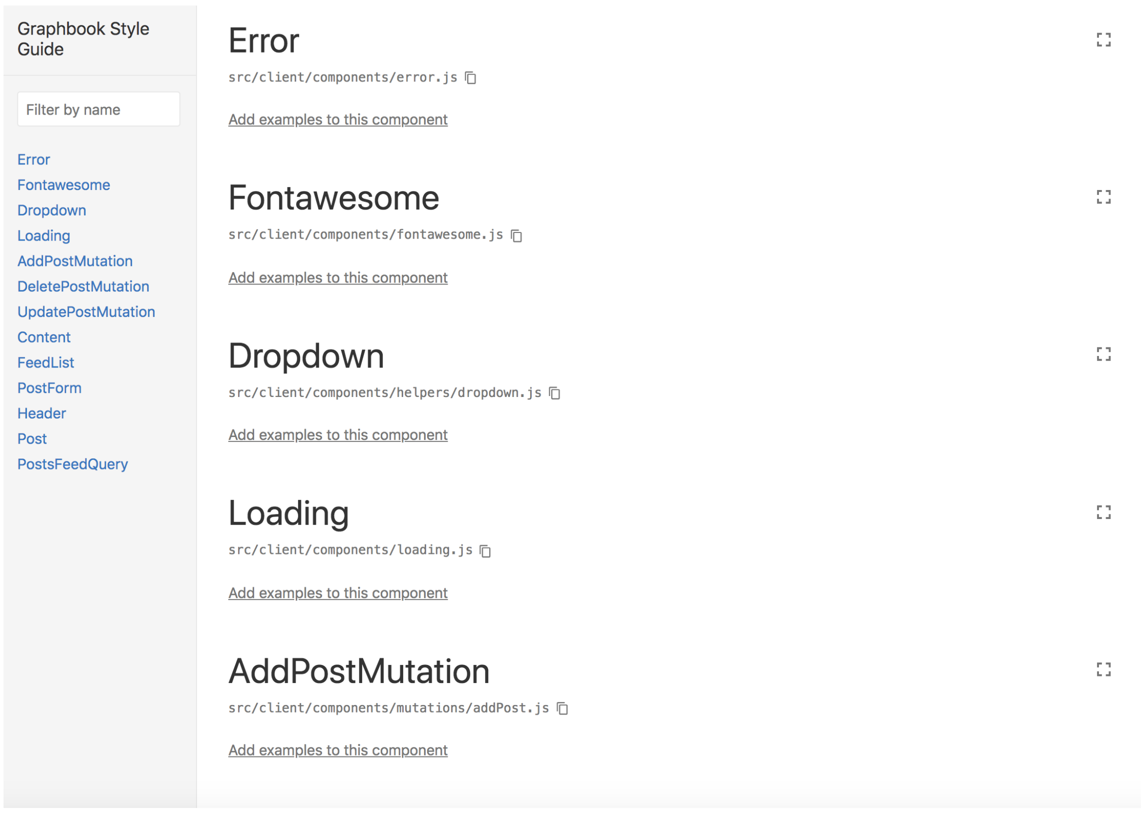
```
npx styleguidist build
```

This command creates a [styleguide] folder inside of the HTML files for our documentation. It is an excellent method when releasing new versions of your application, so that you can save and back up those files with each version.

The second method, for development cases, lets Styleguidist run and create the documentation on the fly, using webpack:

```
npx styleguidist server
```

You can view the results under [http://localhost:6060]. The documentation should look like the following screenshot:



Error
src/client/components/error.js
Add examples to this component

Fontawesome
src/client/components/fontawesome.js
Add examples to this component

Dropdown
src/client/components/helpers/dropdown.js
Add examples to this component

Loading
src/client/components/loading.js
Add examples to this component

AddPostMutation
src/client/components/mutations/addPost.js
Add examples to this component

In the left-hand panel, all of the components are listed in the order of our folder structure. You will always have an excellent overview of the existing components this way.

In the main panel, each component is explained in detail. You may have noticed that the components are missing further information. We will change that next.

React PropTypes

An essential feature of React is passing the properties to the child components. These can be anything from basic strings to numbers, but also complete components. We have already seen all of the scenarios in our application.

Developers that are new to your code base need to read through all of the components and identify which properties they can accept.

React offers a way to describe properties from within each component. Documenting the properties of your components makes it easier for other developers to understand your React components.

We will take a look at how to do this with an example in our [Post] component.

There are two React features that we did have covered yet, as follows:

- If your components have optional parameters, it can make sense to have default properties in the first place. To do this, you can specify [defaultProps] as a static property, in the same way as with the state initializers.
- The important part is the [propTypes] field, which you can fill for all of your components with the custom properties that they accept.

A new package is required to define the property types, as follows:

```
npm install --save prop-types
```

This package includes everything that we need to set up our property definitions.

Now, open your [Post] component's [index.js] file. We need to import the new package at the top of the [Post] component's [index.js] file:

```
import PropTypes from 'prop-types';
```

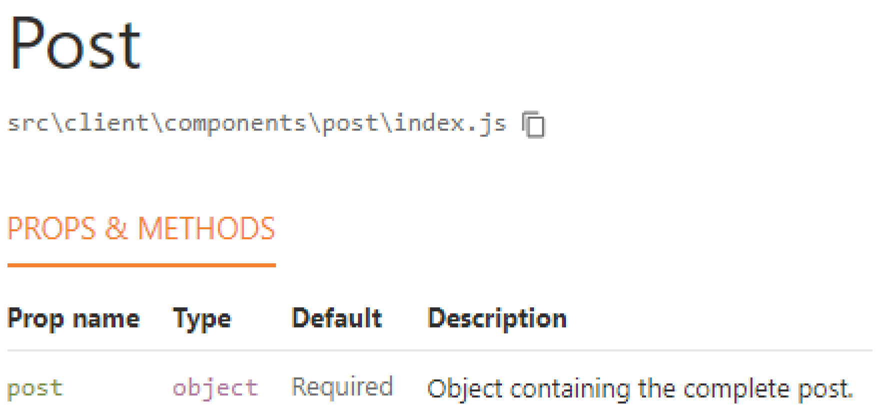
Next, we will add the new field to our component, above the state initializers:

```
static propTypes = {
  /** Object containing the complete post. */
  post: PropTypes.object.isRequired,
}
```

The preceding code should help everyone to understand your component a bit better. Every developer should know that a [post] object is required for this component to work.

The [PropTypes] package offers various types that we can use. You can access each type with [PropTypes.X]. If it is a required property, you can append the word [isRequired] in the same way as in the preceding code.

Not only does React now throw an error inside of our console when the property does not exist, but React Styleguidist is also able to show which properties are needed, as you can see in the following screenshot:



Post

src\client\components\post\index.js

PROPS & METHODS

Prop name	Type	Default	Description
post	object	Required	Object containing the complete post.

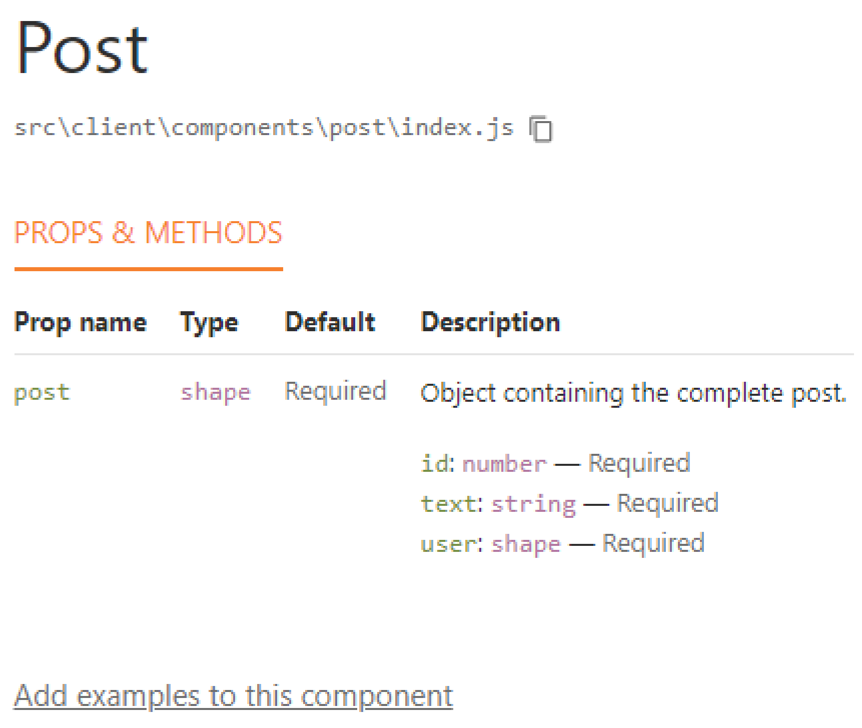
However, what is a [post] object? What kind of fields does it include?

The best way to document a [post] object is to define which properties a post should include, at least for this specific component. Replace the property definition, as follows:

```
static propTypes = {
  /** Object containing the complete post. */
  post: PropTypes.shape({
    id: PropTypes.number.isRequired,
    text: PropTypes.string.isRequired,
    user: PropTypes.shape({
      avatar: PropTypes.string.isRequired,
      username: PropTypes.string.isRequired,
    }).isRequired
  }).isRequired,
}
```

Here, we use the [shape] function. It allows you to hand over a list of fields that the object contains. Each of those is given a type from the [PropTypes] package.

The output from React Styleguidist now looks like the following screenshot:



Post

src\client\components\post\index.js

PROPS & METHODS

Prop name	Type	Default	Description
post	shape	Required	Object containing the complete post. id: number — Required text: string — Required user: shape — Required

Add examples to this component

All of the fields that we specified are listed separately. At the time of writing this course, React Styleguidist does not offer a recursive view of all properties. As you can see, the user object inside of the [post] object is not listed with its properties, but it is only listed as a second shape. If you need this feature, you can, of course, implement it yourself, and send a [pull] request on the official GitHub repo, or switch to another tool.

ProTip

React offers way more prop types and functions that you can use to document all of the components and their properties. To learn a bit more about this, visit the official documentation at https://reactjs.org/docs/typechecking-with-proptypes.html.

One last great feature of React Styleguidist is that you can enter examples for every component. You can also use markdown to add some more descriptions.

For our [Post] component, we need to create an [index.md] file, next to the [index.js] file in the [post] folder. React Styleguidist proposes creating either a [Readme.md] or [Post.md] file, but those did not work for me. The [index.md] file should look as follows:

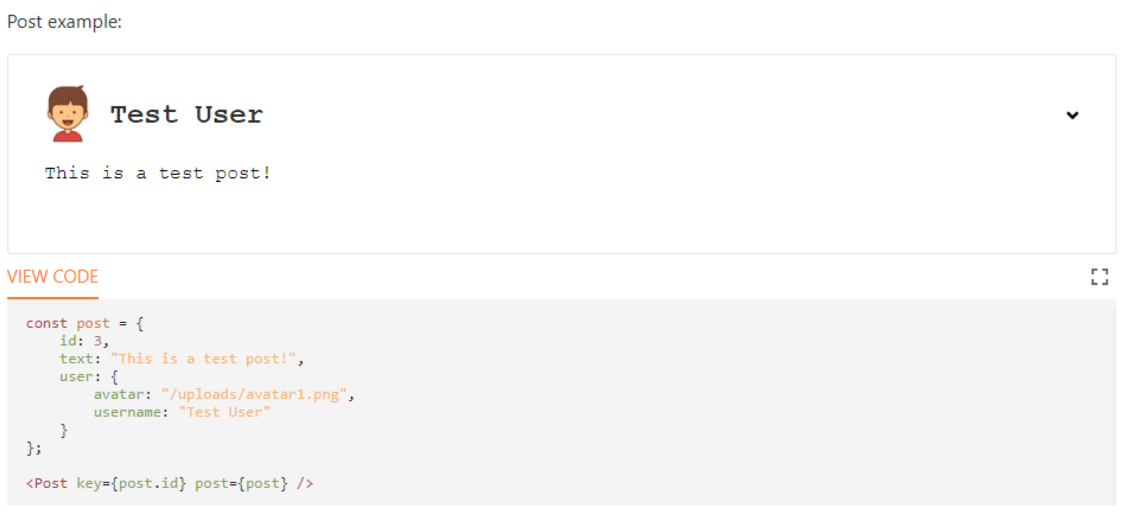
~~~
Post example:

```js
  const post = {
~~~

~~~
    id: 3,
    text: "This is a test post!",
    user: {
      avatar: "/uploads/avatar1.png",
      username: "Test User"
    }
  };

  <Post key={post.id} post={post} />
```
~~~

React Styleguidist automatically rerenders the documentation and generates the following output:


Post example:

Test User

This is a test post!

VIEW CODE

```
const post = {
    id: 3,
    text: "This is a test post!",
    user: {
        avatar: "/uploads/avatar1.png",
        username: "Test User"
    }
};

<Post key={post.id} post={post} />
```

source: https://www.vecteezy.com/

Now, you can see why it was useful to use the CSS style. Not only can React Styleguidist document the code, but it can also execute it within the documentation. Like in the preceding code, providing the correct properties inside of the [post] object enables us to see how the component should look, including the correct styling.

This example shows how reusable our [Post] component is, since it is usable without having to run the Apollo query. The drop-down component is not working, though, because the whole application setup is incorrect, including the required Apollo Client.

The basics should be clear by now. Continue to read up on this topic, because there are more things to learn.

Summary

Through this lab, you have gained a lot of experience in writing a React application. You have applied multiple React patterns to different use cases, such as children passing through a pattern and conditional rendering.

You also learned how to use the React Context API, in comparison with the Apollo Consumer feature, to retrieve the currently logged-in user in our application.

In the next lab, you will learn how to implement authentication in your back end and use it in the front end.