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CRUD Application With React and Spring Boot

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REST (https://www.baeldung.com/category/rest)

Spring Boot (https://www.baeldung.com/category/spring/spring-boot)

React (https://www.baeldung.com/tag/react)

1. Introduction

In this tutorial, we'll learn how to create an application capable of creating, retrieving, updating, and deleting (CRUD) client data. The application will consist of a simple Spring Boot RESTful API (/rest-with-spring-series) and a user interface (UI) implemented with the React JavaScript library (https://reactjs.org/).

2. Spring Boot

2.1. Maven Dependencies

Let's start by adding a few dependencies to our *pom.xml* file:

```
<dependencies>
    <dependency>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-web</artifactId>
        <version>2.4.4</version>
    </dependency>

    <dependency>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-data-jpa</artifactId>
        <version>2.4.4</version>
    </dependency>

    <dependency>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-test</artifactId>
        <version>2.4.4</version>
        <scope>test</scope>
    </dependency>

    <dependency>
        <groupId>com.h2database</groupId>
        <artifactId>h2</artifactId>
        <version>1.4.200</version>
        <scope>runtime</scope>
    </dependency>
</dependencies>
```

Here we added the web, testing, and JPA persistence starters, as well as the H2 dependency, as the application will have an H2 in-memory database.

2.2. Creating the Model

Next, let's create our *Client* entity class, with *name* and *email* properties, to represent our data model:

```
@Entity
@Table(name = "client")
public class Client {

    @Id
    @GeneratedValue
    private Long id;

    private String name;
    private String email;

    // getter, setters, contructors
}
```

2.3. Creating the Repository

Then we'll create our *ClientRepository* class **extending from *JpaRepository* to provide JPA CRUD capabilities**:

```
public interface ClientRepository extends JpaRepository<Client,
Long> {
}
```

2.4. Creating the REST Controller

Finally, let's expose a **REST API by creating a controller** to interact with the *ClientRepository*:

```
@RestController
@RequestMapping("/clients")
public class ClientsController {

    private final ClientRepository clientRepository;

    public ClientsController(ClientRepository clientRepository) {
        this.clientRepository = clientRepository;
    }

    @GetMapping
    public List<Client> getClients() {
        return clientRepository.findAll();
    }

    @GetMapping("/{id}")
    public Client getClient(@PathVariable Long id) {
        return
clientRepository.findById(id).orElseThrow(RuntimeException::new);
    }

    @PostMapping
    public ResponseEntity createClient(@RequestBody Client client)
throws URISyntaxException {
        Client savedClient = clientRepository.save(client);
        return ResponseEntity.created(new URI("/clients/" +
savedClient.getId())).body(savedClient);
    }

    @PutMapping("/{id}")
    public ResponseEntity updateClient(@PathVariable Long id,
@RequestBody Client client) {
        Client currentClient =
clientRepository.findById(id).orElseThrow(RuntimeException::new);
        currentClient.setName(client.getName());
        currentClient.setEmail(client.getEmail());
        currentClient = clientRepository.save(client);

        return ResponseEntity.ok(currentClient);
    }

    @DeleteMapping("/{id}")
    public ResponseEntity deleteClient(@PathVariable Long id) {
        clientRepository.deleteById(id);
        return ResponseEntity.ok().build();
    }
}
```

2.5. Starting Our API

With that complete, we're now ready to start our Spring Boot API. We can do this using the *spring-boot-maven-plugin*:

```
mvn spring-boot:run
```

Then we'll be able to get our clients list by going to http://localhost:8080/clients (http://localhost:8080/clients).

2.6. Creating Clients

Additionally, we can create a few clients using Postman (/postman-testing-collections):

```
curl -X POST http://localhost:8080/clients -d '{"name": "John Doe",
"email": "john.doe@baeldgung.com"}'
```

3. React

React is a JavaScript library for creating user interfaces. Working with React requires that Node.js (https://nodejs.org/) is installed. We can find the installation instructions on the Node.js download page (https://nodejs.org/en/download).

3.1. Creating a React UI

Create React App (https://reactjs.org/docs/create-a-new-react-app.html) is a command utility that **generates React projects for us**. Let's create our *frontend* app in our Spring Boot application base directory by running:

```
npx create-react-app frontend
```

After the app creation process is complete, we'll install Bootstrap (https://getbootstrap.com/), React Router (https://reactrouter.com/), and reactstrap (https://reactstrap.github.io/) in the *frontend* directory:

```
npm install --save bootstrap@5.1 react-cookie@4.1.1 react-router-
dom@5.3.0 reactstrap@8.10.0
```

We'll be using Bootstrap's CSS and reactstrap's components to create a better-looking UI, and React Router components to handle navigability around the application.

Let's add Bootstrap's CSS file as an import in *app/src/index.js*:

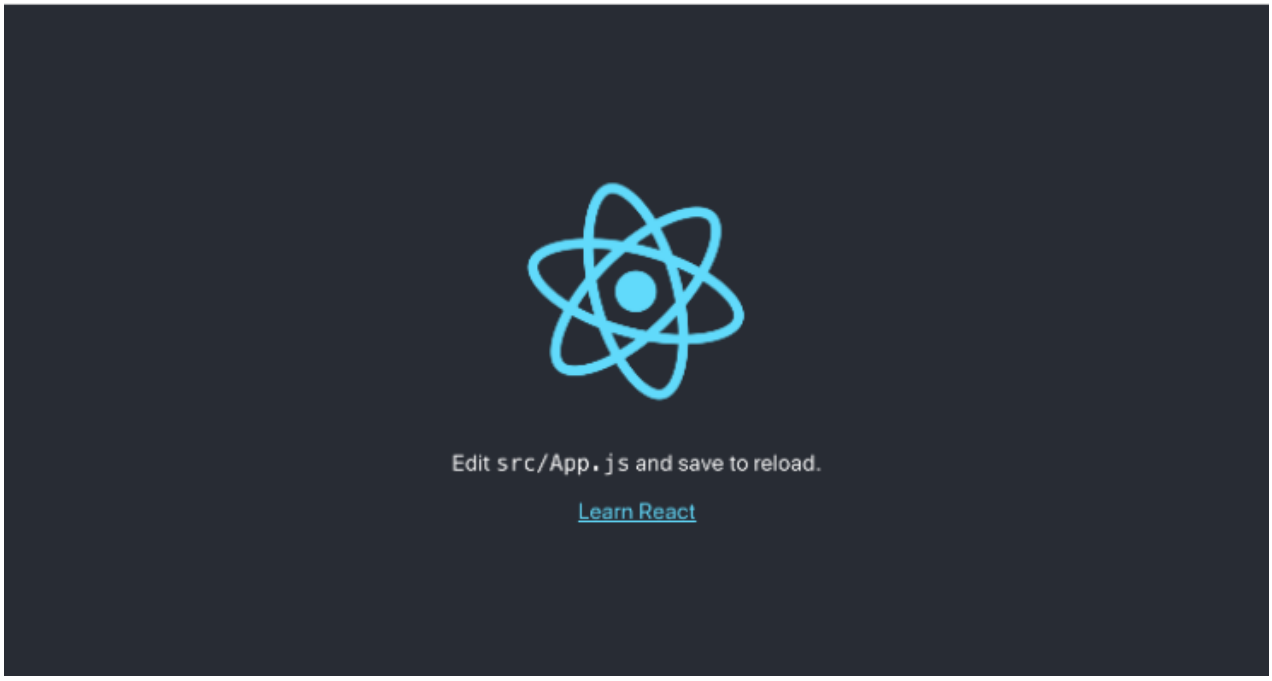
```
import 'bootstrap/dist/css/bootstrap.min.css';
```

3.2. Starting Our React UI

Now we're ready to start our *frontend* application:

```
npm start
```

When accessing http://localhost:3000 (http://localhost:3000) in our browser, we should see the React sample page:



(/wp-content/uploads/2021/04/react.png)

3.3. Calling Our Spring Boot API

Calling our Spring Boot API requires setting up our React application's *package.json* file to configure a proxy when calling the API.

For that, we'll include the URL for our API in *package.json*:

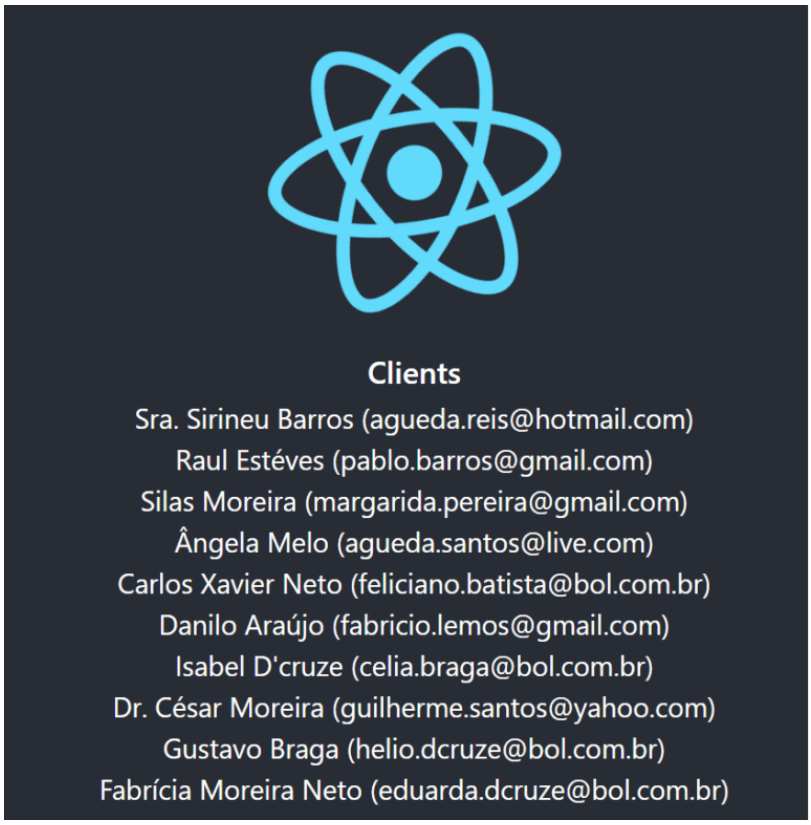
```
...
"proxy": "http://localhost:8080",
...
```

Next, let's edit *frontend/src/App.js* so that it calls our API to show the list of clients with the *name* and *email* properties:

```
class App extends Component {
  state = {
    clients: []
  };

  async componentDidMount() {
    const response = await fetch('/clients');
    const body = await response.json();
    this.setState({clients: body});
  }

  render() {
    const {clients} = this.state;
    return (
        <div className="App">
          <header className="App-header">
            <img src={logo} className="App-logo" alt="logo" />
            <div className="App-intro">
              <h2>Clients</h2>
              {clients.map(client =>
                  <div key={client.id}>
                    {client.name} ({client.email})
                  </div>
              )}
            </div>
          </header>
        </div>
    );
  }
}
export default App;
```

In the *componentDidMount* function, **we fetch our client API** and set the response body in the *clients* variable. In our *render* function, we return the HTML with the list of clients found in the API.

We'll see our client's page, which will look like this:



(/wp-content/uploads/2021/04/react2.png)

Note: Make sure the Spring Boot application is running so that the UI will be able to call the API.

3.4. Creating a *ClientList* Component

We can now improve our UI to display a **more sophisticated component to *list*, *edit*, *delete*, and *create clients*** using our API. Later, we'll see how to use this component and *remove* the client list from the *App* component.

Let's create a file in *frontend/src/ClientList.js*:

```
import React, { Component } from 'react';
import { Button, ButtonGroup, Container, Table } from 'reactstrap';
import AppNavbar from './AppNavbar';
import { Link } from 'react-router-dom';

class ClientList extends Component {

    constructor(props) {
        super(props);
        this.state = {clients: []};
        this.remove = this.remove.bind(this);
    }

    componentDidMount() {
        fetch('/clients')
            .then(response => response.json())
            .then(data => this.setState({clients: data}));
    }
}
export default ClientList;
```

As in *App.js*, the *componentDidMount* function is calling our API to load our client list.

We'll also include the *remove* function to handle the *DELETE* call to the API when we want to delete a client. In addition, we'll create the *render* function, which will render the HTML with *Edit*, *Delete*, and *Add Client* actions:

```
async remove(id) {
    await fetch(`/clients/${id}`, {
        method: 'DELETE',
        headers: {
            'Accept': 'application/json',
            'Content-Type': 'application/json'
        }
    }).then(() => {
        let updatedClients = [...this.state.clients].filter(i =>
i.id !== id);
        this.setState({clients: updatedClients});
    });
}

render() {
    const {clients, isLoading} = this.state;

    if (isLoading) {
        return <p>Loading...</p>;
    }

    const clientList = clients.map(client => {
        return <tr key={client.id}>
            <td style={{whiteSpace: 'nowrap'}}>{client.name}</td>
            <td>{client.email}</td>
            <td>
                <ButtonGroup>
                    <Button size="sm" color="primary" tag={Link}
to={"/clients/" + client.id}>Edit</Button>
                    <Button size="sm" color="danger" onClick={() =>
this.remove(client.id)}>Delete</Button>
                </ButtonGroup>
            </td>
        </tr>
    });

    return (
        <div>
            <AppNavbar/>
            <Container fluid>
                <div className="float-right">
                    <Button color="success" tag={Link}
to="/clients/new">Add Client</Button>
                </div>
                <h3>Clients</h3>
                <Table className="mt-4">
                    <thead>
                    <tr>
                        <th width="30%">Name</th>
                        <th width="30%">Email</th>
                        <th width="40%">Actions</th>
```

```
                    </tr>
                    </thead>
                    <tbody>
                    {clientList}
                    </tbody>
                </Table>
            </Container>
        </div>
    );
}
```

3.5. Creating a *ClientEdit* Component

The *ClientEdit* component will be responsible for **creating and editing our client**.

Let's create a file in *frontend/src/ClientEdit.js*:

```
import React, { Component } from 'react';
import { Link, withRouter } from 'react-router-dom';
import { Button, Container, Form, FormGroup, Input, Label } from
'reactstrap';
import AppNavbar from './AppNavbar';

class ClientEdit extends Component {

    emptyItem = {
        name: '',
        email: ''
    };

    constructor(props) {
        super(props);
        this.state = {
            item: this.emptyItem
        };
        this.handleChange = this.handleChange.bind(this);
        this.handleSubmit = this.handleSubmit.bind(this);
    }
}
export default withRouter(ClientEdit);
```

Let's add the *componentDidMount* function to check whether we're dealing with the create or edit feature; in the case of editing, it'll fetch our client from the API:

```
async componentDidMount() {
    if (this.props.match.params.id !== 'new') {
        const client = await (await
fetch(`/clients/${this.props.match.params.id}`)).json();
        this.setState({item: client});
    }
}
```

Then in the *handleChange* function, we'll update our component state item property that will be used when submitting our form:

```
handleChange(event) {
    const target = event.target;
    const value = target.value;
    const name = target.name;
    let item = {...this.state.item};
    item[name] = value;
    this.setState({item});
}
```

In *handeSubmit*, we'll call our API, sending the request to a *PUT* or *POST* method depending on the feature we're invoking. For that, we can check if the *id* property is filled:

```
async handleSubmit(event) {
    event.preventDefault();
    const {item} = this.state;

    await fetch('/clients' + (item.id ? '/' + item.id : ''), {
        method: (item.id) ? 'PUT' : 'POST',
        headers: {
            'Accept': 'application/json',
            'Content-Type': 'application/json'
        },
        body: JSON.stringify(item),
    });
    this.props.history.push('/clients');
}
```

Last, but not least, our *render* function will be handling our form:

```
render() {
    const {item} = this.state;
    const title = <h2>{item.id ? 'Edit Client' : 'Add Client'}
</h2>;

    return <div>
        <AppNavbar/>
        <Container>
            {title}
            <Form onSubmit={this.handleSubmit}>
                <FormGroup>
                    <Label for="name">Name</Label>
                    <Input type="text" name="name" id="name" value=
{item.name || ''}
                           onChange={this.handleChange}
autoComplete="name"/>
                </FormGroup>
                <FormGroup>
                    <Label for="email">Email</Label>
                    <Input type="text" name="email" id="email"
value={item.email || ''}
                           onChange={this.handleChange}
autoComplete="email"/>
                </FormGroup>
                <FormGroup>
                    <Button color="primary"
type="submit">Save</Button>{' '}
                    <Button color="secondary" tag={Link}
to="/clients">Cancel</Button>
                </FormGroup>
            </Form>
        </Container>
    </div>
}
```

Note: We also have a *Link* with a route configured to go back to */clients* when clicking on the *Cancel* Button.

3.6. Creating an *AppNavbar* Component

To give our application better navigability, let's create a file in *frontend/src/AppNavbar.js*:

```
import React, {Component} from 'react';
import {Navbar, NavbarBrand} from 'reactstrap';
import {Link} from 'react-router-dom';

export default class AppNavbar extends Component {
    constructor(props) {
        super(props);
        this.state = {isOpen: false};
        this.toggle = this.toggle.bind(this);
    }

    toggle() {
        this.setState({
            isOpen: !this.state.isOpen
        });
    }

    render() {
        return <Navbar color="dark" dark expand="md">
            <NavbarBrand tag={Link} to="/">Home</NavbarBrand>
        </Navbar>;
    }
}
```

In the *render* function, **we'll use the *react-router-dom* capabilities to create a *Link*** to route to our application *Home* page.

3.7. Creating Our *Home* Component

This component will be our application *Home* page, and will have a button to our previously created *ClientList* component.

Let's create a file in *frontend/src/Home.js*:

```
import React, { Component } from 'react';
import './App.css';
import AppNavbar from './AppNavbar';
import { Link } from 'react-router-dom';
import { Button, Container } from 'reactstrap';

class Home extends Component {
    render() {
        return (
            <div>
                <AppNavbar/>
                <Container fluid>
                    <Button color="link"><Link
to="/clients">Clients</Link></Button>
                </Container>
            </div>
        );
    }
}
export default Home;
```

Note: In this component, we also have a *Link* from *react-router-dom* that leads us to */clients*. This route will be configured in the next step.

3.8. Using React Router

Now we'll use React Router (https://reactrouter.com/) to navigate between our components.

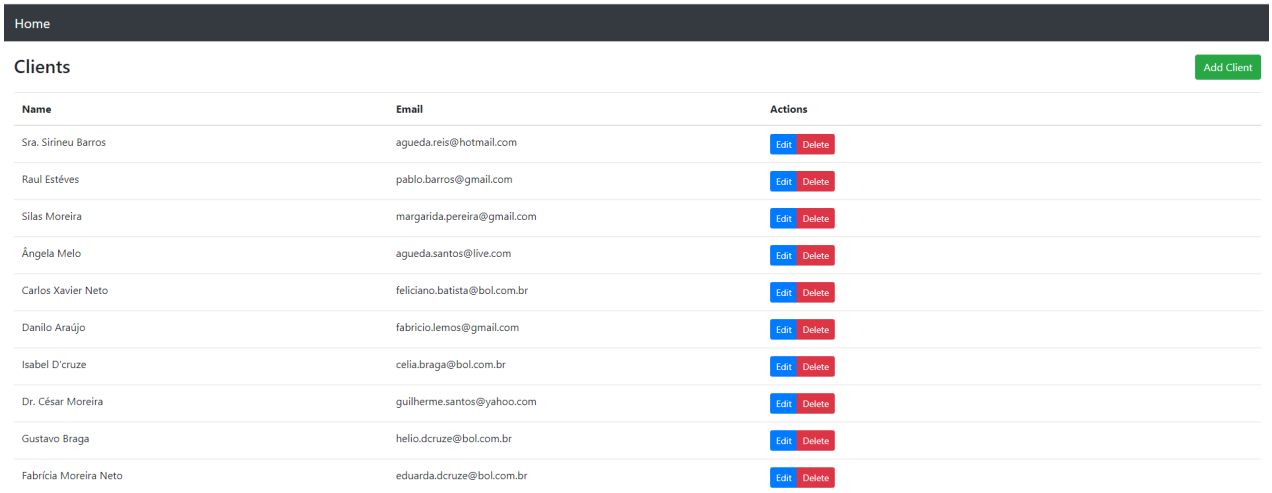
Let's change our *App.js*:

```
import React, { Component } from 'react';
import './App.css';
import Home from './Home';
import { BrowserRouter as Router, Route, Switch } from 'react-
router-dom';
import ClientList from './ClientList';
import ClientEdit from "./ClientEdit";

class App extends Component {
  render() {
    return (
        <Router>
          <Switch>
            <Route path='/' exact={true} component={Home}/>
            <Route path='/clients' exact={true} component=
{ClientList}/>
            <Route path='/clients/:id' component={ClientEdit}/>
          </Switch>
        </Router>
    )
  }
}

export default App;
```

As we can see, we have our application routes defined for each of the components we've created.

When accessing localhost:3000 (http://localhost:3000/), we now have our *Home* page with a *Clients* link:

(/wp-content/uploads/2021/04/react-homepng.png)
Clicking on the *Clients* link, we now have our list of clients, and the *Edit*, *Remove*, and *Add Client* features:



(/wp-content/uploads/2021/04/react-clients.png)

4. Building and Packaging

To **build and package our React application with Maven**, we'll use the *frontend-maven-plugin (https://github.com/eirslett/frontend-maven-plugin)*.

This plugin will be responsible for packaging and copying our *frontend* application into our Spring Boot API build folder:

```
<properties>
    ...
    <frontend-maven-plugin.version>1.6</frontend-maven-
plugin.version>
    <node.version>v14.8.0</node.version>
    <yarn.version>v1.12.1</yarn.version>
    ...
</properties>
...
<build>
    <plugins>
        <plugin>
            <groupId>org.apache.maven.plugins</groupId>
            <artifactId>maven-resources-plugin</artifactId>
            <version>3.1.0</version>
            <executions>
                ...
            </executions>
        </plugin>
        <plugin>
            <groupId>com.github.eirslett</groupId>
            <artifactId>frontend-maven-plugin</artifactId>
            <version>${frontend-maven-plugin.version}</version>
            <configuration>
                ...
            </configuration>
            <executions>
                ...
            </executions>
        </plugin>
        ...
    </plugins>
</build>
```

Let's take a closer look at our *maven-resources-plugin* (https://maven.apache.org/plugins/maven-resources-plugin/), which is responsible for copying our *frontend* sources to the application *target* folder:

```
...
<plugin>
    <groupId>org.apache.maven.plugins</groupId>
    <artifactId>maven-resources-plugin</artifactId>
    <version>3.1.0</version>
    <executions>
        <execution>
            <id>copy-resources</id>
            <phase>process-classes</phase>
            <goals>
                <goal>copy-resources</goal>
            </goals>
            <configuration>

<outputDirectory>${basedir}/target/classes/static</outputDirectory>
                <resources>
                    <resource>
                        <directory>frontend/build</directory>
                    </resource>
                </resources>
            </configuration>
        </execution>
    </executions>
</plugin>
...
```

Our *front-end-maven-plugin* will then be responsible for installing *Node.js* and Yarn (https://yarnpkg.com/), and then building and testing our *frontend* application:

```
...
<plugin>
    <groupId>com.github.eirslett</groupId>
    <artifactId>frontend-maven-plugin</artifactId>
    <version>${frontend-maven-plugin.version}</version>
    <configuration>
        <workingDirectory>frontend</workingDirectory>
    </configuration>
    <executions>
        <execution>
            <id>install node</id>
            <goals>
                <goal>install-node-and-yarn</goal>
            </goals>
            <configuration>
                <nodeVersion>${node.version}</nodeVersion>
                <yarnVersion>${yarn.version}</yarnVersion>
            </configuration>
        </execution>
        <execution>
            <id>yarn install</id>
            <goals>
                <goal>yarn</goal>
            </goals>
            <phase>generate-resources</phase>
        </execution>
        <execution>
            <id>yarn test</id>
            <goals>
                <goal>yarn</goal>
            </goals>
            <phase>test</phase>
            <configuration>
                <arguments>test</arguments>
                <environmentVariables>
                    <CI>true</CI>
                </environmentVariables>
            </configuration>
        </execution>
        <execution>
            <id>yarn build</id>
            <goals>
                <goal>yarn</goal>
            </goals>
            <phase>compile</phase>
            <configuration>
                <arguments>build</arguments>
            </configuration>
        </execution>
    </executions>
```

```
</plugin>
...
```

Note: to specify a different Node.js version, we can simply edit the *node.version* property in our *pom.xml*.

5. Running Our Spring Boot React CRUD Application

Finally, by adding the plugin, we can access our application by running:

```
mvn spring-boot:run
```

Our React application will be fully integrated into our API at the http://localhost:8080/ (http://localhost:8080/) URL.

6. Conclusion

In this article, we examined how to create a CRUD application using Spring Boot and React. To do so, we first created some REST API endpoints to interact with our database. Then we created some React components to fetch and write data using our API. We also learned how to package our Spring Boot Application with our React UI into a single application package.

The source code for our application is available over on GitHub (https://github.com/eugenp/tutorials/tree/master/spring-boot-modules/spring-boot-react).

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