To be RESTful

Developing a quality API

Summary: the tasks in this project will teach you how to use Spring mechanisms to develop REST applications

Contents

Chapter I

Preamble

Levels of compliance of an application's API to the REST architecture as per Richardson model (each subsequent level is based on the previous one):

Level 0. HTTP is used as a transport protocol. A single URI is used for all interactions. All required information is passed in plain XML text.

Level 1. The API uses a "resource" concept. Each resource is a separate business object. Each resource has its own URI. All interactions are described by a single HTTP verb.

Level 2. All interactions are described by an extended set of HTTP verbs: GET (getting an entity), POST (adding a new entity), PUT (updating an existing entity), and DELETE. Hence, a CRUD is defined for each resource.

Level 3. The API is based on Hypermedia format.

Chapter II

Instructions

- Use this page as the only reference. Do not listen to any rumors and speculations about how to prepare your solution.
- Now there is only one Java version for you, 1.8. Make sure that compiler and interpreter of this version are installed on your machine.
- You can use IDE to write and debug the source code.
- The code is read more often than written. Read carefully the document where code formatting rules are given. When performing each task, make sure you follow the generally accepted Oracle standards:
- Comments are not allowed in the source code of your solution. They make it difficult to read the code.
- Pay attention to the permissions of your files and directories.
- To be assessed, your solution must be in your GIT repository.
- Your solutions will be evaluated by your piscine mates.
- You should not leave in your directory any other file than those explicitly specified by the exercise instructions. It is recommended that you modify your .gitignore to avoid accidents.
- When you need to get precise output in your programs, it is forbidden to display a precalculated output instead of performing the exercise correctly.
- Have a question? Ask your neighbor on the right. Otherwise, try with your neighbor on the left.
- Your reference manual: mates / Internet / Google. And one more thing. There's an answer to any question you may have on Stackoverflow. Learn how to ask questions correctly.
- Read the examples carefully. They may require things that are not otherwise specified in the subject.
- Use "System.out" for output.

- And may the Force be with you!
- Never leave that till tomorrow which you can do today ;)

Chapter III

Rules of the project

- The solution for each exercise is a standalone Maven project implemented on the basis of Spring Boot.
- Project structure is at a developer's discretion.
- Each project shall contain a data.sql file with a set of test data.

Chapter IV

Exercice 00 : Spring Security

	Exercise 00
Spring Security	
Turn-in directory : *ex*00/	
Files to turn in : Education Center-folder	
Allowed functions : n/a	

You need to develop an API to manage a training center. A set of operations shall be implemented for the following domain models:

- User
  - First name
  - Last name
  - Role (Administrator, Teacher, Student)
  - Login
  - Password
- Course
  - Start date
  - End date
  - Name
  - Teachers
  - Students
  - Description
  - Lessons

- Lesson
    - Start time
    - End time
    - Day of week
    - Teacher

  The task shall be completed in accordance with REST API requirements, for example:

- Adding a new lesson to a course with ID 42:

  POST /courses/42/lessons

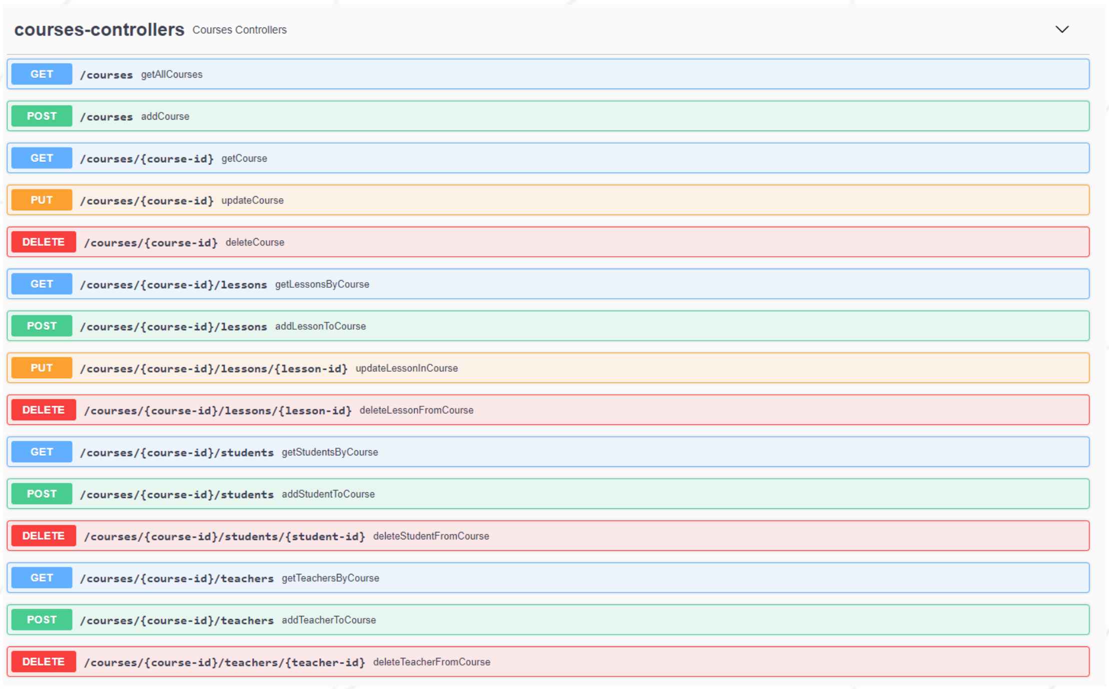
  Тело запроса:

```
{
    "startTime" : "10:00",
    "finishTime" : "12:00",
    "dayOfWeek" : "Monday",
    "teacherId" : 432
}
```

  Тело ответа:

```
"lesson": {
    "id" : 21,
        "startTime" : "10:00",
        "finishTime" : "12:00",
        "dayOfWeek" : "Monday",
        "teacher" : {
            "id" : 432,
            "firstName" : "Best",
            "lastName" : "Teacher"
    }
}
```

Below is a complete list of operations for the courses that need to be implemented as part of the current task:



courses-controllers Courses Controllers

GET `/courses` getAllCourses

POST `/courses` addCourse

GET `/courses/{course-id}` getCourse

PUT `/courses/{course-id}` updateCourse

DELETE `/courses/{course-id}` deleteCourse

GET `/courses/{course-id}/lessons` getLessonsByCourse

POST `/courses/{course-id}/lessons` addLessonToCourse

PUT `/courses/{course-id}/lessons/{lesson-id}` updateLessonInCourse

DELETE `/courses/{course-id}/lessons/{lesson-id}` deleteLessonFromCourse

GET `/courses/{course-id}/students` getStudentsByCourse

POST `/courses/{course-id}/students` addStudentToCourse

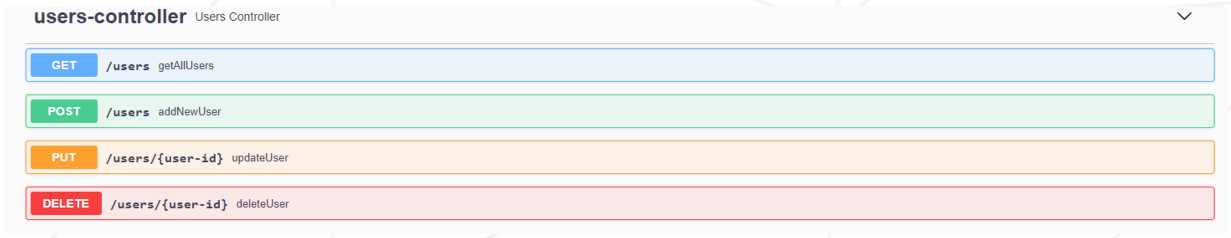
DELETE `/courses/{course-id}/students/{student-id}` deleteStudentFromCourse

GET `/courses/{course-id}/teachers` getTeachersByCourse

POST `/courses/{course-id}/teachers` addTeacherToCourse

DELETE `/courses/{course-id}/teachers/{teacher-id}` deleteTeacherFromCourse

Adding teachers and students to a course involves sending only a user ID in request body (as opposed to adding a lesson, where sending complete information is required). Full-scale work with User entity is performed in a separate controller:



users-controller Users Controller

GET `/users` getAllUsers

POST `/users` addNewUser

PUT `/users/{user-id}` updateUser

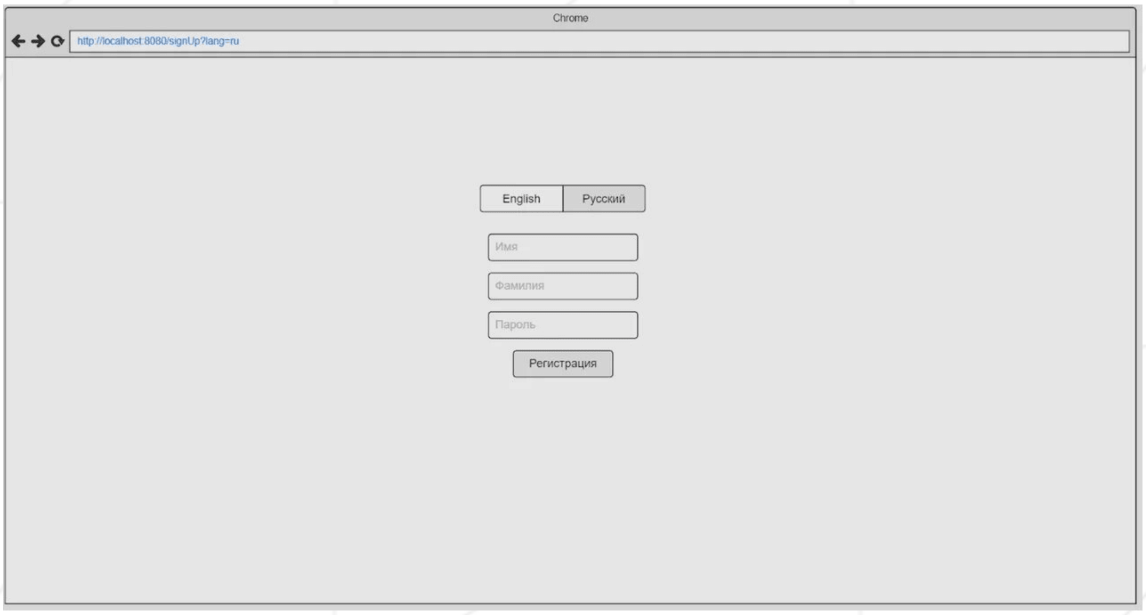
DELETE `/users/{user-id}` deleteUser

Additional requirements:

- Each method that retrieves a collection of objects shall support pagination mechanism.

- For the convenient use of API, you need to integrate Swagger framework into your application: https://swagger.io/.

- For each method, you also need to provide documentation using Swagger, for example:



You need to implement unit test for at least one GET, POST, PUT, and DELETE-метода с использованием MockMvc, например:

```
@ExtendWith(SpringExtension.class)
@AutoConfigureMockMvc
@SpringBootTest
public class CoursesTest {

    @Autowired
    private MockMvc mockMvc;

    @MockBean
    private CoursesService coursesService;

    @BeforeEach
    public void setUp() {
        when(coursesService.delete(1L)).then...;
    }

    @Test
    public void deleteCourseTest() throws Exception {
        mockMvc.perform(delete("/courses/1")).andDo(print())
                .andExpect(status().isOk())
                .andExpect(jsonPath(...));
  }
```

In case of incorrect operations (adding a non-existent teacher/student to the course, indicating an incorrect user role, etc.), you shall return a response with code 400 and the following content:

```
    "error": {
        "status" : 400,
            "message" : "Bad request"
        }
```

Notes:

- Spring Data REST is not allowed for this task

Chapter V

Exercice 01 : JWT

	Exercise 01
JWT	
Turn-in directory : *ex*01/	
Files to turn in : Education Center-folder	
Allowed functions : n/a	

Use JWT authorization to implement a mechanism for providing role-based access to resources.

Now, every request shall be accompanied by a JWT token with the following user information:

- User ID
- User role
- User login

Upon authorization, a user sends a POST request to /signUp URL with a login and a password. If this data is correct, a user receives a JWT token signed with a secret key. The key is stored in application.properties file of the application. If authorization data is incorrect, 403 status shall be returned.

Each user request to API resources shall have an Authorization header with a custom JWT token. In this case, an application shall not access the database to authorize a user because all necessary information is stored in a token.

GET operations are available for a user with any role. POST, PUT and DELETE operations are only available to the center's administrator.

Notes:

- To fully implement authentication using JWT, you need to implement Spring Security components: Authentication, Filter, AuthenticationProvider.

- Spring Data REST is not allowed for this task

Chapter VI

Exercice 02 : HATEOAS

	Exercise 02
HATEOAS	
Turn-in directory : *ex*02/	
Files to turn in : Cinema-folder	
Allowed functions : n/a	

Now, let us implement the functionality of a training center using Spring Data REST technology. Thus, the entire API for User, Course, and Lesson entities will be presented in Hipermedia format. E.g., for a /course GET request, the following response will be returned:

```
{
  "\_embedded": {
    "courses": [
      {
        "title ": "Spring Data Rest",
        "description": "Best framework",
        "state": "Published",
        "\_links": {
          "self ": {
            "href": "http://localhost/courses/1"
          },
          "course": {
            "href": "http://localhost/courses/1"
          },
          "lessons": {
            "href": "http://localhost/courses/1/lessons"
          },
          "students": {
            "href": "http://localhost/courses/1/students"
          }
        }
      },
      {
        "title ": "SQL",
        "description": "All about RDBMS",
        "state": "Draft",
        "\_links": {
          "self ": {
            "href": "http://localhost/courses/2"
          },
          "course": {
            "href": "http://localhost/courses/2"
          },
          "publish": {
            "href": "http://localhost /courses/2/publish"
          },
          "lessons ": {
            "href": "http://localhost /courses/2/lessons"
          },
          "students": {
            "href": "http://localhost /courses/2/students"
          }
        }
      }
    ]
  },
  "\_links": {
    "self ": {
      "href": "http://localhost /courses"
    },
    "profile ": {
      "href": "http://localhost /profile /courses"
    },
    "search": {
      "href": "http://localhost /courses/search"
    }
  },
  "page": {
    "size ": 20,
    "totalElements": 2,
    "totalPages": 1,
    "number": 0
  }
}
```

As you can see from the example, for Course entity you need to implement the ability to publish with /courses/2/publish POST request. A course in the DRAFT state may be published. Once published, it is switched to PUBLISHED state and cannot be re-published.

An ability to work with API through HAL Browser shall be provided.

You also need to provide auto-generation of adoc documentation for the course publishing method based on a unit test of this method. An example of such documentation:

Course API

Methods

Course publish

You can publish a course with status **DRAFT**

request

```
PUT /courses/1/publish HTTP/1.1
Host: localhost:8080
```

response

```
HTTP/1.1 200 OK
Vary: Origin
Vary: Access-Control-Request-Method
Vary: Access-Control-Request-Headers
Content-Type: application/hal+json
Content-Length: 93

{
  "title" : "Spring 5",
  "description" : "All about Spring",
  "state" : "PUBLISHED"
}
```

Table 1. response-fields

Path	Type	Description
`title`	`String`	Title of course
`description`	`String`	Description of course
`state`	`String`	State of course