Jonathan Sifleet 18014017

Enterprise Programming - Completed Sections

6G6Z1103, 6G6Z1903

Completed Sections

Note: some code has been slightly altered since screenshots were taken, although no functionality has been modified.

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Criteria 1

Access to the data using simple http web service calls

Believed class: 1st class, my implementation contains HTTP requests to the backend that as its errors dealt with.
Evidence:

```
// get all films
useEffect(() => {
  async function getFilms() {
    try {
      let url = `format=${format}`;
      if (useREST) {
        url = `${endpoints.restEndpoint}?${url}&getType=all`;
      } else {
        url = `${endpoints.getAllFilmsEndpoint}?${url}`;
      }

      setShowSpinner(true);
      switch (format) {
        case 'xml':
          setFilms(await XMLRequest(url, 'GET'));
          break;
        case 'csv':
          setFilms(await CSVRequest(url, 'GET'));
          break;
        default:
          setFilms(await JSONRequest(url, 'GET'));
      }
    } catch (e) {
      console.error(e);
    }       You, 3 weeks ago • Fix CORS error & add error handling
    setShowSpinner(false);
    setShouldGetAllFilms(false);
  }

  if (shouldGetAllFilms) getFilms();
}, [shouldGetAllFilms]);
```

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All HTTP requests are structured identically, with the URL in the array of the second argument of the useEffect hook determining the URL and logic to be used, e.g. the create new film HTTP request:

```
// create new film
useEffect(() => {
  async function postFilm() {
    let url = `format=${format}`;
    if (useREST) {
      url = `${endpoints.restEndpoint}?${url}`;
    } else {
      url = `${endpoints.insertFilmEndpoint}?${url}`;
    }

    setShowSpinner(true);
    try {
      switch (format) {
        case 'xml':
          await XMLRequest(url, 'POST', `<Film>${jsontoxml(formData)}</Film>`);
          break;
        case 'csv':
          await CSVRequest(url, 'POST', new json2csv({ header: false, delimiter: ',,'}).parse(formData));
          break;
        default:
          await JSONRequest(url, 'POST', formData);
          break;
      }
    } catch (e) {
      console.error(e);
    }
    setShouldPostFilm(false);
    setShowSpinner(false);
  }       You, 3 weeks ago • WIP pass form as XML
  if (shouldPostFilm) postFilm();
}, [shouldPostFilm]);
```

JSONRequest function is structured as follows:

```
const JSONRequest = async (url, method, body) => {
  let options;

  if (body) {
    options = { method, body: JSON.stringify(body) };
  } else {
    options = { method };
  }

  const response = await fetch(url, options);
  return await response.json();
};
       You, 3 weeks ago • Refactor
export default JSONRequest;
```

XMLRequest:

```
const XMLRequest = async (url, method, body) => {
  let response = await fetch(url, {
    method,
    body
  });

  response = await response.text();

  const xml = new DOMParser().parseFromString(response, 'application/xml');
  return new XMLSerializer().serializeToString(xml.documentElement);
};

export default XMLRequest;
```

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CSVRequest:

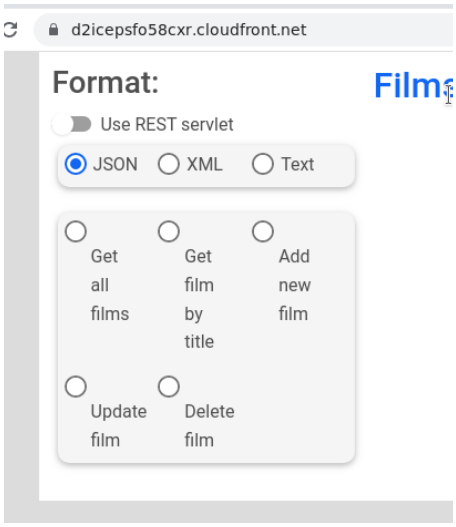
```
const CSVRequest = async (url, method, body) => {
  let response = await fetch(url, {
    method,
    body
  });

  return await response.text();
};

export default CSVRequest;
```

Criteria 2

Options to return the data in text, json, or xml

Believed class: 1st Class, the frontend of the project has options to handle the project's functionality in CSV (text), XML and JSON, with the back-end also handling the format and able to return data in the required format. Additionally, where appropriate libraries have been used to convert between data types.

Frontend format handling:



Back-end format handling:
All servlets implement a similar switch-case block based upon the format URL parameter.

```
@Override
protected void doGet(HttpServletRequest request, HttpServletResponse response) {
  // set relevant headers
  response = IRequestHelpers.setHeaders(response, "GET");
  // get all films from data access object
  ArrayList<Film> films = FilmDAOSingleton.getFilmDAO().getAllFilms();
  // get format from url
  String format = IRequestHelpers.getFormat(request);
  Object payload;
  // convert film array list to relevant data type
  // and set appropriate header for HTTP response
  switch (format) {
    case "xml":
      response.setContentType("text/xml");
      payload = IPolyPOJOToFormat.filmsToXMLArray(films);
      break;
    case "csv":
      response.setContentType("text/csv");
      payload = IPolyPOJOToFormat.filmsToCSVArray(films);
      break;
    default:
      response.setContentType("application/json");
      payload = IPolyPOJOToFormat.filmsToJSONArray(films);
  }
  // send response containing formatted list of all films
  IRequestHelpers.sendResponse(response, payload);
 }
}
```

Some servlets implement the "IFormatToPOJO" interface, responsible for containing the methods shared between servlets that handle single objects. Furthermore, a similar implementation exists for servlets capable of handling multiple objects known as IPolyPOJOToFormat.

Single JSON objects use the Gson Java JSON serialisation library:

```
public interface IMonoObjServletCommon {

  static Film jsonToFilm(String jsonString, Boolean newFilm) {

    // if result is a new film then create a new film POJO
    // from JSON but generate new ID, otherwise create a
    // new film POJO from JSON using existing ID
    if (newFilm) {
      return new Film.Builder(new Gson().fromJson(jsonString, Film.class)).id(ISQLOperations.generateNewID()).build();
    } else {
      return new Film.Builder(new Gson().fromJson(jsonString, Film.class)).build();
    }

  }
```

Single XML objects use the XStream library:

```
 static Film xmlToFilm(String xmlString, Boolean newFilm) {
   XStream xstream = new XStream();
   xstream.allowTypes(new Class[] { Film.class });
   xstream.processAnnotations(Film.class);

   try {
     if (newFilm) {
       return new Film.Builder((Film) xstream.fromXML(xmlString)).id(ISQLOperations.generateNewID()).build();
     } else {
       return new Film.Builder((Film) xstream.fromXML(xmlString)).build();
     }
   } catch (Exception e) {
     e.printStackTrace();
   }
   return null;
 }
```

For multiple objects, JSON again uses the Gson library, whereas XML uses the XStream library:

```
public interface IPolyPOJOToFormat {

  static String filmsToJSONArray(ArrayList<Film> data) {
    // return array list of films to JSON
    return new Gson().toJson(data);
  }

  static String filmsToXMLArray(ArrayList<Film> data) {
    // convert films to XML

    XStream xstream = new XStream();
    // change xml tag name from class name to value of
    // first function parameter
    xstream.alias("root", List.class);
    xstream.alias("film", models.Film.class);

    // convert films to XML
    String xmlString = xstream.toXML(data);

    // return XML and XML declaration
    return "<?xml version=\"1.0\" encoding=\"UTF-8\" ?>" + "\n" + xmlString;
  }
```

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Criteria 3

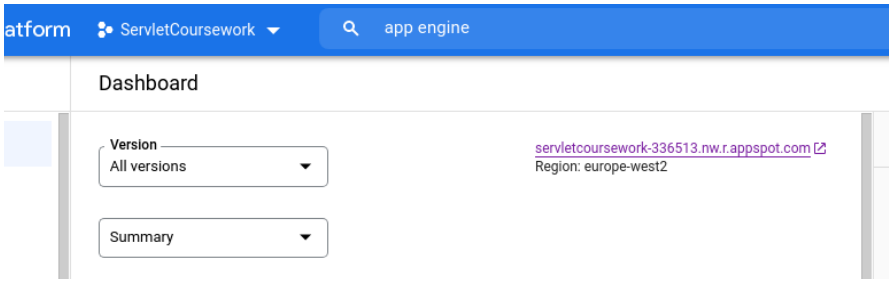
Google App Engine or Microsoft Azure to implement the application on a remote cloud based server

Believed grade: 1st Class: All CRUD operations in addition to RESTful servlet containing CRUD servlet functionality has been implemented both locally and on cloud.

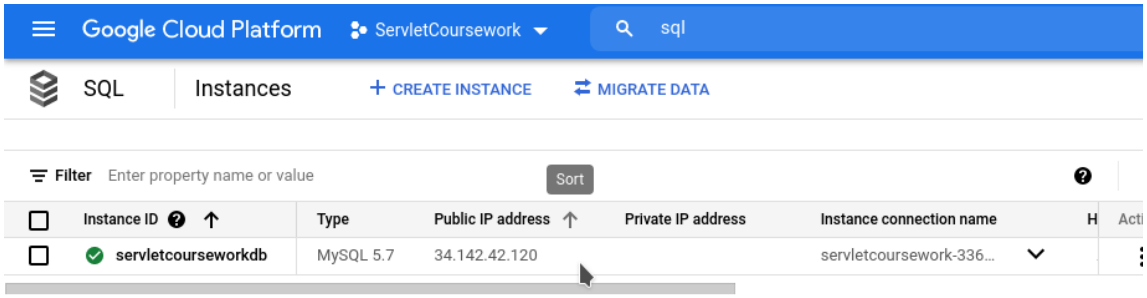
Unfortunately, due to difficult setting up React with Google Cloud Platform, my project in fact uses two separate Cloud platforms, GCP App Engine backend + GCP SQL database, and AWS Cloudfront + S3 for frontend.

Further proof of CRUD operations being “demo’d” will be found in the “CRUD Operations.pdf” file found in the project root.

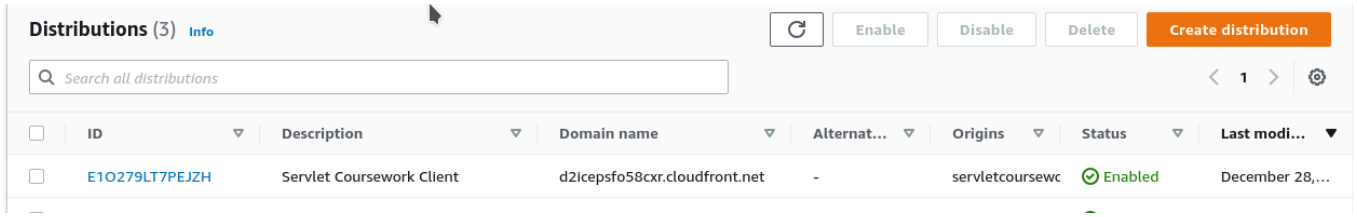
GCP:
Backend:



Database:



AWS:
Frontend:



The frontend:

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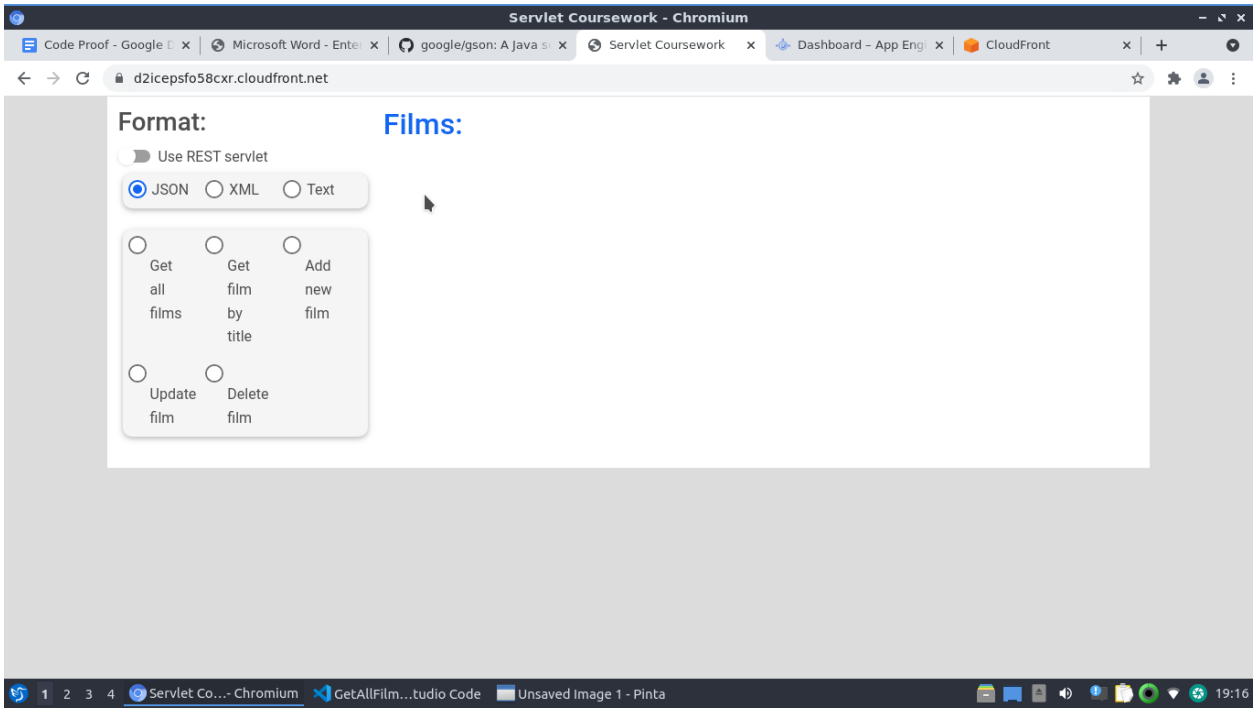
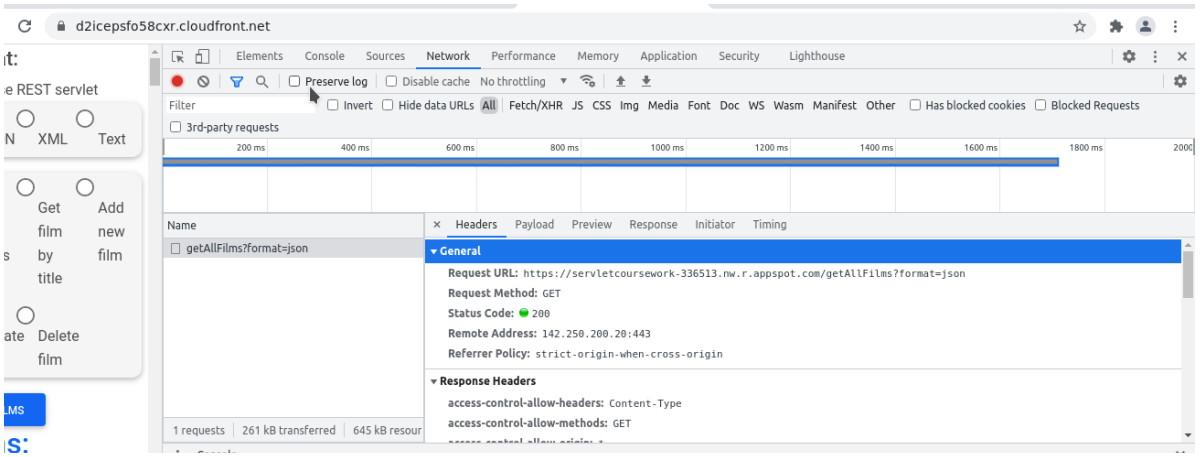


Request to backend:



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Backend code connecting to GCP SQL server:

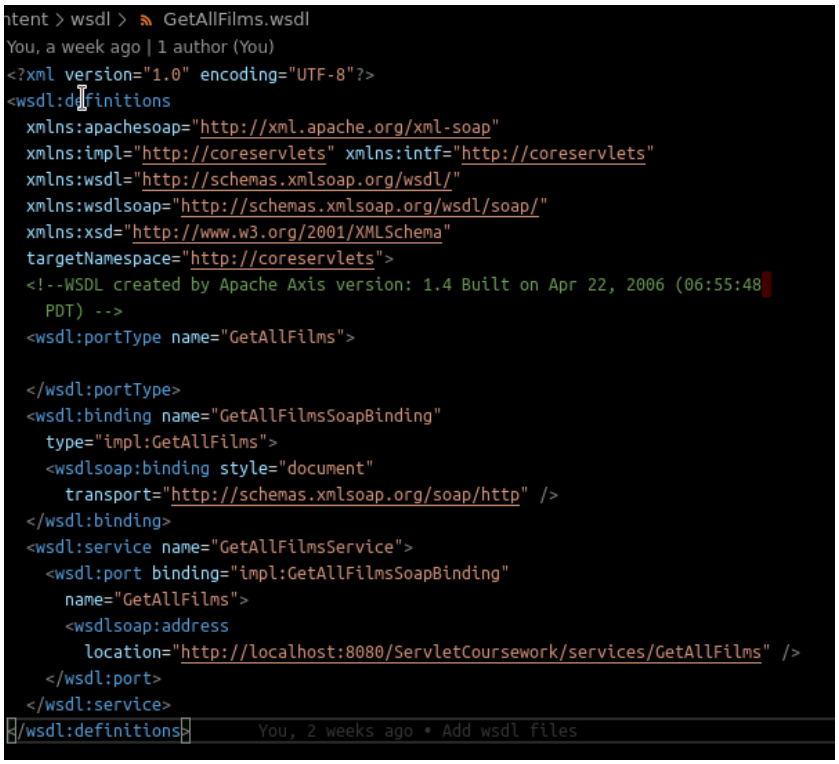
```
public class ConnectionPoolSingleton {

  private static ConnectionPoolSingleton connectionPool;
  private static DataSource pool;

  // prevent other classes instantiating Connection pool
  private ConnectionPoolSingleton() {
  }

  public static synchronized ConnectionPoolSingleton getConnectionPool() {
    if (connectionPool == null) connectionPool = new ConnectionPoolSingleton();
    setPool(createConnectionPool());

    return connectionPool;
  }

  private static DataSource createConnectionPool() {
    HikariConfig config = new HikariConfig();

    String connectionName = "servletcoursework-336513:europe-west2:servletcourseworkdb2";
    String databaseName = "servletcoursework";
    String password = "wu31wMas9nclNh05";

    // connection settings:
    config.setJdbcUrl(String.format("jdbc:mysql:///%s", databaseName));
    config.setUsername("root");
    config.setPassword(password);
    config.addDataSourceProperty("ipTypes", "PUBLIC");

    config.addDataSourceProperty("socketFactory", "com.google.cloud.sql.mysql.SocketFactory");
```

```
    config.addDataSourceProperty("cloudSqlInstance", connectionName);

    config.setMaximumPoolSize(99);
    config.setMinimumIdle(5);

    // establish connection timeout: 10 seconds
    config.setConnectionTimeout(10 * 1000);
    // timeout: 5 minutes
    config.setIdleTimeout(5 * 60 * 1000);
    // max connection length: 30 minutes
    config.setMaxLifetime(30 * 60 * 1000);

    return new HikariDataSource(config);
  }

  public DataSource getPool() {
    return pool;
  }

  private static void setPool(DataSource pool) {
    ConnectionPoolSingleton.pool = pool;
  }
```

Criteria 4

A WSDL description of the interface to the web service

Believed grade: 1st Class, all WSDL files for all servlet including the HTTP servlet can be found in project root / WebContent / wsdl
E.g.:



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Criteria 5

Access to the data using REST type interaction

Believed grade: 1st Class, all servlet functionality is included in a RESTful manner:

REST servlet can be accessed via the URL: https://servletcoursework-336513.nw.r.appspot.com/REST
Get films:

eservlets > REST.java

```java
@Override
protected void doGet(HttpServletRequest request, HttpServletResponse response) {
  // set relevant headers
  response = IHandleHTTP.setHeaders(response, "GET");

  FilmDAOSingleton filmDAO = new FilmDAOSingleton();
  // get format from url
  String format = IGetFormat.getFormat(request);
  Object payload = null;

  // get get type from url
  String getType = request.getParameter("getType");

  // determine which type of get function to use
  // based on get type from url
  switch (getType) {
    case "all":
      payload = getAllFilms(filmDAO, format, response);
      break;
    case "title":
      String title = request.getParameter("title");
      payload = getFilmByTitle(filmDAO, format, title, response);
      break;
    case "id":
      int id = Integer.parseInt(request.getParameter("id"));
      payload = getFilmByID(filmDAO, format, id, response);
  }

  // send response containing film(s)
  IHandleHTTP.sendResponse(response, payload);
}
```

Create film:

preservlets > REST.java

```java
@Override
protected void doPost(HttpServletRequest request, HttpServletResponse response) {
  // set relevant headers
  response = IHandleHTTP.setHeaders(response, "POST");

  // get film from HTTP body
  String requestBodyFilm = IMonoObjServletCommon.getRequestBody(request);
  // get format from url
  String format = IGetFormat.getFormat(request);

  // set film equal to film object converted based on
  // relevant format
  Film film;
  switch (format) {
    case "xml":
      film = IMonoObjServletCommon.xmlToFilm(requestBodyFilm, true);
      break;
    case "csv":
      film = IMonoObjServletCommon.csvToFilm(requestBodyFilm, true);
      break;
    default:
      film = IMonoObjServletCommon.jsonToFilm(requestBodyFilm, true);
  };

  // send response containing number of rows affected by inserting
  // new film
  IHandleHTTP.sendResponse(response, new FilmDAOSingleton().insertFilm(film));
}
```

Update film:

```
@Override       You, seconds ago • Uncommitted changes
protected void doPut(HttpServletRequest request, HttpServletResponse response) {
  // set relevant headers
  response = IHandleHTTP.setHeaders(response, "PUT");

  // get film from HTTP body
  String requestBodyFilm = IMonoObjServletCommon.getRequestBody(request);
  // get format from url
  String format = IGetFormat.getFormat(request);

  // set film equal to film object converted based on
  // relevant format
  Film film;
  switch (format) {
    case "xml":
      film = IMonoObjServletCommon.xmlToFilm(requestBodyFilm, false);
      break;
    case "csv":
      film = IMonoObjServletCommon.csvToFilm(requestBodyFilm, false);
      break;
    default:
      film = IMonoObjServletCommon.jsonToFilm(requestBodyFilm, false);
  };

  // print number of affected rows due to updating film
  IHandleHTTP.sendResponse(response, new FilmDAOSingleton().updateFilm(film));
}
```

Delete film:

```
@Override
protected void doDelete(HttpServletRequest request, HttpServletResponse response) {
  // set relevant headers
  response = IHandleHTTP.setHeaders(response, "DELETE");
  // get id from url
  int id = Integer.parseInt(request.getParameter("id"));

  // print number of affected rows due to deleting film
  IHandleHTTP.sendResponse(response, new FilmDAOSingleton().deleteFilm(id));
}
```

Criteria 6

An Ajax based web front end to retrieve the data and display in a suitable format using library based routines for an enhanced user interface

Believed grade: 1st Class
My frontend consists of the React JavaScript library, developed from scratch. My project is structured in a logic format:

- Client
    - components
    - constants
    - pages
    - styles
    - utils

React components are styled using the CSS modules and SCSS instead of regular CSS. Where possible CSS attributes are sorted alphabetically, and so are many other aspects of the frontend, e.g.
State objects:

```
const ControlPanel = () => {
  const [endpoint, setEndpoint] = useState('');
  const [films, setFilms] = useState(null);
  const [formData, setFormData] = useState({});
  const [format, setFormat] = useState('json');
  const [formatChanged, setFormatChanged] = useState(false);
  const [selectedAttributeVal, setSelectedAttributeVal] = useState(null);
  const [selectedFilm, setSelectedFilm] = useState(null);
  const [selectedFilmID, setSelectedFilmID] = useState(null);
  const [selectedLabel, setSelectedLabel] = useState('Title');
  const [shouldDeleteFilm, setShouldDeleteFilm] = useState(false);
  const [shouldGetAllFilms, setShouldGetAllFilms] = useState(false);
  const [shouldGetFilmByID, setShouldGetFilmByID] = useState(false);
  const [shouldGetFilmByTitle, setShouldGetFilmByTitle] = useState(false);
  const [shouldPostFilm, setShouldPostFilm] = useState(false);
  const [shouldUpdateFilm, setShouldUpdateFilm] = useState(false);
  const [showSpinner, setShowSpinner] = useState(false);
  const [updateFormData, setUpdateFormData] = useState(false);
  const [useREST, setUseREST] = useState(false);
```

Props:

```
<MDBSwitch
  className={classes.RESTToggle}
  label="Use REST servlet"
  onChange={() => toggleHandler()}
  checked={useREST}
/>

<MDBBtnGroup className={classes.FormatRadioGroup}>
  <Radio
    defaultChecked
    label="JSON"
    name="formatGroup"
    onClick={() => {
      setFormatChanged(true);
      setFormat('json');
    }}
  />
```

The frontend also uses asynchronous HTTP requests:

```
switch (format) {
  case 'xml':
    setFilms(await XMLRequest(url, 'GET'));
    break;
  case 'csv':
    setFilms(await CSVRequest(url, 'GET'));
    break;
  default:
    setFilms(await JSONRequest(url, 'GET'));
}
```

Expanded pictures of the various request functions can be found under criteria 1.

In regards to the logic of the frontend, it is also structured logically:
Based upon the operation selected (get all films, create new film, etc.), a switch is responsible for determining with JSX (HTML) to render:

```
const renderSwitch = () => {
  switch (endpoint) {
    case endpoints.getAllFilmsEndpoint:
      return <MDBBtn onClick={() => setShouldGetAllFilms(true)}>Get films</MDBBtn>;
    case endpoints.getFilmByTitleEndpoint:
      return (
        <>
          <Input
            label="Title"
            onChange={(event) => {
              formChangedHandler(event, 'title', 'filmForm');
            }}
          />
          <MDBBtn onClick={() => setShouldGetFilmByTitle(true)}>Get film(s)</MDBBtn>
        </>
      );
    case endpoints.insertFilmEndpoint:
      return (
        <>
          <h3>Film attributes:</h3>

          <form
            onSubmit={(event) => {
              event.preventDefault();
            }}
          >
            <Input
              label="Title"
              onChange={(event) => formChangedHandler(event, 'title', 'filmForm')}
```

Each case in the render switch contains a button which once clicked, sets an appropriate state.

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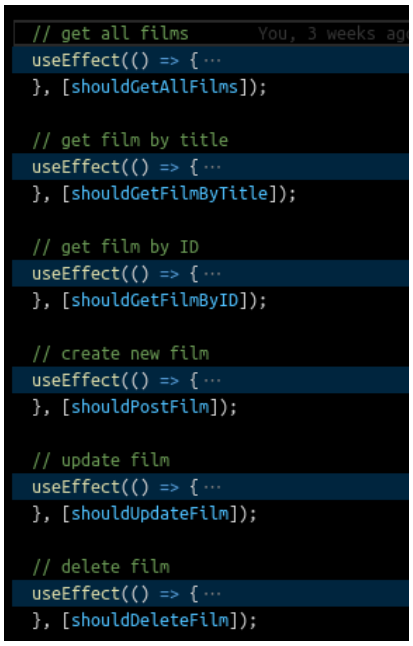
Due to the nature of the useEffect hook in React, the code inside the useEffect hook will run if the value of the variable inside the array of the hook's second parameter is changed. Therefore, if for example, "shouldGetAllFilms" is set to true, the code inside the hook will run. Each different operation has its own useEffect hook:



Criteria 7

Critical analysis of your work and the techniques you have used

Critical analysis of my work can be found in the “Critical analysis.pdf” found in the project’s root.