

Spring Boot CrudRepository Example

By Arvind Rai, December 02, 2017

This page will walk through Spring Boot `CrudRepository` example. Spring Boot Data enables JPA repository support by default. `CrudRepository` provides generic CRUD operation on a repository for a specific type. `CrudRepository` is a Spring data interface and to use it we need to create our interface by extending `CrudRepository`. Spring provides `CrudRepository` implementation class automatically at runtime. It contains methods such as `save`, `findById`, `delete`, `count` etc. Spring boot automatically detects our repository if the package of that repository interface is the same or sub-package of the class annotated with `@SpringBootApplication`. Spring Boot provides default database configurations when it scans Spring Data JPA in classpath. Spring boot uses **spring-boot-starter-data-jpa** starter to configure spring JPA. For data source we need to configure data source properties starting with `spring.datasource.*` in **application.properties**. In Spring Boot 2.0 release, default database pooling technology has been switched from Tomcat Pool to HikariCP. Spring boot prefers HikariCP on first place then Tomcat pooling and then Commons DBCP2 on the basis of availability. Here on this page we will create a Spring Boot Rest web Service for CRUD operation. CRUD operation will be performed by `CrudRepository`. Now find the complete example step by step.

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1. Technologies Used

Find the technologies being used in our example.

1. Java 9
2. Spring 5.0.5.RELEASE
3. Spring Boot 2.0.1.RELEASE
4. Maven 3.5.2
5. MySQL 5.5
6. Eclipse Oxygen

2. Maven File used in Project

Find the `pom.xml` used in our example.

```
<?xml version="1.0" encoding="UTF-8"?>
<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/xsd/maven-4.0.0"
    <modelVersion>4.0.0</modelVersion>
```

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```

<groupId>com.concretepage</groupId>
<artifactId>spring-boot-demo</artifactId>
<version>0.0.1-SNAPSHOT</version>
<packaging>jar</packaging>
<name>spring-demo</name>
<description>Spring Boot Demo Project</description>
<parent>
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-starter-parent</artifactId>
    <version>2.0.1.RELEASE</version>
    <relativePath/>
</parent>
<properties>
    <java.version>9</java.version>
</properties>
<dependencies>
    <dependency>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-web</artifactId>
    </dependency>
    <dependency>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-data-jpa</artifactId>
    </dependency>
    <dependency>
        <groupId>mysql</groupId>
        <artifactId>mysql-connector-java</artifactId>
        <version>6.0.5</version>
    </dependency>
    <dependency>
        <groupId>javax.xml.bind</groupId>
        <artifactId>jaxb-api</artifactId>
        <version>2.3.0</version>
    </dependency>
    <dependency>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-devtools</artifactId>
        <optional>true</optional>
    </dependency>
</dependencies>
<build>
    <plugins>
        <plugin>
            <groupId>org.springframework.boot</groupId>
            <artifactId>spring-boot-maven-plugin</artifactId>
        </plugin>
    </plugins>
</build>
</project>

```

3. CrudRepository Interface

CrudRepository is an interface and extends Spring data **Repository** interface. **CrudRepository** provides generic CRUD operation on a repository for a specific type. It has generic methods for CRUD operation. To use **CrudRepository** we have to create our interface and extend **CrudRepository**. We need not to implement our interface, its implementation will be created automatically at runtime. Find some of **CrudRepository** methods.

<S extends T> S save(S entity): Saves and updates the current entity and returns that entity.

Optional<T> findById(ID primaryKey): Returns the entity for the given id.

Iterable<T> findAll(): Returns all entities.

long count(): Returns the count.

void delete(T entity): Deletes the given entity.

boolean existsById(ID primaryKey): Checks if the entity for the given id exists or not.

`CrudRepository` has subinterface as `PagingAndSortingRepository` that provide additional methods to retrieve entities using the pagination and sorting abstraction.

4. Steps to Use CrudRepository

Spring boot enables JPA repository support by default. To use `CrudRepository` in our Spring data application we need to create an interface implementing `CrudRepository` and then all is done to use it. Let us discuss step wise how to use `CrudRepository` in our Spring data application.

4.1 Create an Interface extending CrudRepository

In our example we will perform CRUD operations on article data for demo. So I will create an interface for article extending `CrudRepository` as following.

```
public interface ArticleRepository extends CrudRepository<Article, Long> {  
}
```

We need not to create its implementation class. Spring will automatically create its implementation class at runtime.

4.2 Auto-Detection of JPA Repository

Spring boot can automatically detect our repository if the package of that interface is the same or sub-package of the class annotated with `@SpringBootApplication` and if not then we need to use `@EnableJpaRepositories` annotation with `@SpringBootApplication`. Let us understand by example.

Suppose we have a class annotated with `@SpringBootApplication` in the package `com.concretepage` as given below.

```
package com.concretepage;  
-----  
@SpringBootApplication  
public class MyApplication {  
-----  
}
```

Now if we have a repository `ArticleRepository` and it resides in package `com.concretepage` or its sub-packages such as `com.concretepage.repository` then Spring boot will automatically detect our repository and so no need to use `@EnableJpaRepositories` annotation.

If we choose a package for our repository that is neither same package nor sub-package of the package of the class annotated with `@SpringBootApplication`, then Spring boot will not be able to detect repository classes by default. In this case we need to use `@EnableJpaRepositories` annotation with `@SpringBootApplication`. Using `@EnableJpaRepositories` we will configure package name in which our repository classes reside. Suppose the package of our repository classes is `com.cp.repository`, we will use `@EnableJpaRepositories` as following.

```
package com.concretepage;  
-----  
@SpringBootApplication  
@EnableJpaRepositories("com.cp.repository")  
public class MyApplication {  
-----  
}
```

If we want to configure specific classes then we need to use `basePackageClasses` attribute of the `@EnableJpaRepositories` annotation. Suppose we have a class `ArticleRepository` in the package `com.cp.repository`, then we can configure repository using `basePackageClasses` as following.

```
package com.concretepage;  
-----  
import com.cp.repository.ArticleRepository;  
@SpringBootApplication  
@EnableJpaRepositories(basePackageClasses= {ArticleRepository.class})  
public class MyApplication {  
-----  
}
```

4.3 Instantiate and Use CrudRepository

To instantiate our `ArticleRepository` that has extended `CrudRepository`, we can use dependency injection.

```
public class ArticleService {
    @Autowired
    private ArticleRepository articleRepository;
    -----
}
```

Now we are ready to use methods of `CrudRepository`. Find the example for some of its methods.

a. Create and Update:

```
Article savedArticle = articleRepository.save(article);
```

b. Read:

```
Article obj = articleRepository.findById(articleId).get();
Iterable<Article> articles = articleRepository.findAll();
```

c. Delete:

```
articleRepository.delete(article);
```

5. Custom Repository Methods

`CrudRepository` provides methods for generic CRUD operation and if we want to add custom methods in our interface that has extended `CrudRepository`, we can add in following ways.

- We can start our query method names with `find...By`, `read...By`, `query...By`, `count...By`, and `get...By`. Before `By` we can add expression such as `Distinct`. After `By` we need to add property names of our entity.
- To get data on the basis of more than one property we can concatenate property names using `And` and `Or` while creating method names.
- If we want to use completely custom name for our method, we can use `@Query` annotation to write query.

Find the code snippet that is using the sample method name for the above scenarios.

```
public interface ArticleRepository extends CrudRepository<Article, Long> {
    List<Article> findByTitle(String title);
    List<Article> findDistinctByCategory(String category);
    List<Article> findByTitleAndCategory(String title, String category);

    @Query("SELECT a FROM Article a WHERE a.title=:title and a.category=:category")
    List<Article> fetchArticles(@Param("title") String title, @Param("category") String category);
}
```

The implementation class of the above methods will be created by Spring at runtime automatically.

6. @Transactional with CrudRepository

CRUD methods of `CrudRepository` are transactional by default. They are annotated with `@Transactional` annotation with default settings in implementation class at runtime. For reading operation `readOnly` flag is set to `true`. To override default transactional settings of any `CrudRepository` methods we need to override that method in our interface and annotate with `@Transactional` using required configurations. Find the example.

```
public interface ArticleRepository extends CrudRepository<Article, Long> {
    @Override
    @Transactional(timeout = 8)
    Iterable<Article> findAll();
}
```

Here we have configured `timeout` as 8 seconds to execute query without `readOnly` flag for `findAll()` method.

7. Configure Properties in application.properties File

Datasource, JPA properties and logging etc need to be configured in `application.properties` file located in the classpath of Spring boot application. These properties will automatically be read by Spring boot.

application.properties

```
spring.datasource.url=jdbc:mysql://localhost:3306/concretepage
spring.datasource.username=root
spring.datasource.password=cp

spring.datasource.hikari.connection-timeout=20000
spring.datasource.hikari.minimum-idle=5
spring.datasource.hikari.maximum-pool-size=12
```

```

spring.datasource.hikari.idle-timeout=300000
spring.datasource.hikari.max-lifetime=1200000

spring.jpa.properties.hibernate.dialect = org.hibernate.dialect.MySQLDialect
spring.jpa.properties.hibernate.id.new_generator_mappings = false
spring.jpa.properties.hibernate.format_sql = true

logging.level.org.hibernate.SQL=DEBUG
logging.level.org.hibernate.type.descriptor.sql.BasicBinder=TRACE

```

In Spring Boot 2.0 release, default database pooling technology has been switched from Tomcat Pool to HikariCP. `spring-boot-starter-jdbc` and `spring-boot-starter-data-jpa` resolve HikariCP dependency by default and `spring.datasource.type` property has `HikariDataSource` as default value. The datasource properties starting with `spring.datasource.*` will automatically be read by Spring boot JPA. To change the Hibernate properties we will use prefix `spring.jpa.properties.*` with Hibernate property name. On the basis of given data source URL, Spring boot can automatically identify data source driver class. So we need not to configure driver class.

Find the properties to configure `JpaBaseConfiguration` and `HibernateJpaAutoConfiguration` in `application.properties`.

spring.data.jpa.repositories.enabled: It enables JPA repositories. The default value is **true**.

spring.jpa.database: It targets database to operate on. By default embedded database is auto-detected.

spring.jpa.database-platform: It is used to provide the name of database to operate on. By default it is auto-detected.

spring.jpa.generate-ddl: It is used to initialize schema on startup. By default the value is **false**.

spring.jpa.hibernate.ddl-auto: It is DDL mode used for embedded database. Default value is **create-drop**.

spring.jpa.hibernate.naming.implicit-strategy: It is Hibernate 5 implicit naming strategy fully qualified name.

spring.jpa.hibernate.naming.physical-strategy: It is Hibernate 5 physical naming strategy fully qualified name.

spring.jpa.hibernate.use-new-id-generator-mappings: It is used for Hibernate `IdentifierGenerator` for AUTO, TABLE and SEQUENCE.

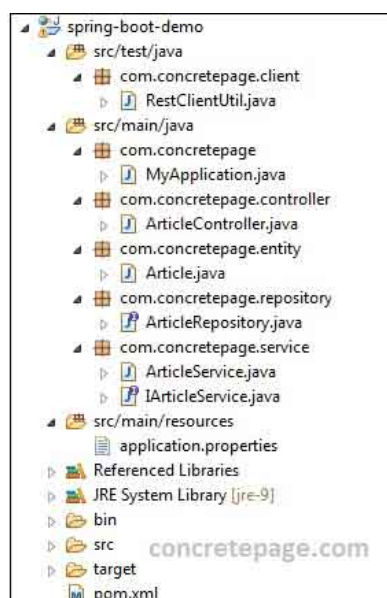
spring.jpa.open-in-view: The default value is **true**. It binds a JPA `EntityManager` to the thread for the entire processing of the request.

spring.jpa.properties.*: It sets additional native properties to set on the JPA provider.

spring.jpa.show-sql: It enables logging of SQL statements. Default value is **false**.

8. Spring Boot REST + Spring Boot Data CrudRepository + JPA + Hibernate + MySQL CRUD Example

Find the project structure of our demo project.



Find the MySQL database table used in our example.

Database Table

```

CREATE DATABASE IF NOT EXISTS `concretepage`;
USE `concretepage`;

CREATE TABLE IF NOT EXISTS `articles` (
  `article_id` bigint(5) NOT NULL AUTO_INCREMENT,
  `title` varchar(200) NOT NULL,

```

```

`category` varchar(100) NOT NULL,
PRIMARY KEY (`article_id`)
) ENGINE=InnoDB;

INSERT INTO `articles` (`article_id`, `title`, `category`) VALUES
(1, 'Java Concurrency', 'Java'),
(2, 'Spring Boot Getting Started', 'Spring Boot'),
(3, 'Lambda Expressions Java 8 Example', 'Java 8');

```

Now find the complete code.

ArticleRepository.java

```

package com.concretepage.repository;
import java.util.List;
import org.springframework.data.repository.CrudRepository;
import com.concretepage.entity.Article;
public interface ArticleRepository extends CrudRepository<Article, Long> {
    List<Article> findByTitle(String title);
    List<Article> findDistinctByCategory(String category);
    List<Article> findByTitleAndCategory(String title, String category);
}

```

Article.java

```

package com.concretepage.entity;
import java.io.Serializable;
import javax.persistence.Column;
import javax.persistence.Entity;
import javax.persistence.GeneratedValue;
import javax.persistence.GenerationType;
import javax.persistence.Id;
import javax.persistence.Table;
@Entity
@Table(name="articles")
public class Article implements Serializable {
    private static final long serialVersionUID = 1L;
    @Id
    @GeneratedValue(strategy=GenerationType.AUTO)
    @Column(name="article_id")
    private long articleId;
    @Column(name="title")
    private String title;
    @Column(name="category")
    private String category;
    public long getArticleId() {
        return articleId;
    }
    public void setArticleId(long articleId) {
        this.articleId = articleId;
    }
    public String getTitle() {
        return title;
    }
    public void setTitle(String title) {
        this.title = title;
    }
    public String getCategory() {
        return category;
    }
    public void setCategory(String category) {
        this.category = category;
    }
}

```

IArticleService.java

```

package com.concretepage.service;
import java.util.List;

```

```
import com.concretepage.entity.Article;

public interface IArticleService {

    List<Article> getAllArticles();
    Article getArticleById(long articleId);
    boolean addArticle(Article article);
    void updateArticle(Article article);
    void deleteArticle(int articleId);

}
```

ArticleService.java

```
package com.concretepage.service;

import java.util.ArrayList;
import java.util.List;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.stereotype.Service;
import com.concretepage.entity.Article;
import com.concretepage.repository.ArticleRepository;

@Service
public class ArticleService implements IArticleService {

    @Autowired
    private ArticleRepository articleRepository;

    @Override
    public Article getArticleById(long articleId) {
        Article obj = articleRepository.findById(articleId).get();
        return obj;
    }

    @Override
    public List<Article> getAllArticles(){
        List<Article> list = new ArrayList<>();
        articleRepository.findAll().forEach(e -> list.add(e));
        return list;
    }

    @Override
    public synchronized boolean addArticle(Article article){
        List<Article> list = articleRepository.findByTitleAndCategory(article.getTitle(), ar
        if (list.size() > 0) {
            return false;
        } else {
            articleRepository.save(article);
            return true;
        }
    }

    @Override
    public void updateArticle(Article article) {
        articleRepository.save(article);
    }

    @Override
    public void deleteArticle(int articleId) {
        articleRepository.delete(getArticleById(articleId));
    }

}
```

ArticleController.java

```
package com.concretepage.controller;

import java.util.List;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.http.HttpHeaders;
import org.springframework.http.HttpStatus;
import org.springframework.http.ResponseEntity;
import org.springframework.stereotype.Controller;
import org.springframework.web.bind.annotation.DeleteMapping;
import org.springframework.web.bind.annotation.GetMapping;
import org.springframework.web.bind.annotation.PathVariable;
import org.springframework.web.bind.annotation.PostMapping;
import org.springframework.web.bind.annotation.PutMapping;
```

```

import org.springframework.web.bind.annotation.RequestBody;
import org.springframework.web.bind.annotation.RequestMapping;
import org.springframework.web.util.UriComponentsBuilder;
import com.concretepage.entity.Article;
import com.concretepage.service.IArticleService;
@Controller
@RequestMapping("user")
public class ArticleController {
    @Autowired
    private IArticleService articleService;
    @GetMapping("article/{id}")
    public ResponseEntity<Article> getArticleById(@PathVariable("id") Integer id) {
        Article article = articleService.getArticleById(id);
        return new ResponseEntity<Article>(article, HttpStatus.OK);
    }
    @GetMapping("articles")
    public ResponseEntity<List<Article>> getAllArticles() {
        List<Article> list = articleService.getAllArticles();
        return new ResponseEntity<List<Article>>(list, HttpStatus.OK);
    }
    @PostMapping("article")
    public ResponseEntity<Void> addArticle(@RequestBody Article article, UriComponentsBuilder builder) {
        boolean flag = articleService.addArticle(article);
        if (flag == false) {
            return new ResponseEntity<Void>(HttpStatus.CONFLICT);
        }
        HttpHeaders headers = new HttpHeaders();
        headers.setLocation(builder.path("/article/{id}").buildAndExpand(article.getId()));
        return new ResponseEntity<Void>(headers, HttpStatus.CREATED);
    }
    @PutMapping("article")
    public ResponseEntity<Article> updateArticle(@RequestBody Article article) {
        articleService.updateArticle(article);
        return new ResponseEntity<Article>(article, HttpStatus.OK);
    }
    @DeleteMapping("article/{id}")
    public ResponseEntity<Void> deleteArticle(@PathVariable("id") Integer id) {
        articleService.deleteArticle(id);
        return new ResponseEntity<Void>(HttpStatus.NO_CONTENT);
    }
}

```

MyApplication.java

```

package com.concretepage;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
@SpringBootApplication
public class MyApplication {
    public static void main(String[] args) {
        SpringApplication.run(MyApplication.class, args);
    }
}

```

9. Client Code with RestTemplate

RestClientUtil.java

```

package com.concretepage.client;
import java.net.URI;
import org.springframework.http.HttpEntity;
import org.springframework.http.HttpHeaders;
import org.springframework.http.HttpMethod;
import org.springframework.http.MediaType;
import org.springframework.http.ResponseEntity;
import org.springframework.web.client.RestTemplate;
import com.concretepage.entity.Article;

```



```

public class RestClientUtil {
    public void getArticleByIdDemo() {
        HttpHeaders headers = new HttpHeaders();
        headers.setContentType(MediaType.APPLICATION_JSON);
        RestTemplate restTemplate = new RestTemplate();
        String url = "http://localhost:8080/user/article/{id}";
        HttpEntity<String> requestEntity = new HttpEntity<String>(headers);
        ResponseEntity<Article> responseEntity = restTemplate.exchange(url, HttpMethod.GET, requestEntity, Article.class);
        Article article = responseEntity.getBody();
        System.out.println("Id:"+article.getArticleId()+"", Title:"+article.getTitle()
            +", Category:"+article.getCategory());
    }

    public void getAllArticlesDemo() {
        HttpHeaders headers = new HttpHeaders();
        headers.setContentType(MediaType.APPLICATION_JSON);
        RestTemplate restTemplate = new RestTemplate();
        String url = "http://localhost:8080/user/articles";
        HttpEntity<String> requestEntity = new HttpEntity<String>(headers);
        ResponseEntity<Article[]> responseEntity = restTemplate.exchange(url, HttpMethod.GET, requestEntity, Article[].class);
        Article[] articles = responseEntity.getBody();
        for(Article article : articles) {
            System.out.println("Id:"+article.getArticleId()+"", Title:"+article.getTitle()
                +", Category: "+article.getCategory());
        }
    }

    public void addArticleDemo() {
        HttpHeaders headers = new HttpHeaders();
        headers.setContentType(MediaType.APPLICATION_JSON);
        RestTemplate restTemplate = new RestTemplate();
        String url = "http://localhost:8080/user/article";
        Article objArticle = new Article();
        objArticle.setTitle("Spring REST Security using Hibernate");
        objArticle.setCategory("Spring");
        HttpEntity<Article> requestEntity = new HttpEntity<Article>(objArticle, headers);
        URI uri = restTemplate.postForLocation(url, requestEntity);
        System.out.println(uri.getPath());
    }

    public void updateArticleDemo() {
        HttpHeaders headers = new HttpHeaders();
        headers.setContentType(MediaType.APPLICATION_JSON);
        RestTemplate restTemplate = new RestTemplate();
        String url = "http://localhost:8080/user/article";
        Article objArticle = new Article();
        objArticle.setArticleId(1);
        objArticle.setTitle("Update:Java Concurrency");
        objArticle.setCategory("Java");
        HttpEntity<Article> requestEntity = new HttpEntity<Article>(objArticle, headers);
        restTemplate.put(url, requestEntity);
    }

    public void deleteArticleDemo() {
        HttpHeaders headers = new HttpHeaders();
        headers.setContentType(MediaType.APPLICATION_JSON);
        RestTemplate restTemplate = new RestTemplate();
        String url = "http://localhost:8080/user/article/{id}";
        HttpEntity<Article> requestEntity = new HttpEntity<Article>(headers);
        restTemplate.exchange(url, HttpMethod.DELETE, requestEntity, Void.class, 4);
    }

    public static void main(String args[]) {
        RestClientUtil util = new RestClientUtil();
        //util.getArticleByIdDemo();
        //util.addArticleDemo();
        //util.updateArticleDemo();
        //util.deleteArticleDemo();
        util.getAllArticlesDemo();
    }
}

```

10. Test Application

To test the application, first create table in MySQL as given in the example. Then we can run REST web service in following ways.

1. Using Eclipse: Download the project source code using the download link given at the end of article. Import the project into eclipse. Using command prompt, go to the root folder of the project and run.

```
mvn clean eclipse:eclipse
```

and then refresh the project in eclipse. Run Main class `MyApplication` by clicking **Run as -> Java Application**. Tomcat server will be started.

2. Using Maven Command: Download the project source code. Go to the root folder of the project using command prompt and run the command.

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

Tomcat server will be started.

3. Using Executable JAR: Using command prompt, go to the root folder of the project and run the command.

```
mvn clean package
```

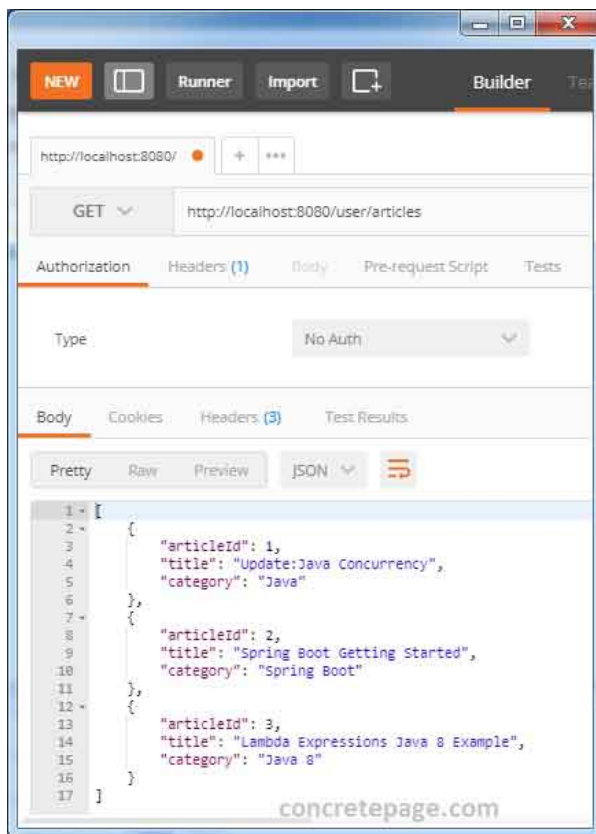
We will get executable JAR `spring-boot-demo-0.0.1-SNAPSHOT.jar` in target folder. Run this JAR as

```
java -jar target/spring-boot-demo-0.0.1-SNAPSHOT.jar
```

Tomcat server will be started.

Now we are ready to test the application. To run client, go to the `RestClientUtil` class in eclipse and click on **Run as -> Java Application**.

We can also test application using **Postman**. Find the print screen.



11. References

[Accessing Data with JPA](#)


[Spring Data CrudRepository Example](#)




[Spring Boot REST + JPA + Hibernate + MySQL Example](#)

12. Download Source Code

[spring-boot-crudrepository-example.zip](#)

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Thanks Aravind.... I'm new to spring boot. Do we need to create two projects to run both client and and service..

Thanks in advance
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How do we pass the whole request and response objects using ResponseEntity and retrieve their values using spring data jpa and insert response values into dB.
Please provide the example if possible.
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