School of Computing

ST0503 Back End Web Development

Practical 7

Authentication and Authorization

Objectives:

After completing this lab, you should be able to:

- Implement JWT for authentication and authorization
- Secure the REST API endpoints

In this practical, we will implement authentication, so that only logged in users can access certain endpoints .

Open MySQLWorkbench and execute the following SQL to add the `password` column:

```
use friendbook;

ALTER TABLE user ADD COLUMN password VARCHAR(255) NOT NULL;
```

If you inspect the `password` column for the `user` table, you will notice that all our user's have a password of `''` (empty string).

1. Login endpoint

Let's implement the endpoint (`POST /login/`) for logging in. We will send back a JWT token if the login details are correct. JWT tokens allow us to identify who is calling our endpoints.

1.1. JWT secret key

JWT token needs to be signed with a secret so that we can verify that a token sent to us is untampered. Let's setup environment variables for storing our JWT secret key.

Create a new config.js file in the main project folder

```
var secretKey='dfkhfkda6812683216jcxzm876875@!#@$dsd';
```

```
module.exports=secretKey;
```

1.2. User.verify()

Install the `jsonwebtoken` package:

```
npm install --save jsonwebtoken
```

Add the `verify` method to the `User` model:

```
verify: function (username, password, callback) {

    var dbConn = db.getConnection();
    dbConn.connect(function (err) {

      if (err) {//database connection gt issue!

        console.log(err);
        return callback(err, null);
      } else {

        const query = "SELECT * FROM user WHERE username=? and password=?";

        dbConn.query(query, [username, password], (error, results) => {
          if (error) {
            callback(error, null);
            return;
          }
          if (results.length === 0) {
            return callback(null, null);

          } else {
            const user = results[0];
            return callback(null, user);
          }
        });
      }
    });
  }
```

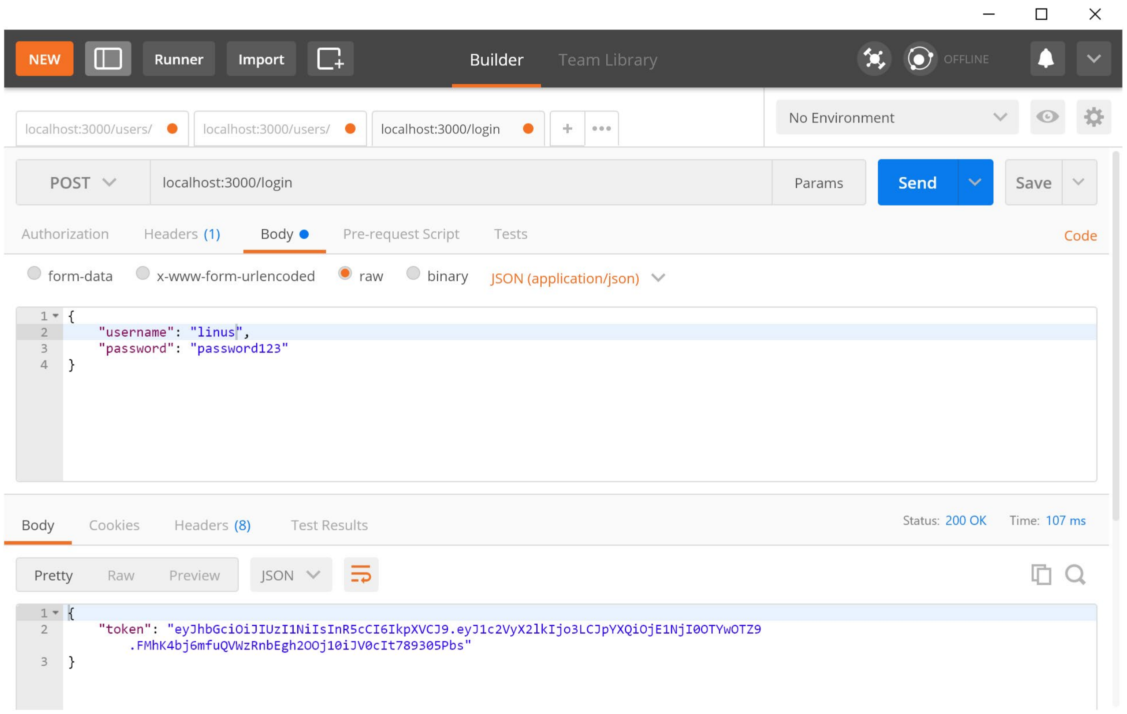
Add the `POST /login/` handler to `app.js`. Make sure to import `JWT_SECRET` and `jsonwebtoken`:

```
...
...
...
const jwt = require("jsonwebtoken");
const JWT_SECRET = require("../config.js");

app.post("/login/", (req, res) => {
  User.verify(
    req.body.username,
    req.body.password,
    (error, user) => {
      if (error) {
        res.status(500).send();
        return;
      }
      if (user === null) {
        res.status(401).send();
        return;
      }
      const payload = { user_id: user.id };
      jwt.sign(payload, JWT_SECRET, { algorithm: "HS256" }, (error, token) =>
{
        if (error) {
          console.log(error);
          res.status(401).send();
          return;
        }
        res.status(200).send({
          token: token,
          user_id: user.id
        });
      })
  });
});
...
```

```
...
...

module.exports = app;
```

We send a `401 Unauthorized` when the login fails. Otherwise, we send the JWT token and the user ID. Note that the JWT token's payload contains the user ID, which is important because when the user sends the JWT token in a HTTP request, we can decode it to check which user is accessing our endpoint. We send the user ID even though we could decode the token on the client side to retrieve the user ID for simplicity's sake.

Test out the endpoint on Postman:



POST localhost:3000/login

JSON (application/json)

```
{
    "username": "linus",
    "password": "password123"
}
```

Status: 200 OK Time: 107 ms

JSON

```
{
    "token": "eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJ1c2VyX2lkIjo3LCJpYXQiOjE1NjI0OTYwOTZ9
        .FMhK4bj6mfuQVWzRnbEgh2OOj10iJV0cIt789305Pbs"
}
```

Provide a wrong password. You should get a `401 Unauthorized`. Repeat with a non-existent username. You should also see a `401 Unauthorized`.

3.3. Securing our endpoints

We will now require users to provide the authentication header to access certain endpoints (`POST` and `PUT` ones). When we make a request to an authenticated endpoint, the JWT token should be included in the Authentication header with a "Bearer" prefix.

Create a file named `isLoggedInMiddleware.js` in a new **auth** directory with the following content:

```
const jwt = require("jsonwebtoken");
const JWT_SECRET = require("../config.js");
```

```
var check = (req, res, next) => {
  const authHeader = req.headers.authorization;
  if (authHeader === null || authHeader === undefined || !authHeader.startsWi
th("Bearer ")) {
    res.status(401).send();
    return;
  }
  const token = authHeader.replace("Bearer ", "");
  jwt.verify(token, JWT_SECRET, { algorithms: ["HS256"] }, (error, decodedTok
en) => {
    if (error) {
      res.status(401).send();
      return;
    }
    req.decodedToken = decodedToken;
    next();
  });
};

module.exports=check;
```

As you see in the `jwt.verify()` callback, if the verification is successful, we store the decoded token in `req.decodedToken` and invoke the `next()` method to pass the `req` and `res` object to the next middleware (authenticated endpoint handlers). Otherwise, we send a `401 Unauthorized`.

Mount the middleware before the following handlers in `controller.js`:

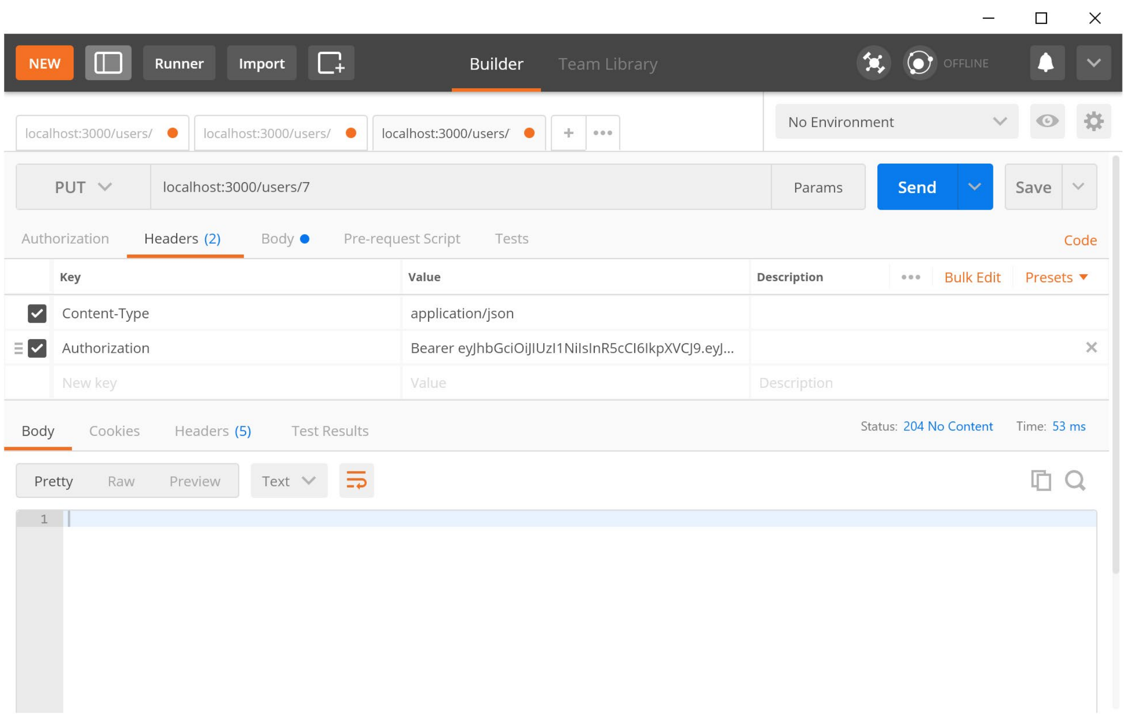
```
const isLoggedInMiddleware = require("../auth/isLoggedInMiddleware");
...
app.put("/users/:userID/", isLoggedInMiddleware, (req, res, next) => {
...
app.post("/users/:userID/friends/:friendID", isLoggedInMiddleware, (req, res)
=> {
...
app.delete("/users/:userID/friends/:friendID/", isLoggedInMiddleware, (req, r
es) => {
```

Make a request to `PUT /users/:userID`. Put in Linus' user ID. You should get a 401.

Now, make the same request, but with the Authorization header. The value should be the JWT token from Section 3.2. with "Bearer" as a prefix, and the body should be the following:

```
{
    "full_name": "Linus Torvalds",
    "username": "linus",
    "bio": "Works on Linux and Git!",
    "date_of_birth": "1970-10-19"
}
```

You should be get a `201 No Content`:



PUT localhost:3000/users/7

Key	Value	Description
Content-Type	application/json	
Authorization	Bearer eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJ...	
New key	Value	Description

Status: 204 No Content Time: 53 ms

Repeat the same request with no Authorization header. You should get a `401 Unauthorized`.

While the three endpoints now require authentication, they do not have any authorization implemented. Any one that is logged in can freely update or delete users. We only want the logged in user to be able to update or delete their own accounts, and add or remove friends to their own account.

Add a check after the `userID` has been parsed. If the user ID in the decoded token does not match the one in the request parameters, send a 403.

```
app.put("/users/:userID/", isLoggedInMiddleware, (req, res, next) => {
  const userID = parseInt(req.params.userID);
  if (isNaN(userID)) {
    res.status(400).send();
    return;
  }

  // user ID in the request params should be the same as the logged in user I
D
  if (userID !== req.decodedToken.user_id) {
    res.status(403).send();
    return;
  }
  ...

app.post("/users/:userID/friends/:friendID", isLoggedInMiddleware, (req, res)
=> {
    const userID = parseInt(req.params.userID);
    const friendID = parseInt(req.params.friendID);
    if (isNaN(userID) || isNaN(friendID)) {
      res.status(400).send();
      return;
    }

    if (userID === friendID) {
      res.status(400).send();
      return;
    }

    // user ID in the request params should be the same as the logged in user
ID
    if (userID !== req.decodedToken.user_id) {
      res.status(403).send();
      return;
    }
    ...

app.delete("/users/:userID/friends/:friendID/", isLoggedInMiddleware, (req, r
es) => {
    const userID = parseInt(req.params.userID);
    const friendID = parseInt(req.params.friendID);

    if (isNaN(userID) || isNaN(friendID)) {
      res.status(400).send();
      return;
    }

    // user ID in the request params should be the same as the logged in user
ID
    if (userID !== req.decodedToken.user_id) {
      res.status(403).send();
      return;
    }
    ...
```

Test out the endpoints with Postman to ensure that only the logged in user is be able to update or delete their own accounts, and add or remove friends to their own account.

3.4. Hiding the password

Perform a `GET /users/1/` request. You should see that the `password` property is present. We should not expose it through our REST endpoints.

Modify the `SELECT` SQL queries in both models to include all user columns except for `password`.

New `User.findByID()` query

```
SELECT id, full_name, username, bio, date_of_birth, created_at FROM user WHER
E id = ?;
```

New `User.findAll()` query

```
SELECT id, full_name, username, bio, date_of_birth, created_at FROM user;
```

New `User.showFriends()` query

```
SELECT user.id, user.full_name, user.username, user.bio, user.date_of_birth,
user.created_at
FROM user
INNER JOIN friendship
ON user.id = friendship.fk_friend_one_id
WHERE friendship.fk_friend_two_id = ?;

OR

SELECT user.id, user.full_name, user.username, user.bio, user.date_of_birth,
user.created_at
FROM user, friendship
where user.id = friendship.fk_friend_one_id
and friendship.fk_friend_two_id = ?;
```

New `Post.findLikers()` query

```
SELECT user.id, user.full_name, user.username, user.bio, user.date_of_birth,
user.created_at FROM user
INNER JOIN likes ON likes.fk_user_id = user.id
WHERE likes.fk_post_id = ?

OR

SELECT user.id, user.full_name, user.username, user.bio, user.date_of_birth,
user.created_at FROM user, likes where likes.fk_user_id = user.id
and likes.fk_post_id = ?
```

New `Post.findLikersByPostIDs` query:

```
SELECT user.id, user.full_name, user.username, user.bio, user.date_of_birth,
user.created_at, likes.fk_post_id FROM user
INNER JOIN likes ON likes.fk_user_id = user.id
WHERE likes.fk_post_id IN (?);

OR

SELECT user.id, user.full_name, user.username, user.bio, user.date_of_birth,
user.created_at, likes.fk_post_id FROM user,likes where likes.fk_user_id = us
er.id and likes.fk_post_id IN (?);
```

The `user.password` column should no longer be exposed through our API.

3.5. Exercise: Securing the Post endpoints

Modify the handlers for:

1. `POST /posts/`
2. `PUT /posts/:postID`
3. `DELETE /posts/:postID/`

such that the logged in user can only create/update/delete the Post resource if it belongs to them. You may need to use the `Post.findByID()` method to get the `fk_poster_id`.

For the following endpoints:

1. `POST /posts/:postID/likers/:likerID/`
2. `DELETE /posts/:postID/likers/:likerID/`

Modify the handlers such that `403 Forbidden` is sent if `likerID !== req.decodedToken`.