Lab 7: Handling Image Uploads

All social networks have one thing in common: each of them allows their users to upload custom and personal pictures, videos, or any other kind of document. This feature can take place inside chats, posts, groups, or profiles. To offer the same functionality, we are going to implement an image upload feature in Graphbook.

This lab will cover the following topics:

- Setting up Amazon Web Services
- Configuring an AWS S3 bucket
- Accepting file uploads on the server
- Uploading images with React through Apollo
- Cropping images

This lab is optional and requires creating account on AWS.

Lab Solution

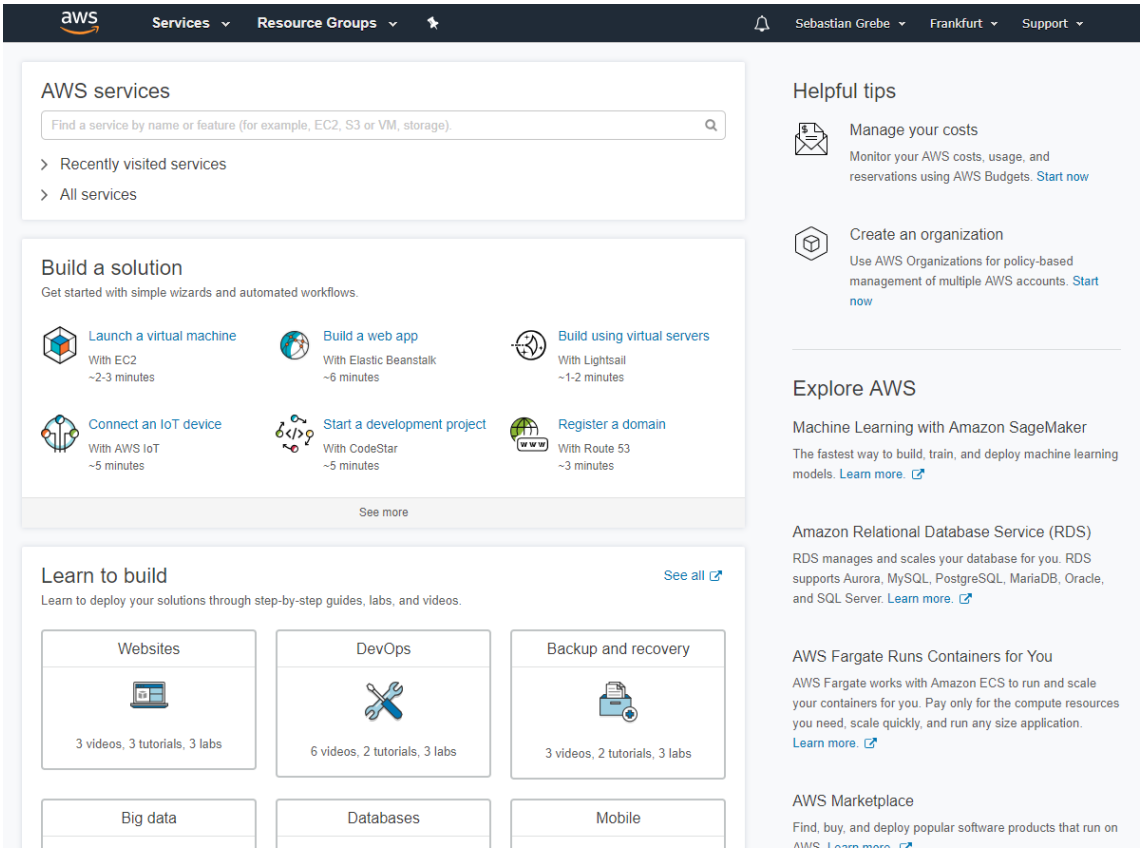
Complete solution for this lab is available in the following directory:

```
cd ~/Desktop/react-graphql-course/labs/Lab07
```

Setting up Amazon Web Services

Before continuing with this lab, you will be required to have an account for Amazon Web Services. You can create one on the official web page at https://aws.amazon.com/. For this, you will need a valid credit card; you can also run nearly all of the services on the free tier while working through this course without facing any problems.

Once you have successfully registered for AWS, you will see the following dashboard. This screen is called the Amazon Web Services Console:

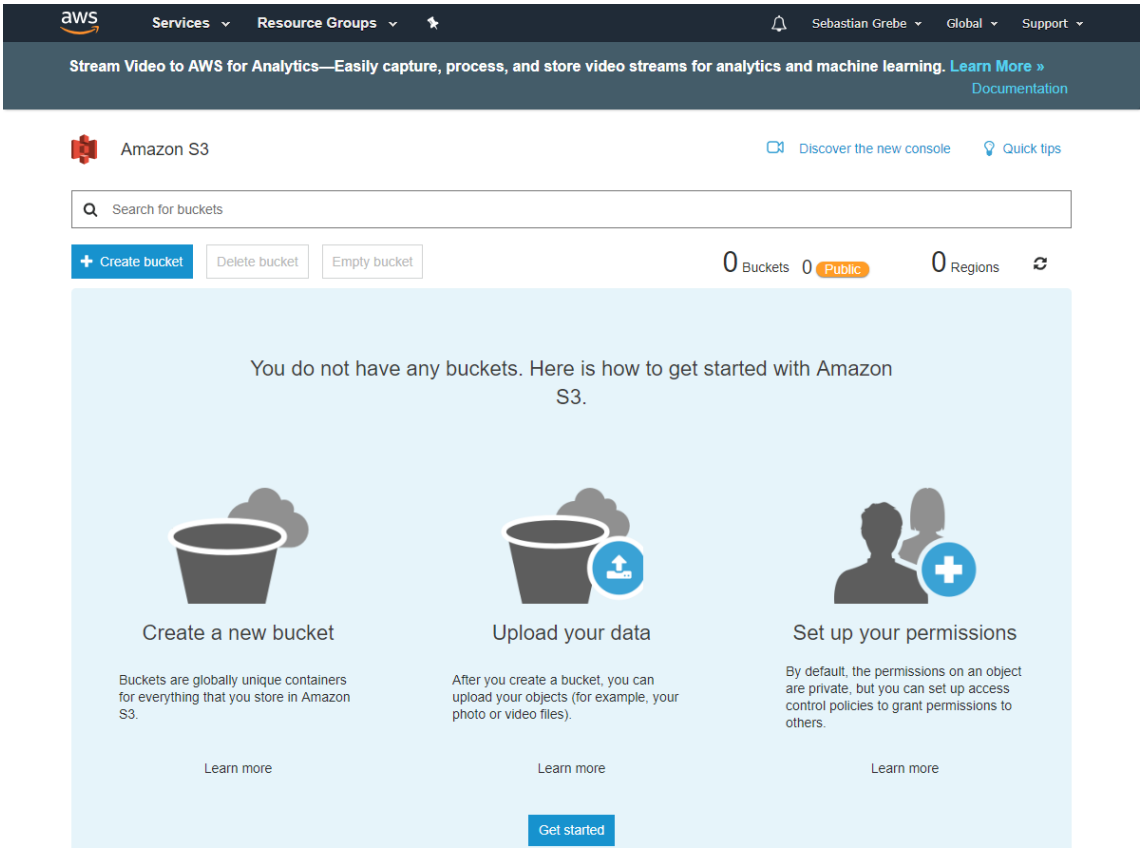


The next section will cover the options for storing files with AWS.

Creating an AWS S3 bucket

For this lab, we will require a storage service to save all uploaded images. AWS provides different storage types, for various use cases. In our scenario of a social network, we will have dozens of people accessing many images at once. **AWS Simple Storage Service** (**AWS S3**) is the best option for our scenario.

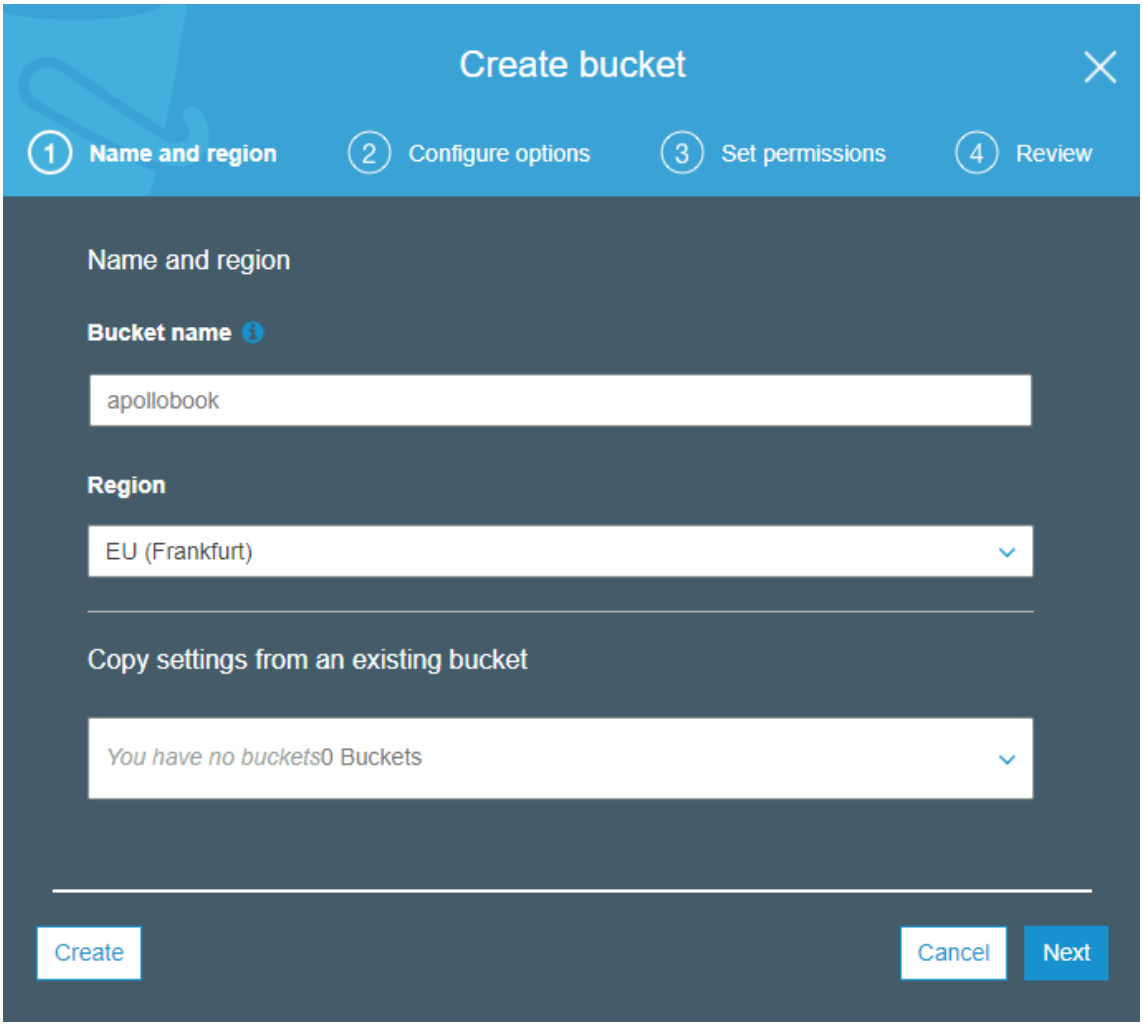
You can visit the S3 screen by clicking on the [Services] drop-down menu at the top of the page, and then looking under the [Storage] category in the drop-down menu. There, you will find the link to S3. Having clicked on it, the screen will look as follows:



In S3, you create a bucket inside of a specific AWS region, where you can store files.

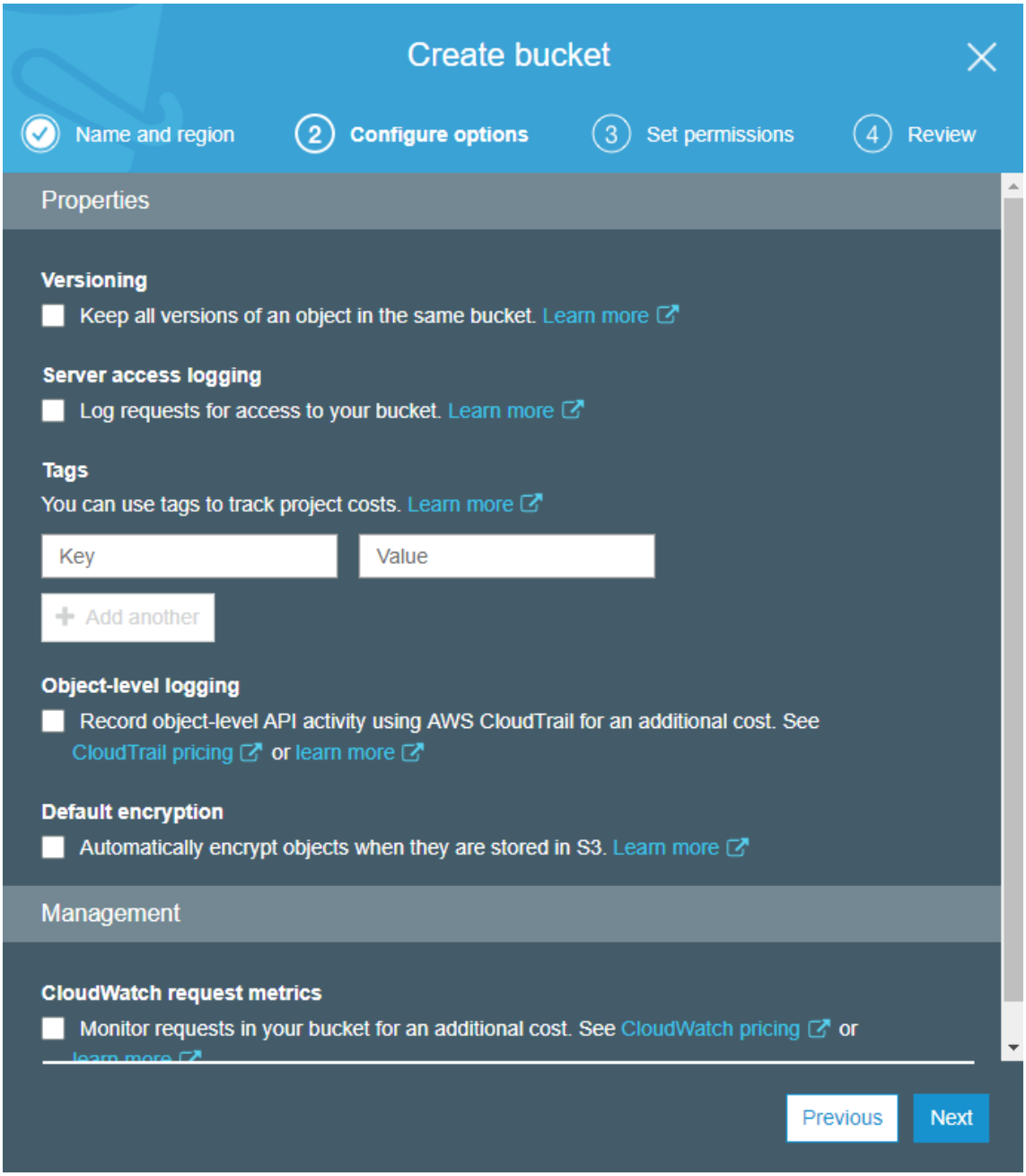
The preceding screen provides many features for interacting with your S3 bucket. You can browse all of the files, upload your files via the management interface, and configure more settings.

We will now create a new bucket for our project by clicking on [Create Bucket] in the upper-left corner, as shown in the preceding screenshot. You will be presented with a formula, as shown in the following screenshot. To create the bucket, you must fill it out:



The bucket has to have a unique name across all buckets in S3. Then, we need to pick a region. For me, [EU (Frankfurt)] is the best choice, as it is the nearest origin point. Choose the best option for you, since the performance of a bucket corresponds to the distance between the region of the bucket and its accessor.

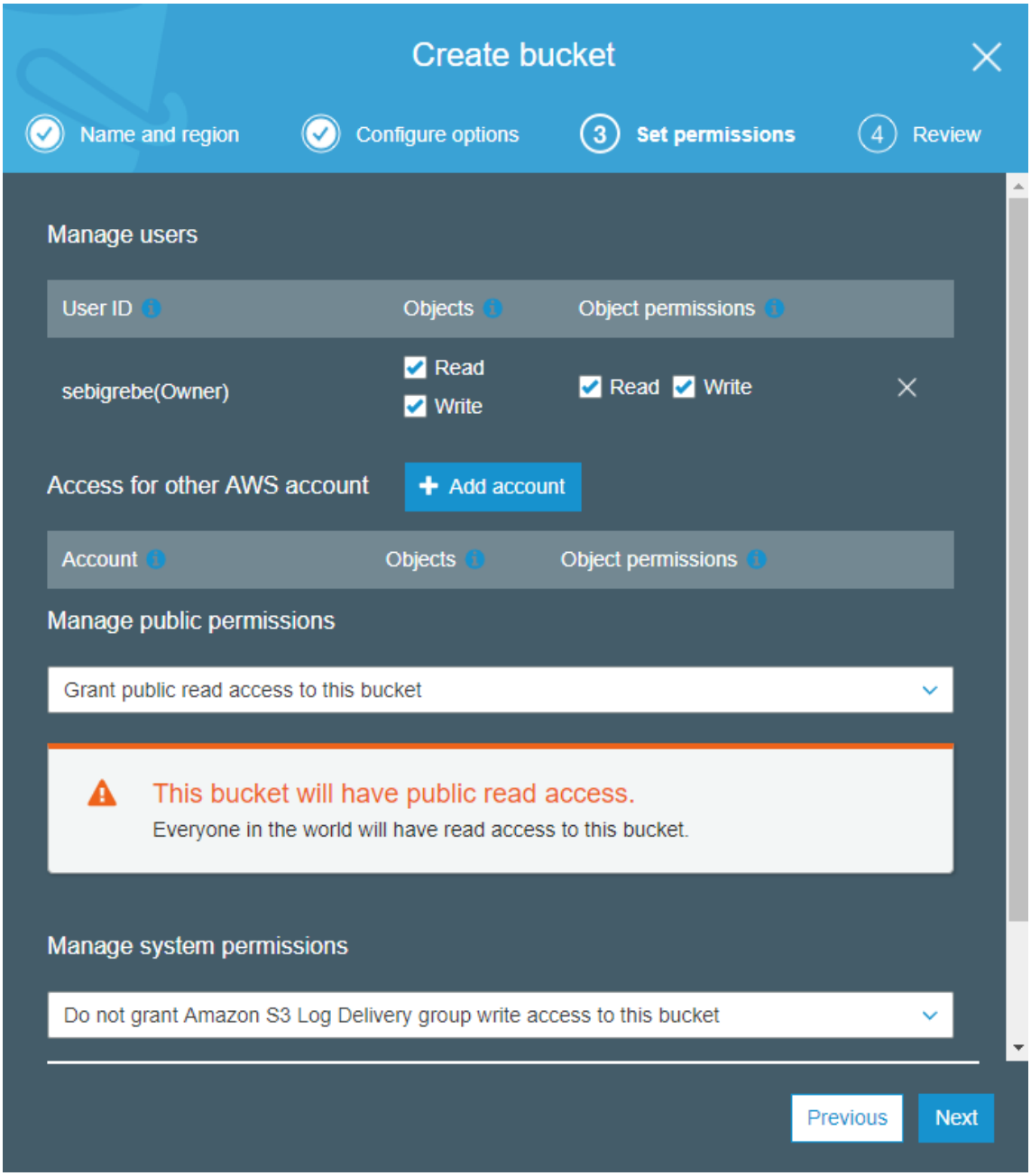
Once you have picked a region, continue by clicking on [Next]. You will be confronted with a lot of new options:



For our use case, we will not select any of these options, but they can be helpful in more advanced scenarios. AWS offers many features, such as a complete access log and versioning, which you can configure in this menu.

Move on with the creation of the bucket by clicking on [Next].

This step defines the permissions for other AWS users, or the public. Under [Manage public permissions], you have to select [Grant public read access to this bucket] to enable public access to all files saved in your S3 bucket. Take a look at the following screenshot to ensure that everything is correct:



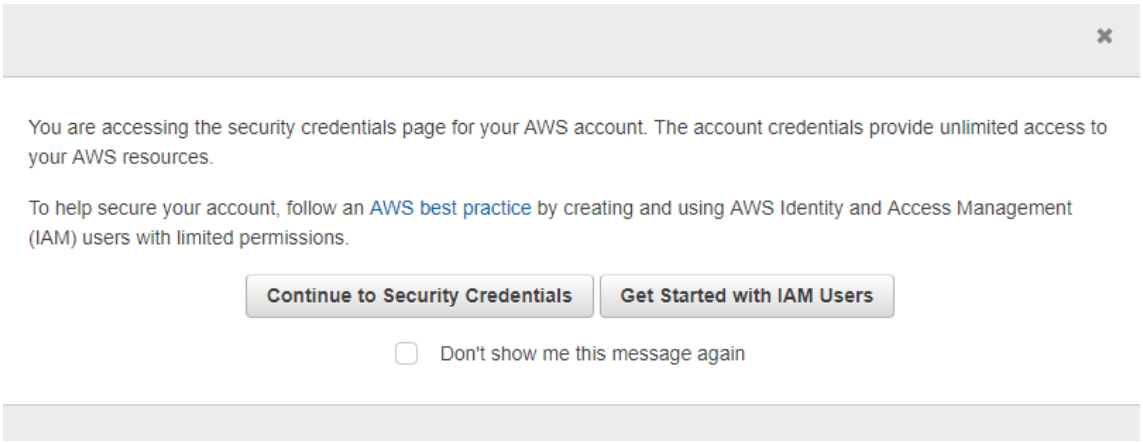
Finish the setup process by clicking on [Next], and then [Create bucket]. You should be redirected to your empty bucket.

Generating AWS access keys

Before implementing the upload feature, we must create an AWS API key to authorize our back end at AWS, in order to upload new files to the S3 bucket.

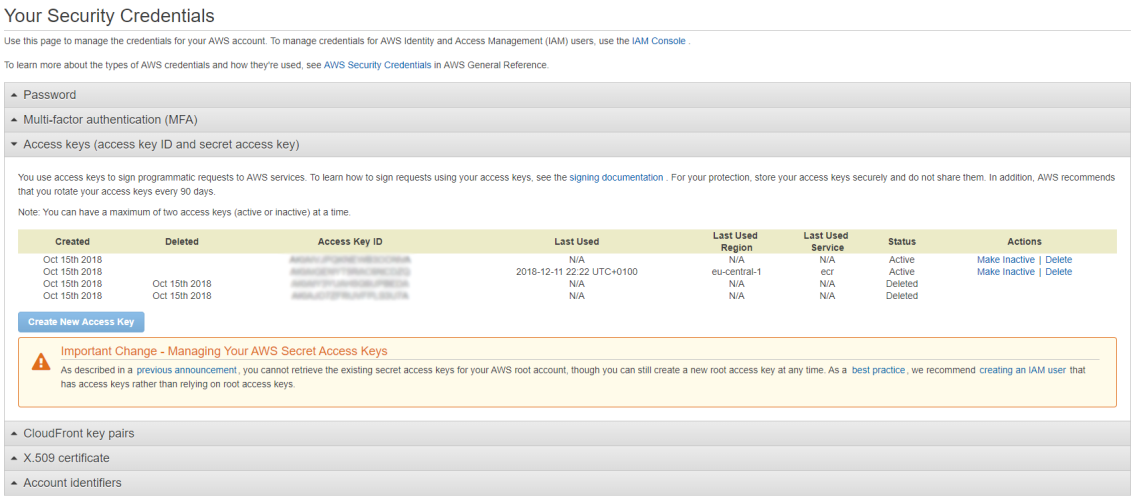
Click on your username in the top bar of AWS. There, you find a tab called [My Security Credentials], which navigates to a screen offering various options to secure access to your AWS account.

You will probably be confronted with a dialog box like the following:



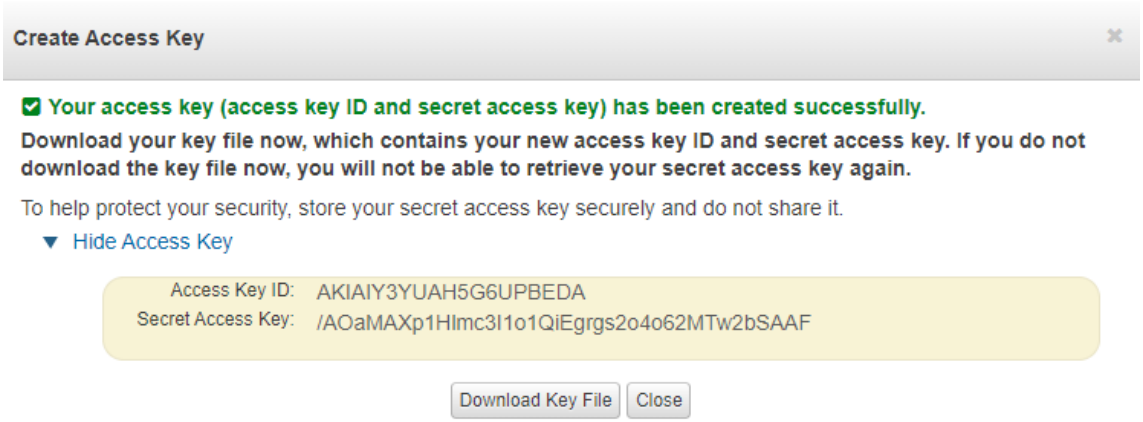
You can click on [Continue to Security Credentials] to continue. It is generally recommended to use **AWS Identity and Access Management** (**IAM**). It allows you to efficiently manage secure access to AWS resources with separate IAM users. Throughout this course, we are going to use the root user in the same way that we are now, but I recommend looking at AWS IAM when writing your next application.

You should now see the credentials page, with a big list of different methods for storing credentials. This should look like the following screenshot:



In the list, expand the tab titled [Access keys] shown in the preceding screenshot. In this tab, you will find all access tokens for your AWS account.

To generate a new access token, click on [Create New Access Key]. The output should look as follows:



The best practice is to download the key file as prompted, and save it somewhere securely, just in case you lose the key at any time. You cannot retrieve access keys again after closing the window; so, if you lose them, you will have to delete the old key and generate a new one.

As you can see in the preceding screenshot, AWS gives us two tokens. Both are required to gain access to our S3 bucket.

Now, we can start to program the uploading mechanism. Let's start by implementing the upload process on the back end.

GraphQL image upload mutation

When uploading images to S3, it is required to use an API key, which we have already generated. Because of this, we cannot directly upload the files from the client to S3 with the API key. Anyone accessing our application could read out the API key from the JavaScript code and access our bucket without us knowing.

Uploading images directly from the client into the bucket is generally possible, however. To do this, you would need to send the name and type of the file to the server, which would then generate a URL and signature. The client can then use the signature to upload the image. This technique results in many round-trips for the client, and does not allow us to post-process the image, such as by converting or compressing, if needed.

The better solution is to upload the images to our server, have the GraphQL API accept the file, and then make another request to S3---including the API key---to store the file in our bucket.

We have to prepare our back end to communicate with AWS and accept file uploads. The preparation steps are as follows:

1. Interact with AWS to install the official [npm] package. It provides everything that's needed to use any AWS feature, not just S3:

```
npm install --save aws-sdk
```

2. The next thing to do is edit the GraphQL schema and add a [scalar Upload] to the top of it. The [scalar] is used to resolve details such as the MIME type and encoding when uploading files:

```
scalar Upload
```

3. Add the [File] type to the schema. This type returns the filename and the resulting URL under which the image can be accessed in the browser:

```
type File {
  filename: String!
  url: String!
}
```

4. Create the new [uploadAvatar] mutation. It is required that the user is logged in to upload avatar images, so append the [@auth] directive to the mutation. The mutation takes the previously mentioned [Upload] scalar as input:

```
uploadAvatar (
  file: Upload!
): File @auth
```

5. Next, we will implement the mutation's resolver function in the [resolvers.js] file. For this, we will import and set up our dependencies at the top of the [resolvers.js] file, as follows:

```
import aws from 'aws-sdk';
const s3 = new aws.S3({
  signatureVersion: 'v4',
  region: 'eu-central-1',
});
```

We will initialize the [s3] object that we will use to upload images in the next step. It is required to pass a [region], like the instance in which we created the bucket. We set the [signatureVersion] to version ['v4'], as this is recommended.

ProTip

You can find details about the signature process of AWS requests at https://docs.aws.amazon.com/general/latest/gr/signature-version-4.html.

6. Inside the [mutation] property, insert the [uploadAvatar] function, as follows:

```
async uploadAvatar(root, { file }, context) {
  const { stream, filename, mimetype, encoding } = await file;
  const bucket = 'apollobook';
  const params = {
    Bucket: bucket,
    Key: context.user.id + '/' + filename,
    ACL: 'public-read',
    Body: stream
  };

  const response = await s3.upload(params).promise();

  return User.update({
    avatar: response.Location
  },
  {
    where: {
      id: context.user.id
    }
  }).then(() => {
```

```
    return {
      filename: filename,
      url: response.Location
    }
  });
},
```

In the preceding code, we start by specifying the function as [async], so that we can use the [await] method to resolve the file and its details. The result of the resolved [await file] method consists of the properties [stream], [filename], [mimetype], and [encoding].

Then, we collect the following parameters in the [params] variable, in order to upload our avatar image.

The [params] variable is given to the [s3.upload] function, which saves the file to our bucket. We directly chain the [promise] function onto the [upload] method. In the preceding code, we use the [await] statement to resolve the promise returned by the upload function. Therefore, we specified the function as [async]. The [response] object of the AWS S3 upload includes the public URL under which the image is accessible for everyone.

The last step is to set the new avatar picture on the user in our database. We execute the [User.update] model function from Sequelize by setting the new URL from [response.Location], which S3 gave us after we resolved the promise.

An example link to an S3 image is as follows:

```
https://apollobook.s3.eu-central-1.amazonaws.com/1/test.png
```

As you can see, the URL is prefixed with the name of the bucket and then the region. The suffix is, of course, the folder, which is the user id and the filename. The preceding URL will differ from the one that your back end generates, because your bucket name and region will vary.

After updating the user, we can return the AWS response to update the UI accordingly, without refreshing the browser window.

In the previous section, we generated the access tokens, in order to authorize our back end at AWS. By default, the AWS SDK expects both tokens to be available in our environment variables. Like we did before with the [JWT_SECRET], we will set the tokens as follows:

```
export AWS_ACCESS_KEY_ID=YOUR_AWS_KEY_ID
export AWS_SECRET_ACCESS_KEY=YOUR_AWS_SECRET_KEY
```

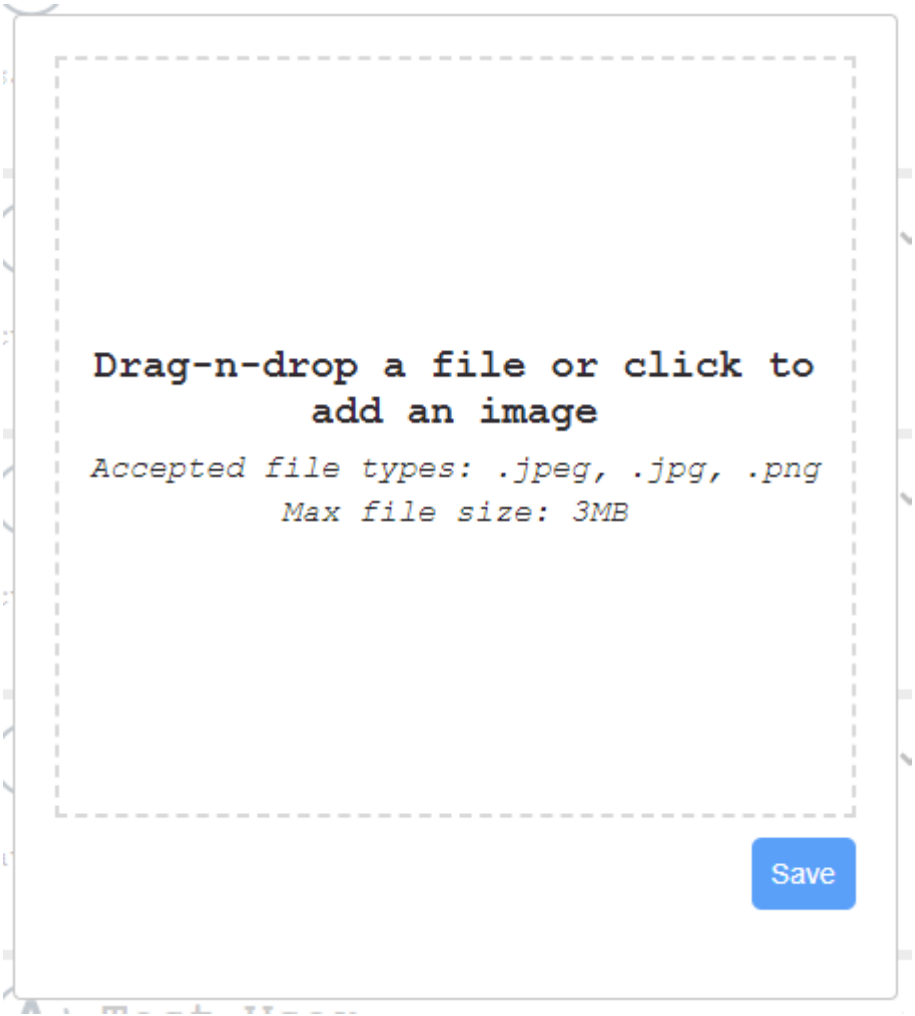
Insert your AWS tokens into the preceding code. The AWS SDK will detect both environment variables automatically. We do not need to read and configure them anywhere in our code.

We will now continue and implement all of the image upload features in the front end.

React image cropping and uploading

In social networks such as Facebook, there are multiple locations where you can select and upload files. You can send images in chats, attach them to posts, create galleries in your profile, and much more. For now, we will only look at how to change our user's avatar image. This is a great example for easily showing all of the techniques.

The result that we are targeting looks like the following screenshot:



The user can select a file, crop it directly in the modal, and save it to AWS with the preceding dialog.

I am not a big fan of using too many [npm] packages, as this often makes your application unnecessarily big. As of writing this course, we cannot write custom React components for everything, such as displaying dialog or cropping, no matter how easy it might be.

To get the image upload working, we will install two new packages. To do this, you can follow these instructions:

1. Install the packages with [npm]:

```
npm install --save react-modal @synapsestudios/react-drop-n-crop
```

The [react-modal] package offers various dialog options that you can use in many different situations. The [react-drop-n-crop] package is a wrapper package around [Cropper.js] and [react-dropzone]. Personally, I dislike wrapper packages, since they are often poorly maintained or leave features unimplemented. Against all prejudice, this package does a really excellent job of allowing users to drop images with [react-dropzone], and then cropping them with the well-known [Cropper.js] library.

2. When using the [react-drop-n-crop] package, we can rely on its included CSS package. In your main [App.js], import it straight from the package itself, as follows:

```
import '@synapsestudios/react-drop-n-crop/lib/react-drop-n-crop.min.css';
```

webpack takes care of bundling all assets, like we are already doing with our custom CSS.

3. The next package that we will install is an extension for the Apollo Client, which will enable us to upload files, as follows:

```
npm install --save apollo-upload-client
```

4. To get the [apollo-upload-client] package running, we have to edit the `index.js` from the [apollo] folder where we initialize the Apollo Client and all of its links. Import the [createUploadLink] function at the top of the `index.js` file, as follows:

```
import { createUploadLink } from 'apollo-upload-client';
```

5. You must replace the old [HttpLink] at the bottom of the link array with the new upload link. Instead of having a new [HttpLink], we will now pass the [createUploadLink], but with the same parameters. When executing it, a regular link is returned. The link should look like the following code:

```
createUploadLink({
  uri: 'http://localhost:8000/graphql',
  credentials: 'same-origin',
}),
```

It is important to note that when we make use of the new upload link and send a file with a GraphQL request, we do not send the standard [application/json] [Content-Type] request, but instead send a [multi-part] [FormData] request. This allows us to upload files with GraphQL. Standard JSON HTTP bodies, like we use with our GraphQL requests, cannot hold any file objects.

ProTip

Alternatively, it is possible to send a [base64] instead of a file object when transferring images. This procedure would save you from the work that we are doing right now, as sending and receiving strings is no problem with GraphQL. You have to convert the [base64] string to a file if you want to save it in AWS S3. This approach only works for images, however, and web applications should be able to accept any file type.

6. Now that the packages are prepared, we can start to implement our [uploadAvatar] mutation component for the client. Create a new file, called [uploadAvatar.js], in the [mutations] folder.
7. At the top of the file, import all dependencies and parse all GraphQL requests with [graphql-tag] in the conventional way, as follows:

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

const GET_CURRENT_USER = gql`
  query currentUser {
    currentUser {
      id
      username
      avatar
    }
  }
`;
```

```
const UPLOAD_AVATAR = gql`
  mutation uploadAvatar($file: Upload!) {
    uploadAvatar(file : $file) {
      filename
      url
    }
  }
`;
```

As you can see, we have the [uploadAvatar] mutation, which takes the [file] as a parameter of the [Upload] type. Furthermore, we have the [currentUser] GraphQL query, which we are going to use in the next step to update the avatar image without re-fetching all queries, but only by updating the cache.

8. Next, you can copy the [UploadAvatarMutation] class. It passes the [uploadAvatar] mutation function to the underlying children, and sets the newly uploaded avatar image inside of the cache for the [currentUser] query. It shows the new user avatar directly in the top bar when the request is successful:

```
export default class UploadAvatarMutation extends Component {
  render() {
    const { children } = this.props;
    return (
      <Mutation
        update = {(store, { data: { uploadAvatar } }) => {
          var query = {
            query: GET_CURRENT_USER,
          };
          const data = store.readQuery(query);
          data.currentUser.avatar = uploadAvatar.url;
          store.writeQuery({ ...query, data });
        }}
        mutation={UPLOAD_AVATAR}>
          {uploadAvatar =>
            React.Children.map(children, function(child){
              return React.cloneElement(child, { uploadAvatar });
            })
          }
      </Mutation>
    )
  }
}
```

The preceding code is nothing utterly new, as we used the same approach for the other mutations that we implemented.

The preparation is now complete. We have installed all of the required packages, configured them, and implemented the new mutation component. We can begin to program the user-facing dialog to change the avatar image.

For the purposes of this course, we are not relying on separate pages or anything like that. Instead, we are giving the user the opportunity to change his avatar when he clicks on his image in the top bar. To do so, we are going to listen for the click event on the avatar, opening up a dialog that includes a file dropzone and a button to submit the new image.

Execute the following steps to get this logic running:

1. It is always good to make your components as reusable as possible, so create an [avatarModal.js] file inside of the [components] folder.
2. As always, you will have to import the two new [react-modal] and [react-drop-n-crop] packages first, as follows:

```
import React, { Component } from 'react';
import Modal from 'react-modal';
import DropNCrop from '@synapsestudios/react-drop-n-crop';

Modal.setAppElement('#root');

const modalStyle = {
  content: {
    width: '400px',
    height: '450px',
    top: '50%',
    left: '50%',
    right: 'auto',
    bottom: 'auto',
    marginRight: '-50%',
    transform: 'translate(-50%, -50%)'
  }
};
```

As you can see in the preceding code snippet, we tell the modal package at which point in the browser's DOM we want to render the dialog, using the [setAppElement] method. For our use case, it is okay to take the [root] DOMNode, as this is the starting point of our application. The modal is instantiated in this DOMNode.

The modal component accepts a special [style] parameter for the different parts of the dropzone. We can style all parts of the modal by specifying the [modalStyle] object with the correct properties.

3. The [react-drop-n-crop] package enables the user to select or drop the file. Beyond this feature, it gives the user the opportunity to crop the image. The result is not a [file] or [blob] object, but a [data URI], formatted as [base64]. Generally, this is not a problem, but our GraphQL API expects that we sent a real file, not just a string, as we explained previously. Consequently, we have to convert the [data URI] to a blob that we can send with our GraphQL request. Add the following function to take care of the conversion:

```
function dataURItoBlob(dataURI) {
  var byteString = atob(dataURI.split(',')[1]);
  var mimeString = dataURI.split(',')[0].split(':')[1].split(';')
  [0];
  var ia = new Uint8Array(byteString.length);

  for (var i = 0; i < byteString.length; i++) {
    ia[i] = byteString.charCodeAt(i);
  }

  const file = new Blob([ia], {type:mimeString});
  return file;
}
```

Let's not get too deep into the logic behind the preceding function. The only thing that you need to know it is that it converts all readable ASCII characters into 8-bit binary data, and at the end, it returns a blob object to the calling

function. It converts data URIs to blobs.

4. The new component that we are implementing at the moment is called [AvatarUpload]. It receives the [isOpen] property, which sets the modal to visible or invisible. By default, the modal is invisible. Furthermore, when the modal is shown, the dropzone is rendered inside. The [Modal] component takes an [onRequestClose] method, which executes the [showModal] function when the user tries to close the modal (by clicking outside of it, for example). We receive the [showModal] function from the parent component, which we are going to cover in the next step.

The [DropNCrop] component does not need any properties except for the [onChange] event and the state variable as a default value. The [value] of the [DropNCrop] component is filled with the [AvatarUpload] component's state. The state only holds a default set of fields that the [DropNCrop] component understands.

It tells the package to start with an empty dropzone. Switching between file selection and cropping is handled by the package on its own:

```
export default class AvatarUpload extends Component {
  state = {
    result: null,
    filename: null,
    filetype: null,
    src: null,
    error: null,
  }
  onChange = value => {
    this.setState(value);
  }
  uploadAvatar = () => {
    const self = this;
    var file = dataURItoBlob(this.state.result);
    file.name = this.state.filename;
    this.props.uploadAvatar({variables: { file }}).then(() => {
      self.props.showModal();
    });
  }
  changeImage = () => {
    this.setState({ src: null });
  }
  render() {
    return (
      <Modal
        isOpen={this.props.isOpen}
        onRequestClose={this.props.showModal}
        contentLabel="Change avatar"
        style={modalStyle}
      >
        <DropNCrop onChange={this.onChange} value={this.state} />
        {this.state.src !== null && (
          <button className="cancelUpload" onClick=
          {this.changeImage}>Change image</button>
        )}
        <button className="uploadAvatar" onClick=
        {this.uploadAvatar}>Save</button>
      </Modal>
```

```
    )
  }
}
```

The `AvatarUpload` class receives an `isOpen` property from its parent component. We directly pass it to the `DropNCrop` component. Whenever the parent component changes the passed property's value, the modal is either shown or not, based on the value.

When a file is selected or cropped, the component state is updated with the new image. The response of the cropper package is saved in the `result` state variable.

We are using the conditional rendering pattern to show a `Change image` button when the `src` state variable is filled, which happens when a file is selected. The `changeImage` function sets the `src` of the `DropNCrop` component back to `null`, which lets it switch back to the file selection mode.

When the user has finished editing his picture, he can hit the `Save` button. The `uploadAvatar` method will be executed. It converts the `base64` string returned from the cropper component to a `blob` object, using the `dataURItoBlob` function. We send the result with the GraphQL request inside of the mutation's `variables` parameter. When the request has finished, the modal is hidden again by running the `showModal` functions from the properties.

5. Now, switch over to the [user.js] file in the [bar] folder, where all of the other application bar-related files are stored. Import the mutation and the new [AvatarUpload] component that we wrote before, as follows:

```
import UploadAvatarMutation from '../mutations/uploadAvatar';
import AvatarUpload from '../avatarModal';
```

6. The [UserBar] component is the parent of [AvatarUploadModal]. Open the [user.js] file from the [bar] folder. That is why we handle the [isOpen] state variable of the dialog in the [UserBar] class. We introduce an [isOpen] state variable and catch the [onClick] event on the avatar of the user. Copy the following code to the [UserBar] class:

```
state = {
  isOpen: false,
}
showModal = () => {
  this.setState({ isOpen: !this.state.isOpen });
}
```

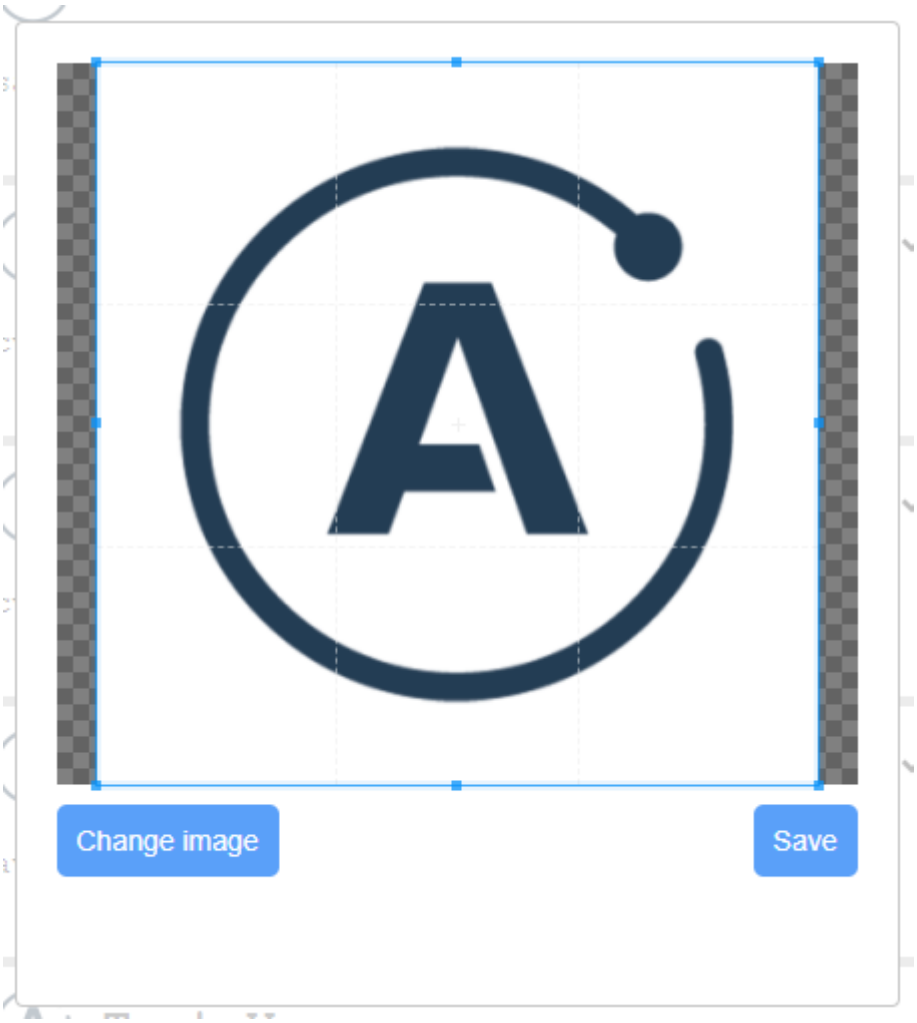
7. Replace the return value of the [render] method with the following code:

```
return (
  <div className="user">
    <img src={user.avatar} onClick={this.showModal}/>
    <UploadAvatarMutation>
      <AvatarUpload isOpen={this.state.isOpen} showModal={this.showModal}/>
    </UploadAvatarMutation>
    <span>{user.username}</span>
  </div>
);
```

The [UploadAvatarMutation] surrounds the modal component to pass the mutation function over.

Furthermore, the modal component directly receives the [isOpen] property, as we explained earlier. The [showModal] method is executed when the avatar image is clicked. This function updates the property of the [AvatarUpload] class, and either shows or hides the modal.

Start the server and client with the matching [npm run] commands. Reload your browser and try out the new feature. When an image is selected, the cropping tool is displayed. You can drag and resize the image area that should be uploaded. You can see an example of this in the following screenshot:



Hitting [Save] uploads the image under the [user] folder in the S3 bucket. Thanks to the Mutation component that we wrote, the avatar image in the top bar is updated with the new URL to the S3 bucket location of the image.

The great thing that we have accomplished is that we send the images to our server. Our server transfers all of the images to S3. AWS responds with the public URL, which is then placed directly into the avatar field in the browser. The way that we query the avatar image from the back end, using our GraphQL API, does not change. We return the URL to the S3 file, and everything works.

Summary

In this lab, we started by creating an AWS account and an S3 bucket for uploading static images from our back end. Modern social networks consist of many images, videos, and other types of files. We introduced the Apollo Client, which allows us to upload any type of file. In this lab, we managed to upload an image to our server, and we covered

how to crop images and save them through a server in AWS S3. Your application should now be able to serve your users with images at any time.

The next lab will cover the basics of client-side routing, with the use of React Router.