in28minutes

Spring Microservices - Course Guide

Create Microservices with Spring Boot and Spring Cloud in 100 easy steps!

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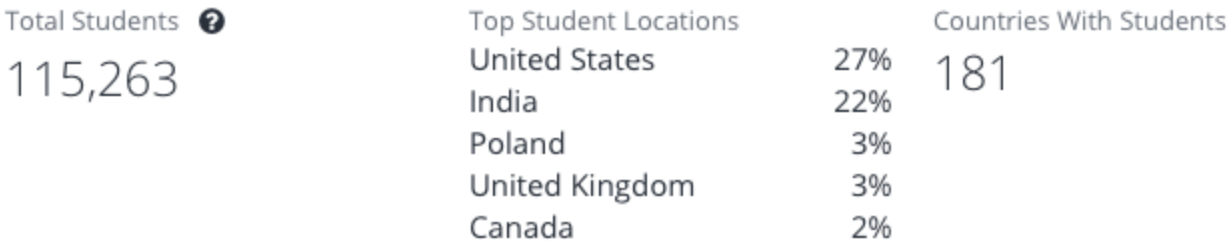
Congratulations

You have made a great choice in learning with in28Minutes. You are joining 150,000+ Learners learning everyday with us.

150,000+ Java beginners are learning from in28Minutes to become experts on APIs, Web Services and Microservices with Spring, Spring Boot and Spring Cloud.

About in28Minutes

How did in28Minutes get to 100,000 learners across the world?



We are focused on creating the awesome course (learning) experiences. Period.

An awesome learning experience?

What's that?

You need to get insight into the in28Minutes world to answer that.

You need to understand "***The in28Minutes Way***"

- What are our beliefs?
- What do we love?
- Why do we do what we do?
- How do we design our courses?

Let's get started on "***The in28Minutes Way***"!

Important Components of "The in28Minutes Way"

- Continuous Learning
- Hands-on
- We don't teach frameworks. We teach building applications!
- We want you to be strong on the fundamentals

- Step By Step

- Efficient and Effective
- Real Project Experiences
- Debugging and Troubleshooting skills
- Modules - Beginners and Experts!
- Focus on Unit Testing
- Code on Github

- Design and Architecture
- Modern Development Practices
- Interview Guides
- Bring the technology trends to you
- Building a connect
- Socially Conscious
- We care for our learners
- We love what we do

Troubleshooting Guide

We love all our 100,000 learners. We want to help you in every way possible.

We do not want you to get stuck because of a simple error.

This 50 page troubleshooting guide and faq is our way of thanking you for choosing to learn from in28Minutes.

.in28Minutes Trouble Shooting Guide

Getting Started

Recommended Versions

Tool/Framework/Language	Recommended Version	More Details
Java	Java 8	http://www.in28minutes.com/spr...
Eclipse	Eclipse Java EE Oxygen	Basics
Spring Boot	Spring Boot 2.0.0.RELEASE	
Spring Cloud	Finchley.M8	

Installation

- Video : https://www.youtube.com/playlist?list=PLBBog2r6uMCSmMVTW_QmDLyASBvovyAO3
- PDF : https://github.com/in28minutes/SpringIn28Minutes/blob/master/InstallationGuide-JavaEclipseAndMaven_v2.pdf
- More Details : https://github.com/in28minutes/getting-started-in-5-steps

Troubleshooting

- A 50 page troubleshooting guide with more than 200 Errors and Questions answered

Spring Microservices - Course Overview

Github Repository :

https://github.com/in28minutes/spring-microservices/

Course Overview

Title	Github	
Introduction To Web Services	None	
Restful Web Services with Spring Boot	Project Folder on Github	
Microservices with Spring Cloud	Project Folder on Github	

2 Bonus Sections - Introduction to Spring Boot and JPA

Title	Category	Github
Spring Boot in 10 Steps	Introduction	Project Folder on Github
JPA in 10 Steps	Introduction	Project Folder on Github

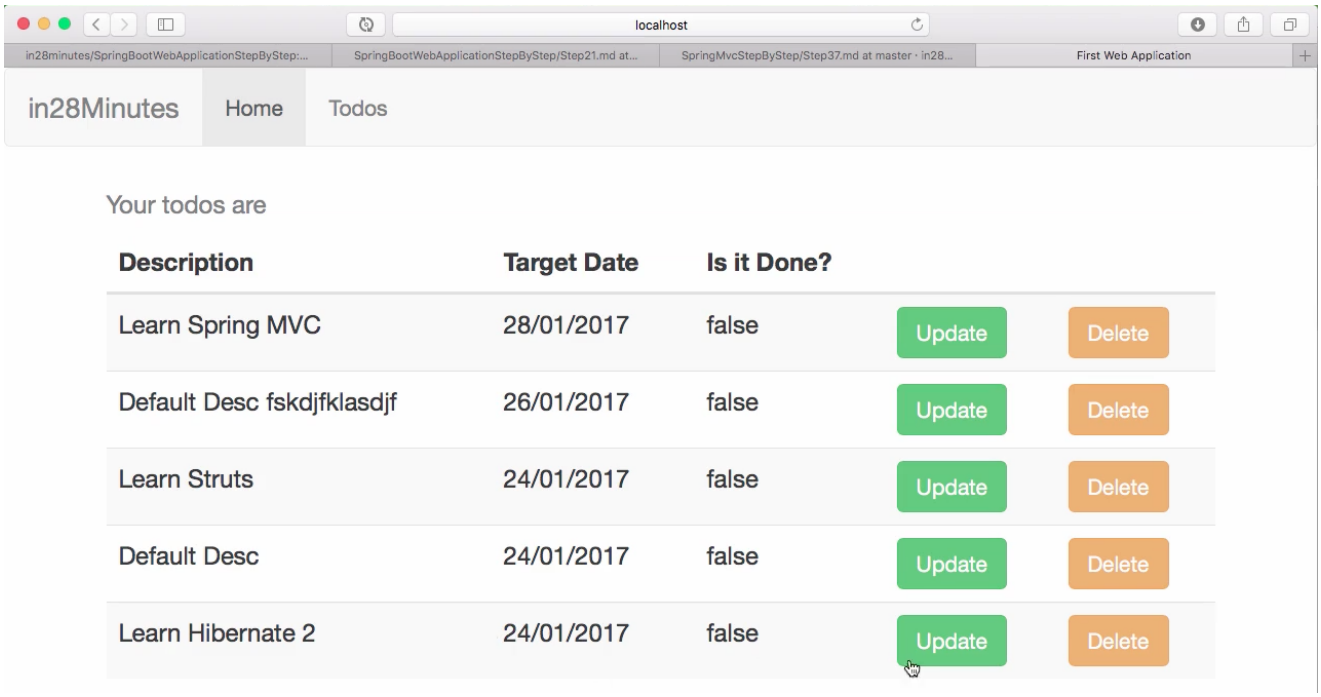
Introduction to Web Services

Introduction to Web Services

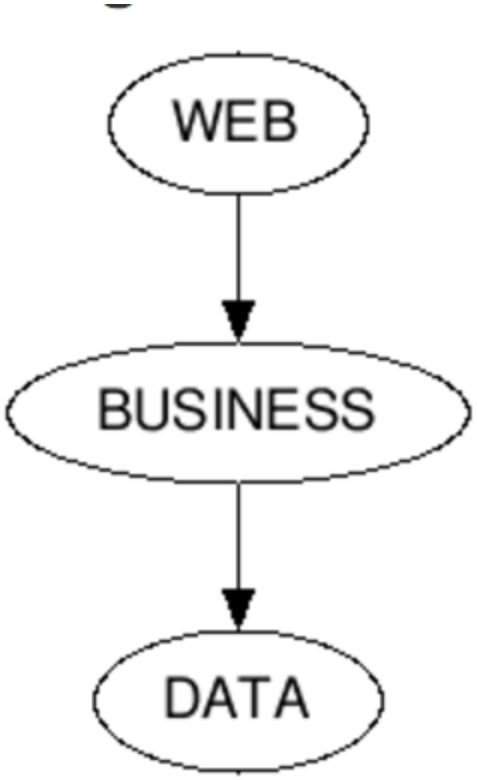
- What is a Web Service?
- Important How Questions related to Web Services
- Web Services - Key Terminology
- Introduction to SOAP Web Services
- Introduction to RESTful Web Services
- SOAP vs RESTful Web Services

Web Service

Service delivered over the web?



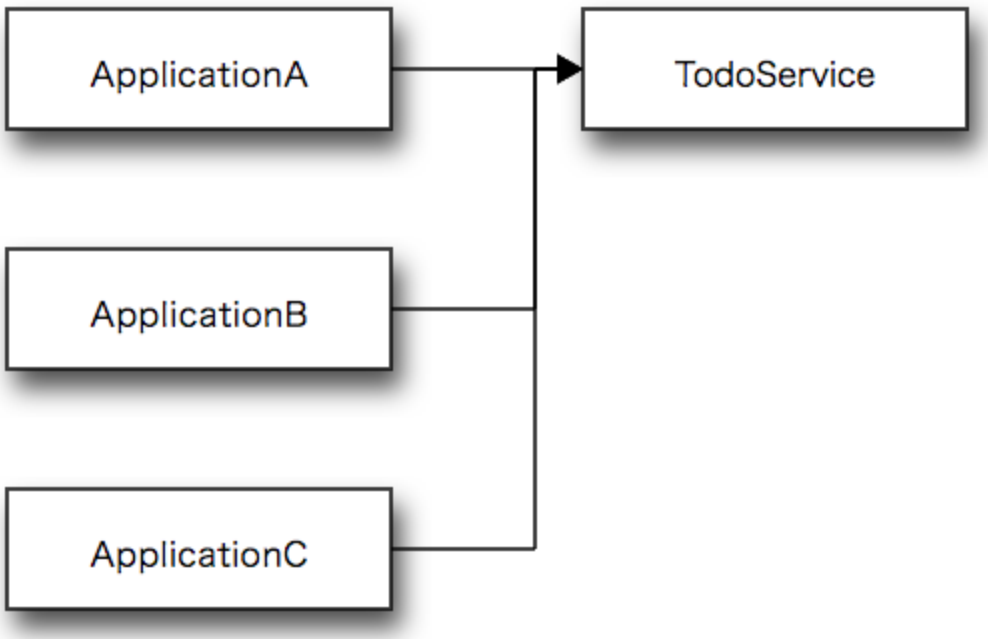
Is the Todo Management Application a Web Service?

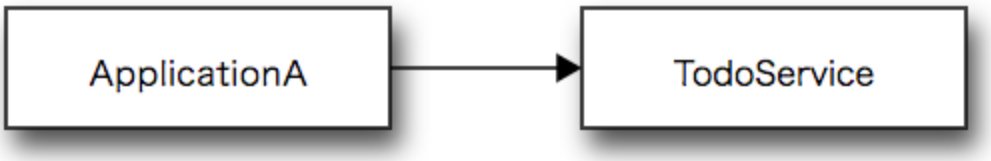
- It delivers HTML output - Not consumable by other applications.
- 

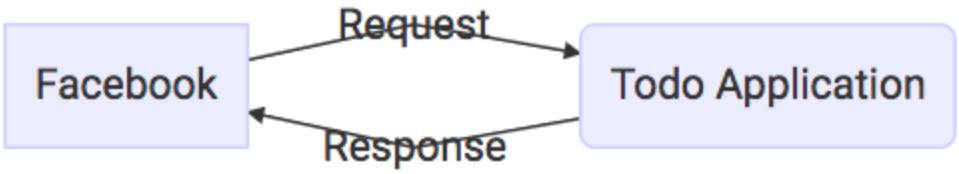
- Can I reuse the Business Layer by creating a JAR?
    - Not Platform independent
    - Communication of Changes
    - Managing Dependencies - like Database

How can I make my Todo application consumable by other applications?

That where we get into the concept of a web service!







Web Service - W3C definition

> *Software system designed to support interoperable machine-to-machine interaction over a network.*

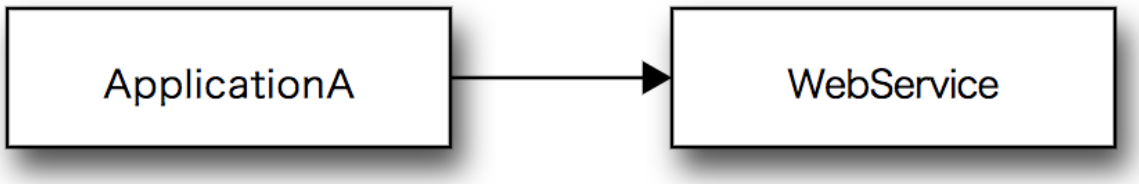
3 Keys

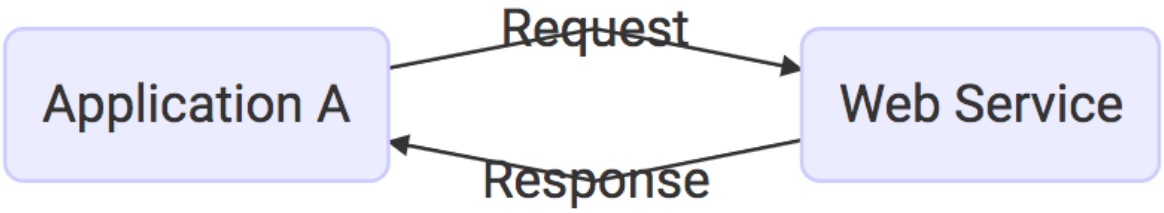
- Designed for machine-to-machine (or application-to-application) interaction

- Should be interoperable - Not platform dependent
- Should allow communication over a network

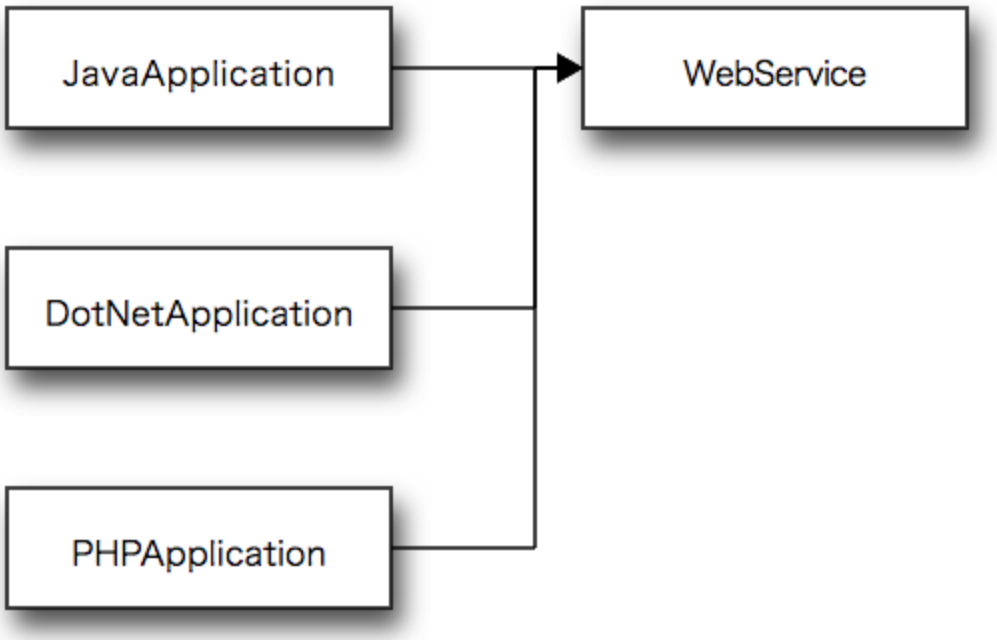
How?

How does data exchange between applications take place?





How can we make web services platform independent?



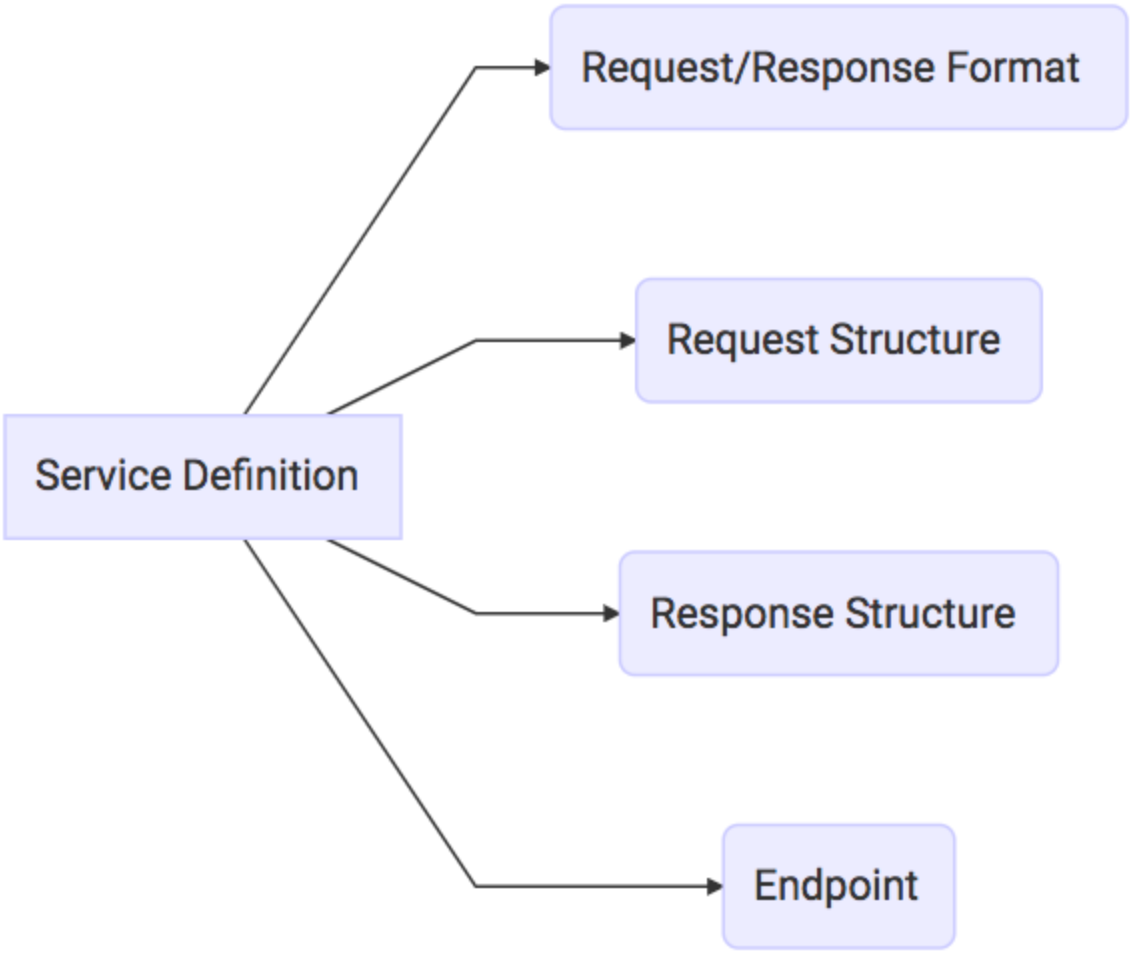
XML

```
        <getCourseDetailsRequest>
            <id>Course1</id>
        </getCourseDetailsRequest>
```

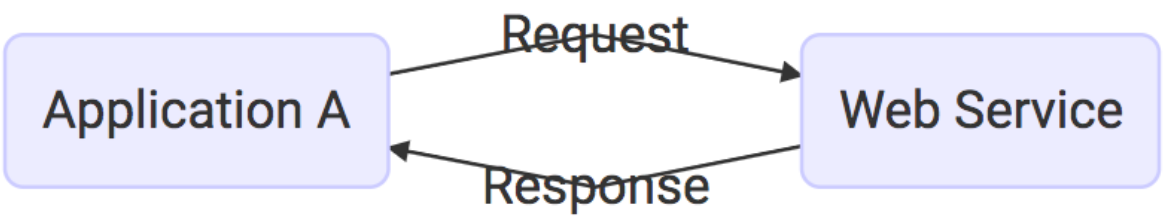
JSON

```
[
  {
    "id": 1,
    "name": "Even",
    "birthDate": "2017-07-10T07:52:48.270+0000"
  },
  {
    "id": 2,
    "name": "Abe",
    "birthDate": "2017-07-10T07:52:48.270+0000"
  }
]
```

How does the Application A know the format of Request and Response?



How does Application A and Web Service convert its internal data to (XML or JSON)?



Key Terminology

- Request and Response

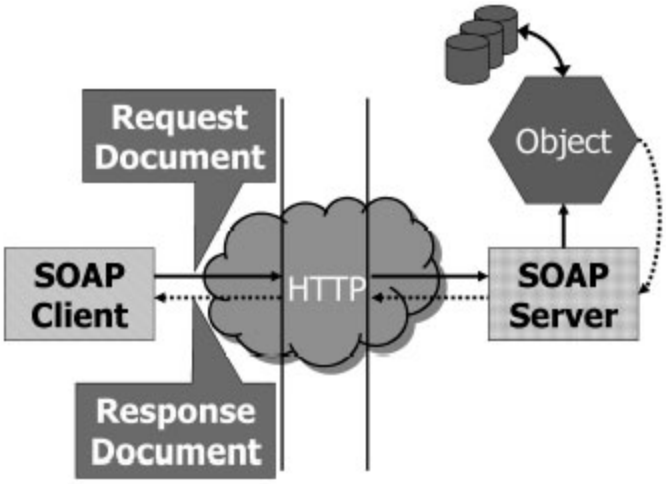
- Message Exchange Format
  - XML and JSON

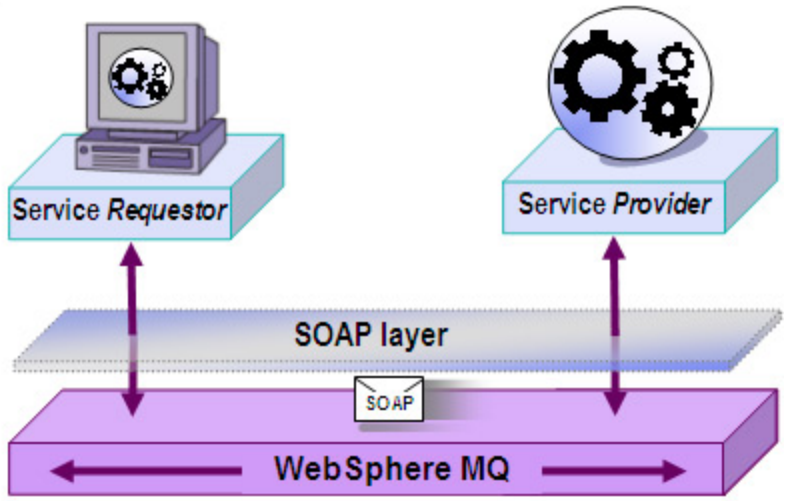
Key Terminology

- Service Provider or Server
- Service Consumer or Client
- Service Definition

Key Terminology

- Transport
  - HTTP and MQ





Web Service Groups

- SOAP-based
- REST-styled

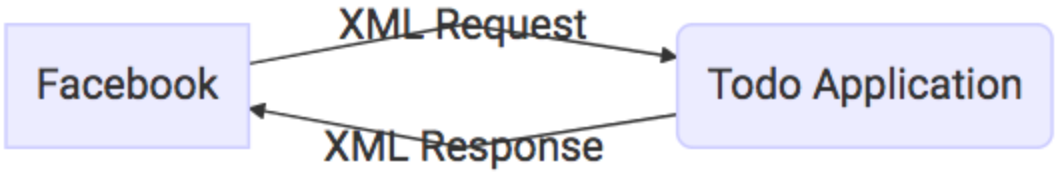
WebSphere MQ is the Message Queue
Like RabbitMQ, Apache Kafka

SOAP and REST are not really comparable.

It is apple to orange comparision

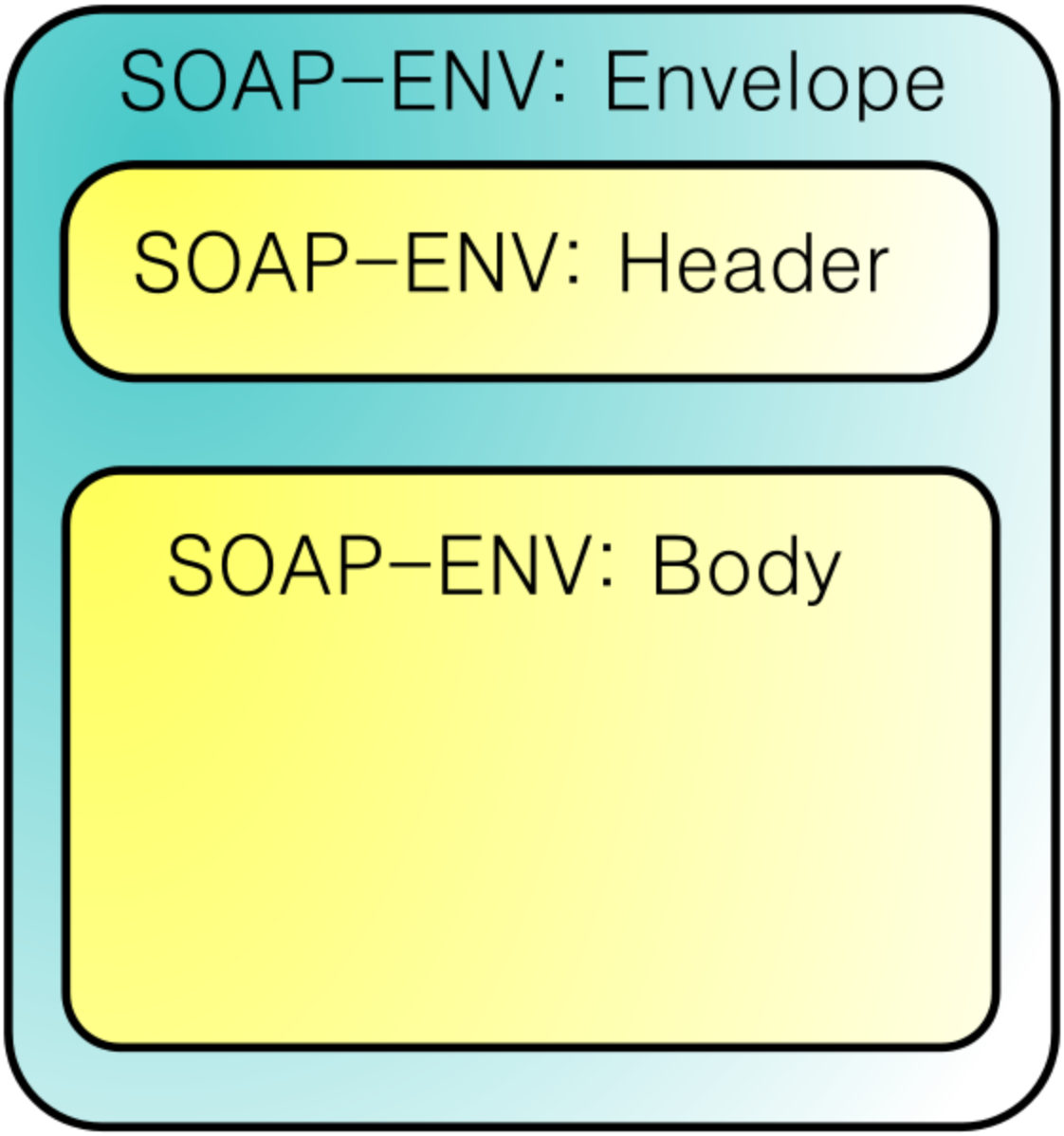
SOAP

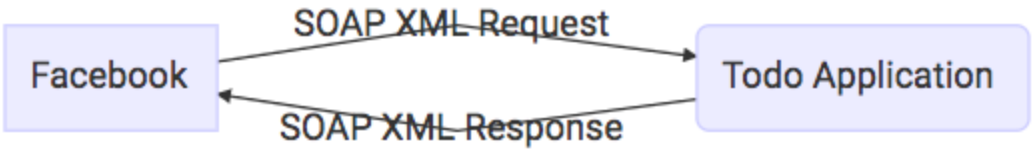
SOAP?




```
<getCourseDetailsRequest>
     <id>Course1</id>
</getCourseDetailsRequest>
```

SOAP STRUCTURE






```
<SOAP-ENV:Envelope xmlns:SOAP-
ENV="http://schemas.xmlsoap.org/soap/envelope/">
    <SOAP-ENV:Header/>
    <SOAP-ENV:Body>
        <ns2:getCourseDetailsResponse
xmlns:ns2="http://in28minutes.com/courses">
            <ns2:course>
```

```
 <ns2:id>Course1</ns2:id>
                <ns2:name>Spring</ns2:name>
                <ns2:description>10 Steps</ns2:description>
            </ns2:course>
        </ns2:getCourseDetailsResponse>
    </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

SOAP

- Format - SOAP XML Request - SOAP XML Response
- Transport
  - SOAP over MQ
  - SOAP over HTTP

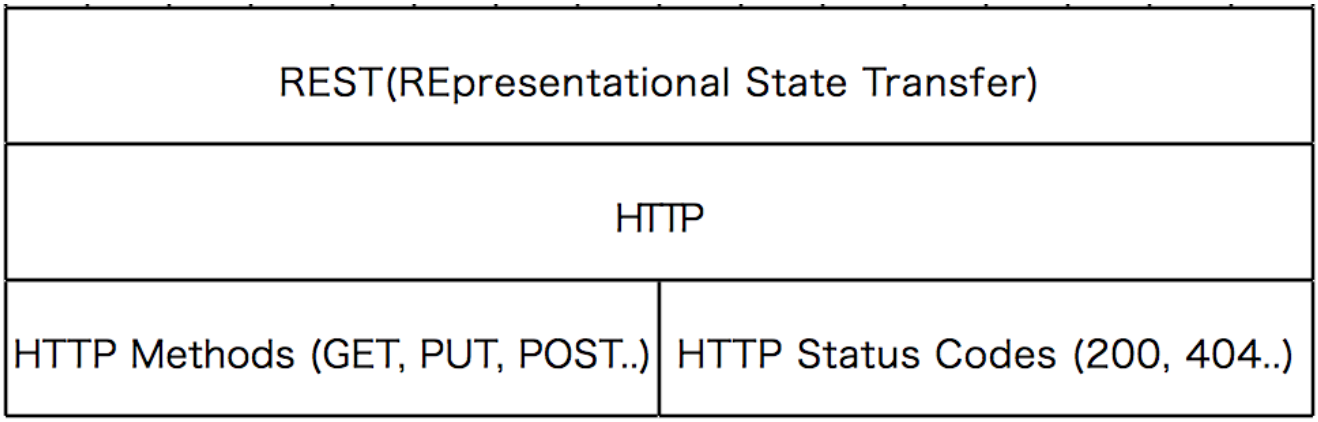
- Service Definition
  - WSDL

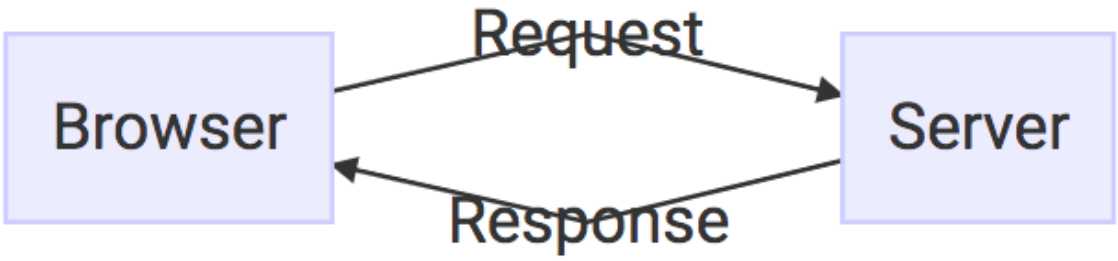
REST

> *REpresentational State Transfer*

> *REST is a style of software architecture for distributed hypermedia systems*

Make best use of HTTP





Key abstraction - Resource

- A resource has an URI (Uniform Resource Identifier)
- /users/Ranga/todos/1
- /users/Ranga/todos
- /users/Ranga
- A resource can have different representations
- XML
- HTML
- JSON

Example

- Create a User - POST /users
- Delete a User - DELETE /users/1
- Get all Users - GET /users
- Get one Users - GET /users/1

REST

- Data Exchange Format - No Restriction. JSON is popular
- Transport
  - Only HTTP
- Service Definition
  - No Standard. WADL/Swagger/...

REST vs SOAP

- Restrictions vs Architectural Approach
- Data Exchange Format
- Service Definition
- Transport

-
- Ease of implementation

```
<SOAP-ENV:Envelope xmlns:SOAP-
ENV="http://schemas.xmlsoap.org/soap/envelope/">
    <SOAP-ENV:Header/>
    <SOAP-ENV:Body>
        <ns2:GetCourseDetailsRequest
xmlns:ns2="http://in28minutes.com/courses">
                <ns2:id>Course1</ns2:id>
         </ns2:GetCourseDetailsRequest>
    </SOAP-ENV:Body>
</SOAP-ENV:Envelope>

<SOAP-ENV:Envelope xmlns:SOAP-
ENV="http://schemas.xmlsoap.org/soap/envelope/">
    <SOAP-ENV:Header/>
    <SOAP-ENV:Body>
        <ns2:GetCourseDetailsResponse
xmlns:ns2="http://in28minutes.com/courses">
            <ns2:CourseDetails>
                <ns2:id>Course1</ns2:id>
                <ns2:name>Spring</ns2:name>
                <ns2:description>10 Steps</ns2:description>
            </ns2:CourseDetails>
         </ns2:GetCourseDetailsResponse>
    </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

Restful Web Services with Spring Boot

Github Folder

https://github.com/in28minutes/spring-microservices/tree/master/02.restful-web-services

Restful Web Services with Spring Boot

- Step 01 - Initializing a RESTful Services Project with Spring Boot
- Step 02 - Understanding the RESTful Services we would create in this course
- Step 03 - Creating a Hello World Service
- Step 04 - Enhancing the Hello World Service to return a Bean
- Step 05 - Quick Review of Spring Boot Auto Configuration and Dispatcher Servlet
- Step 06 - Enhancing the Hello World Service with a Path Variable
- Step 07 - Creating User Bean and User Service
- Step 08 - Implementing GET Methods for User Resource
- Step 09 - Implementing POST Method to create User Resource
- Step 10 - Enhancing POST Method to return correct HTTP Status Code and Location

- Step 11 - Implementing Exception Handling - 404 Resource Not Found
- Step 12 - Implementing Generic Exception Handling for all Resources
- Step 13 - Exercise : User Post Resource and Exception Handling
- Step 14 - Implementing DELETE Method to delete a User Resource
- Step 15 - Implementing Validations for RESTful Services
- Step 16 - Implementing HATEOAS for RESTful Services
- Step 17 - Overview of Advanced RESTful Service Features
- Step 18 - Internationalization for RESTful Services
- Step 19 - Content Negotiation - Implementing Support for XML

- Step 20 - Configuring Auto Generation of Swagger Documentation
- Step 21 - Introduction to Swagger Documentation Format
- Step 22 - Enhancing Swagger Documentation with Custom Annotations
- Step 23 - Monitoring APIs with Spring Boot Actuator
- Step 24 - Implementing Static Filtering for RESTful Service
- Step 25 - Implementing Dynamic Filtering for RESTful Service
- Step 26 - Versioning RESTful Services - Basic Approach with URIs
- Step 27 - Versioning RESTful Services - Header and Content Negotiation Approach
- Step 28 - Implementing Basic Authentication with Spring Security
- Step 29 - Overview of Connecting RESTful Service to JPA
- Step 30 - Creating User Entity and some test data
- Step 31 - Updating GET methods on User Resource to use JPA
- Step 32 - Updating POST and DELETE methods on User Resource to use JPA
- Step 33 - Creating Post Entity and Many to One Relationship with User Entity
- Step 34 - Implementing a GET service to retrieve all Posts of a User
- Step 35 - Implementing a POST service to create a Post for a User
- Step 36 - Richardson Maturity Model
- Step 37 - RESTful Web Services - Best Practices

You will learn

- What is a RESTful Web Service?
- How to implement RESTful Web Services with Spring and Spring Boot?
- What are the best practices in designing RESTful Web Services?
- How to design Resources and GET, POST and DELETE operations?
- How to implement Validation for RESTful Web Services?
- How to implement Exception Handling for RESTful Web Services?
- What is HATEOAS? How to implement HATEOAS for a Resource?

- What are the different approach in versioning RESTful Services?
- How to use Postman to execute RESTful Service Requests?
- How to implement basic authentication with Spring Security?
- How to implement filtering for RESTful Services?
- How to monitor RESTful Services with Spring Boot Actuator?
- How to document RESTful Web Services with Swagger?
- How to connect RESTful Services to a backend with JPA?

Useful Links

- POSTMAN - http://www.getpostman.com

Links from course examples

- Basic Resources
  - http://localhost:8080/hello-world
  - http://localhost:8080/hello-world-bean
  - http://localhost:8080/hello-world/path-variable/Ranga
  - http://localhost:8080/users/
  - http://localhost:8080/users/1

- JPA Resources
  - http://localhost:8080/jpa/users/
  - http://localhost:8080/jpa/users/1
  - http://localhost:8080/jpa/users/10001/posts

- Filtering
  - http://localhost:8080/filtering
  - http://localhost:8080/filtering-list

- Actuator
  - http://localhost:8080/actuator

- Versioning
  - http://localhost:8080/v1/person
  - http://localhost:8080/v2/person
  - http://localhost:8080/person/param
    - params=[version=1]

  - http://localhost:8080/person/param

-
    - params=[version=2]

  - http://localhost:8080/person/header
    - headers=[X-API-VERSION=1]

  - http://localhost:8080/person/header
    - headers=[X-API-VERSION=2]

  - http://localhost:8080/person/produces

- produces=[application/vnd.company.app-v1+json]
  - http://localhost:8080/person/produces
    - produces=[application/vnd.company.app-v2+json]
- Swagger
  - http://localhost:8080/swagger-ui.html
  - http://localhost:8080/v2/api-docs
- H2-Console
  - http://localhost:8080/h2-console

Error in the Log

```
Resolved exception caused by Handler execution:
org.springframework.http.converter.HttpMessageNotWritableException:
No converter found for return value of type:
class
com.in28minutes.rest.webservices.restfulwebservices.HelloWorldBean
```

- This happened because there were no getters in HelloWorldBean class

Questions to Answer

- What is dispatcher servlet?
- Who is configuring dispatcher servlet?
- What does dispatcher servlet do?
- How does the HelloWorldBean object get converted to JSON?
- Who is configuring the error mapping?

- Mapping servlet: 'dispatcherServlet' to [/]

- Mapped "{[/hello-world],methods=[GET]}" onto public java.lang.String com.in28minutes.rest.webservices.restfulwebservices.HelloWorldController.helloWorld()
- Mapped "{[/hello-world-bean],methods=[GET]}" onto public com.in28minutes.rest.webservices.restfulwebservices.HelloWorldBean com.in28minutes.rest.webservices.restfulwebservices.HelloWorldController.helloWorldBean()

- Mapped “{[/error]}” onto public org.springframework.http.ResponseEntity<java.util.Map<java.lang.String, java.lang.Object» org.springframework.boot.autoconfigure.web.servlet.error.BasicErrorController.error(javax.servlet.http.HttpServletRequest)
- Mapped “{[/error],produces=[text/html]}” onto public org.springframework.web.servlet.ModelAndView org.springframework.boot.autoconfigure.web.servlet.error.BasicErrorController.errorHtml(javax.servlet.http.HttpServletRequest,javax.servlet.http.HttpServletResponse)

Example Requests

GET http://localhost:8080/users

```
[
    {
        "id": 1,
        "name": "Adam",
        "birthDate": "2017-07-19T04:40:20.796+0000"
    },
    {
        "id": 2,
        "name": "Eve",
        "birthDate": "2017-07-19T04:40:20.796+0000"
    },
    {
        "id": 3,
        "name":

 "Jack",
        "birthDate": "2017-07-19T04:40:20.796+0000"
    }
]
```

GET http://localhost:8080/users/1

```
{
    "id":
```

```
 1,
    "name": "Adam",
    "birthDate": "2017-07-19T04:40:20.796+0000"
}
```

POST http://localhost:8080/users

```
{
    "name": "Ranga",
    "birthDate": "2000-07-19T04:29:24.054+0000"
}
```

GET http://localhost:8080/users/1000

- Get request to a non existing resource.
- The response shows default error message structure auto configured by Spring Boot.

```
{
    "timestamp": "2017-07-19T05:28:37.534+0000",
    "status": 404,
    "error": "Not Found",
    "message": "id-500",
    "path": "/users/500"
}
```

GET http://localhost:8080/users/1000

- Get request to a non existing resource.
- The response shows a Customized Message Structure

```
{
  "timestamp": "2017-07-19T05:31:01.961+0000",
  "message":  "id-500",
  "details": "Any details you would want to add"
```

- ```
  }
  ```

POST http://localhost:8080/users with Validation Errors

Request
  ```

```
{
    "name": "R",
    "birthDate": "2000-07-19T04:29:24.054+0000"
}
```

Response - 400 Bad Request

```
{
    "timestamp": "2017-07-19T09:00:27.912+0000",
    "message": "Validation Failed",
    "details":
"org.springframework.validation.BeanPropertyBindingResult:
1 errors\nField error in object 'user' on field 'name':
rejected value [R]; codes
[Size.user.name,Size.name,Size.java.lang.String,Size];
arguments
[org.springframework.context.support.DefaultMessageSourceRe
solvable: codes [user.name,name]; arguments []; default
message [name],2147483647,2]; default message [Name should
have atleast 2 characters]"
}
```

GET http://localhost:8080/users/1 with HATEOAS

```
{
    "id": 1,
    "name": "Adam",
    "birthDate": "2017-07-19T09:26:18.337+0000",
    "_links": {
        "all-users": {
            "href": "http://localhost:8080/users"
        }
    }
}
```

XML Representation of Resources

GET http://localhost:8080/users

- Accept application/xml

```
<List>
    <item>
        <id>2</id>
         <name>Eve</name>
        <birthDate>2017-07-19T10:25:20.450+0000</birthDate>
    </item>
    <item>
        <id>3</id>
        <name>Jack</name>
        <birthDate>2017-07-19T10:25:20.450+0000</birthDate>
    </item>
    <item>
        <id>4</id>
        <name>Ranga</name>
        <birthDate>2017-07-19T10:25:20.450+0000</birthDate>
    </item>
</List>
```

POST http://localhost:8080/users

- Accept : application/xml
- Content-Type : application/xml

Request

```
<item>
        <name>Ranga</name>
        <birthDate>2017-07-19T10:25:20.450+0000</birthDate>
</item>
```

Response

- Status - 201 Created

Generating Swagger Documentation

```
  public static final Contact DEFAULT_CONTACT = new
Contact(
      "Ranga Karanam", "http://www.in28minutes.com",
```

```
 "in28minutes@gmail.com");

  public static final ApiInfo DEFAULT_API_INFO = new
ApiInfo(
      "Awesome API Title", "Awesome API Description",
"1.0",
      "urn:tos", DEFAULT_CONTACT,
      "Apache 2.0",
"http://www.apache.org/licenses/LICENSE-2.0");

  private static final Set<String>
DEFAULT_PRODUCES_AND_CONSUMES =
      new HashSet<String>(Arrays.asList("application/json",
          "application/xml"));

  @Bean
  public Docket api() {
    return new Docket(DocumentationType.SWAGGER_2)
        .apiInfo(DEFAULT_API_INFO)
        .produces(DEFAULT_PRODUCES_AND_CONSUMES)
        .consumes(DEFAULT_PRODUCES_AND_CONSUMES);
  }
```

Resource Method description

```
  @GetMapping("/users/{id}")
  @ApiOperation(value = "Finds Users by  id",
    notes = "Also returns a link to retrieve all users with
rel - all-users")
  public Resource<User> retrieveUser(@PathVariable int id)
{
```

API Model

```
@ApiModel(value="User Details", description="Contains all
details of a user")
public class User
```

```
 {

  @Size(min=2, message="Name should have atleast 2
characters")
  @ApiModelProperty(notes = "Name should have atleast 2
characters")
  private String name;

  @Past
  @ApiModelProperty(notes = "Birth Date should be in the
Past")
  private Date birthDate;
```

Filtering

Code

```
@JsonIgnoreProperties(value={"field1"})
public class SomeBean {

  private String field1;

  @JsonIgnore
  private String field2;

  private String field3;
```

Response

```
{
    "field3": "value3"
}
```

Versioning

- Media type versioning (a.k.a “content negotiation” or “accept header”)
  - GitHub
- (Custom) headers versioning
  - Microsoft

- URI Versioning
  - Twitter

- Request Parameter versioning
  - Amazon

- Factors
- URI Pollution
- Misuse of HTTP Headers
- Caching
- Can we execute the request on the browser?
- API Documentation
- No Perfect Solution

More

- https://www.mnot.net/blog/2011/10/25/web_api_versioning_smackdown
- http://urthen.github.io/2013/05/09/ways-to-version-your-api/
- http://stackoverflow.com/questions/389169/best-practices-for-api-versioning
- http://www.lexicalscope.com/blog/2012/03/12/how-are-rest-apis-versioned/
- https://www.3scale.net/2016/06/api-versioning-methods-a-brief-reference/

Table Structure

```
create table user (
id integer not null,
birth_date timestamp,
name varchar(255),
primary key (id) );

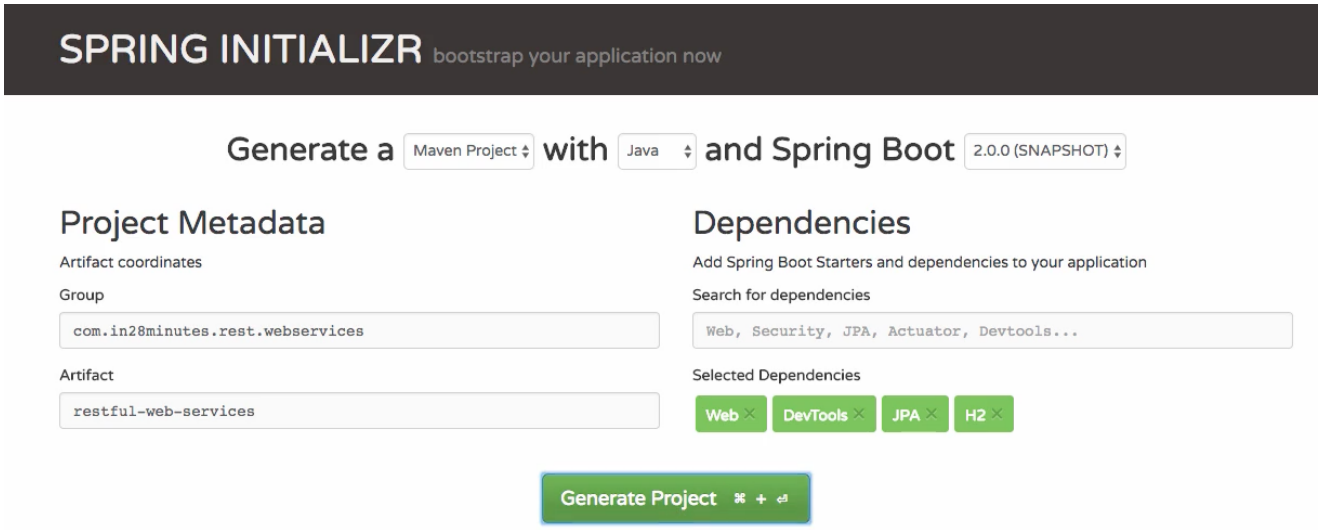
create table post (
id integer not null,
description varchar(255),
user_id integer,
primary key (id) );

alter table post
add constraint post_to_user_foreign_key foreign key
(user_id) references user;
```

Step 01 - Initializing a RESTful Services Project with Spring Boot

Creating a Spring Project with Spring Initializr is a cake walk.

> *Spring Initializr http://start.spring.io/ is great tool to bootstrap your Spring Boot projects.*



As shown in the image above, following steps have to be done

- Launch Spring Initializr and choose the following
  - Choose `com.in28minutes.rest.webservices` as Group
  - Choose `restful-web-services` as Artifact
  - Choose Release >= 2.0.0 (Avoid SNAPSHOT!)
  - Choose following dependencies
    - Web
    - DevTools
    - JPA
    - H2
- Click Generate Project.
- Import the project into Eclipse.
- If you want to understand all the files that are

- part of this project, you can go here.

Step 02 - Understanding the RESTful Services we would create in this course

Social Media Application Resource Mappings

User -> Posts

- Retrieve all Users - GET /users
- Create a User - POST /users
- Retrieve one User - GET /users/{id} -> /users/1
- Delete a User - DELETE /users/{id} -> /users/1

- Retrieve all posts for a User - GET /users/{id}/posts
- Create a posts for a User - POST /users/{id}/posts
- Retrieve details of a post - GET /users/{id}/posts/{post_id}

Step 03 - Creating a Hello World Service

```
@RestController
public class HelloWorldController {

  @GetMapping(path = "/hello-world")
  public String helloWorld() {
    return "Hello World";
  } }
```

Step 04 - Enhancing the Hello World Service to return a Bean

```
  @GetMapping(path = "/hello-world-bean")
  public HelloWorldBean helloWorldBean() {
    return new HelloWorldBean("Hello  World");
  }
```

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/HelloWorldBean.java New

```
package
```

```
com.in28minutes.rest.webservices.restfulwebservices;
public class HelloWorldBean {

 private String message;

 public HelloWorldBean(String message) {
   this.message = message;
 }

 public String getMessage() {
   return message;
 }

 public void setMessage(String message) {
   this.message = message;
 }

 @Override
 public String toString() {
   return String.format("HelloWorldBean [message=%s]",
message);
 }
}
```

Step 05 - Quick Review of Spring Boot Auto Configuration and Dispatcher Servlet

Let us understand Spring Boot Auto Configuration in depth
- http://www.springboottutorial.com/spring-boot-auto-configuration

Step 06 - Enhancing the Hello World Service with a Path Variable

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/HelloWorldController.java

```
package
com.in28minutes.rest.webservices.restfulwebservices;

import org.springframework.web.bind.annotation.GetMapping;
import
org.springframework.web.bind.annotation.PathVariable;
import
org.springframework.web.bind.annotation.RestController;

//Controller
@RestController
public class HelloWorldController {

  @GetMapping(path = "/hello-world")
  public String helloWorld() {
    return "Hello World";
  }

  @GetMapping(path = "/hello-world-bean")
  public HelloWorldBean helloWorldBean() {
    return new HelloWorldBean("Hello World");
   }

  ///hello-world/path-variable/in28minutes
  @GetMapping(path = "/hello-world/path-variable/{name}")
  public HelloWorldBean
helloWorldPathVariable(@PathVariable String name) {
    return new HelloWorldBean(String.format("Hello World,
%s",  name));
  }


}
```

/src/main/resources/application.properties Modified

New Lines

```
logging.level.org.springframework = info
```

Step 07 - Creating User Bean and User Service

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/HelloWorldBean.java

Package Change

```
package
com.in28minutes.rest.webservices.restfulwebservices.hellowo
rld;
```

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/HelloWorldController.java

Package Change

```
package
com.in28minutes.rest.webservices.restfulwebservices.hellowo
rld;
```

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/user/User.java New

```
package
com.in28minutes.rest.webservices.restfulwebservices.user;

import java.util.Date;

public class User {

  private Integer  id;

  private String

 name;

  private Date birthDate;

  public User(Integer id, String name, Date birthDate)
```

```
{
   super();
   this.id = id;
   this.name = name;
   this.birthDate = birthDate;
 }

 public Integer getId() {
   return id;
 }

 public void setId(Integer id) {
   this.id = id;
 }

 public String getName() {
   return name;
 }

 public void setName(String name) {
   this.name = name;
  }

 public Date getBirthDate() {
   return birthDate;
 }

 public void setBirthDate(Date birthDate) {
   this.birthDate = birthDate;
  }



@Override
 public String toString() {
   return String.format("User [id=%s, name=%s,
```

```
 birthDate=%s]", id, name, birthDate);
  }

}
```

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/user/UserDaoService.java New

```
package
com.in28minutes.rest.webservices.restfulwebservices.user;

import java.util.ArrayList;
import java.util.Date;
import java.util.List;

import org.springframework.stereotype.Component;

@Component
public class UserDaoService {
  private static List<User> users = new ArrayList<>();

  private static int usersCount =  3;

  static {
    users.add(new User(1, "Adam", new Date()));
    users.add(new User(2, "Eve", new Date()));
    users.add(new User(3, "Jack", new Date()));
  }

  public List<User> findAll() {
    return users;
   }

  public User save(User user)

 {
    if (user.getId() == null)
```

```
 {
      user.setId(++usersCount);
    }
    users.add(user);
    return user;
  }

  public User findOne(int id) {
    for (User user : users) {
      if (user.getId() == id) {
        return user;
      }
    }
    return null;
  }

}
```

Step 08 - Implementing GET Methods for User Resource

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/user/UserResource.java New

```
package
com.in28minutes.rest.webservices.restfulwebservices.user;

import java.util.List;

import
org.springframework.beans.factory.annotation.Autowired;
import org.springframework.web.bind.annotation.GetMapping;
import
org.springframework.web.bind.annotation.PathVariable;
import
org.springframework.web.bind.annotation.RestController;

@RestController
```

```
public class UserResource {

  @Autowired
  private UserDaoService service;

  @GetMapping("/users")
  public List<User> retrieveAllUsers() {
    return service.findAll();
  }

  @GetMapping("/users/{id}")
  public User retrieveUser(@PathVariable int id) {
    return service.findOne(id);
  }

}
```

/src/main/resources/application.properties Modified

New Lines

```
#This is not really needed as this is the default after
2.0.0.RELEASE spring.jackson.serialization.write-dates-as-
timestamps=false
```

Step 09 - Implementing POST Method to create User Resource

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/user/UserResource.java Modified

```
  // input - details of user
  // output - CREATED & Return the created URI
  @PostMapping("/users")
  public void createUser(@RequestBody User  user){
    User savedUser = service.save(user);
  }
```

Step 10 - Enhancing POST Method to return correct HTTP Status Code and Location

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/user/UserResource.java Modified

```
  // input - details of user
  // output - CREATED & Return the created URI
  @PostMapping("/users")
  public ResponseEntity<Object> createUser(@RequestBody
User user) {
    User savedUser = service.save(user);
    // CREATED
    // /user/{id}     savedUser.getId()

    URI location = ServletUriComponentsBuilder
      .fromCurrentRequest()
      .path("/{id}")
      .buildAndExpand(savedUser.getId()).toUri();

    return  ResponseEntity.created(location).build();

  }
```

Step 11 - Implementing Exception Handling - 404 Resource Not Found

Step 12 - Implementing Generic Exception Handling for all Resources

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/exception/CustomizedResponseEntityExceptionHandler.java New

```
package
com.in28minutes.rest.webservices.restfulwebservices.exception;

import java.util.Date;
```

```
import org.springframework.http.HttpStatus;
import org.springframework.http.ResponseEntity;
import
org.springframework.web.bind.annotation.ControllerAdvice;
import
org.springframework.web.bind.annotation.ExceptionHandler;
import
org.springframework.web.bind.annotation.RestController;
import org.springframework.web.context.request.WebRequest;
import
org.springframework.web.servlet.mvc.method.annotation.Respo
nseEntityExceptionHandler;

import
com.in28minutes.rest.webservices.restfulwebservices.user.Us
erNotFoundException;

@ControllerAdvice
@RestController
public class CustomizedResponseEntityExceptionHandler
extends ResponseEntityExceptionHandler  {

  @ExceptionHandler(Exception.class)
  public final ResponseEntity<Object>
handleAllExceptions(Exception ex, WebRequest request) {
    ErrorDetails errorDetails = new ErrorDetails(new
Date(), ex.getMessage(),
        request.getDescription(false));
    return new ResponseEntity(errorDetails,
HttpStatus.INTERNAL_SERVER_ERROR);
  }

   @ExceptionHandler(UserNotFoundException.class)
  public final ResponseEntity<Object>
handleUserNotFoundException(UserNotFoundException ex,
WebRequest request) {
    ErrorDetails errorDetails = new ErrorDetails(new

 Date(),
```

```
 ex.getMessage(),
        request.getDescription(false));
    return new ResponseEntity(errorDetails,
HttpStatus.NOT_FOUND);
  }

}
```

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/exception/ErrorDetails.java New

```
package
com.in28minutes.rest.webservices.restfulwebservices.exception;

import java.util.Date;

public class ErrorDetails {
  private Date timestamp;
  private String message;
  private String  details;

  public ErrorDetails(Date timestamp, String message,
String details) {
    super();
    this.timestamp = timestamp;
    this.message = message;
    this.details = details;
  }

  public Date getTimestamp() {
    return timestamp;
   }

  public String getMessage() {
    return message;
```

```
 }

  public String getDetails() {
    return details;
  }

}
```

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/user/UserNotFoundException.java New

```
package
com.in28minutes.rest.webservices.restfulwebservices.user;

import org.springframework.http.HttpStatus;
import
org.springframework.web.bind.annotation.ResponseStatus;

@ResponseStatus(HttpStatus.NOT_FOUND) public class
UserNotFoundException extends RuntimeException {
  public UserNotFoundException(String message) {
    super(message);
  }
}
```

Step 13 - Exercise : User Post Resource and Exception Handling

Step 14 - Implementing DELETE Method to delete a User Resource

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/user/UserDaoService.java Modified

```
   public User deleteById(int id) {
    Iterator<User> iterator = users.iterator();
    while (iterator.hasNext()) {
      User user =
```

```
 iterator.next();
      if (user.getId() == id) {
        iterator.remove();
        return user;
      }
    }
    return null;
  }
```

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/user/UserResource.java Modified

```
  @GetMapping("/users/{id}")
  public User retrieveUser(@PathVariable int id) {
    User user = service.findOne(id);

     if(user==null)
      throw new UserNotFoundException("id-"+ id);

    return user;
  }

  @DeleteMapping("/users/{id}")
  public void deleteUser(@PathVariable int id) {
    User user = service.deleteById(id);

    if(user==null)
      throw new UserNotFoundException("id-"+ id);
  }

  //
  // input - details of user
  // output - CREATED & Return the created  URI
  @PostMapping("/users")
  public ResponseEntity<Object> createUser(@RequestBody
User user)
```

```
 {
    User savedUser = service.save(user);
    // CREATED
    // /user/{id}     savedUser.getId()

    URI location = ServletUriComponentsBuilder
      .fromCurrentRequest()
      .path("/{id}")
      .buildAndExpand(savedUser.getId()).toUri();

    return ResponseEntity.created(location).build();

  }
```

Step 15 - Implementing Validations for RESTful Services

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/exception/CustomizedResponseEntityExceptionHandler.java Modified

```
@Override
protected ResponseEntity<Object>
handleMethodArgumentNotValid(MethodArgumentNotValidExceptio
n ex,
    HttpHeaders headers, HttpStatus status, WebRequest
request) {
  ErrorDetails errorDetails = new ErrorDetails(new Date(),
"Validation Failed",
      ex.getBindingResult().toString());
  return new ResponseEntity(errorDetails,
HttpStatus.BAD_REQUEST);
}
```

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/user/User.java Modified

```
  @Size(min=2, message="Name should have atleast 2
characters")
  private String
```

```
 name;

  @Past
  private Date birthDate;
```

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/user/UserResource.java Modified

```
public ResponseEntity<Object> createUser(@Valid
@RequestBody User user) {
```

Step 16 - Implementing HATEOAS for RESTful Services

/pom.xml Modified

```
    <dependency>
       <groupId>org.springframework.boot</groupId>
      <artifactId>spring-boot-starter-hateoas</artifactId>
    </dependency>
```

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/user/UserResource.java Modified

```
  @GetMapping("/users/{id}")
  public Resource<User> retrieveUser(@PathVariable int id)
{
    User user = service.findOne(id);

    if(user==null)
      throw new UserNotFoundException("id-"+ id);


    //"all-users", SERVER_PATH + "/users"
    //retrieveAllUsers
    Resource<User> resource = new  Resource<User>(user);

    ControllerLinkBuilder linkTo  =
```

```
 linkTo(methodOn(this.getClass()).retrieveAllUsers());

    resource.add(linkTo.withRel("all-users"));

    //HATEOAS

    return resource;
  }


  //HATEOAS

  @PostMapping("/users")
  public ResponseEntity<Object> createUser(@Valid
@RequestBody User user) {
    User savedUser = service.save(user);
    // CREATED
    // /user/{id}     savedUser.getId()

    URI location = ServletUriComponentsBuilder
      .fromCurrentRequest()
      .path("/{id}")
      .buildAndExpand(savedUser.getId()).toUri();

    return ResponseEntity.created(location).build();

  }
```

Step 17 - Overview of Advanced RESTful Service Features

- Step 18 - Internationalization for RESTful Services
- Step 19 - Content Negotiation - Implementing Support for XML
- Step 20 - Configuring Auto Generation of Swagger Documentation
- Step 21 - Introduction to Swagger Documentation Format
- Step 22 - Enhancing Swagger Documentation with Custom Annotations

- Step 23 - Monitoring APIs with Spring Boot Actuator
- Step 24 - Implementing Static Filtering for RESTful Service
- Step 25 - Implementing Dynamic Filtering for RESTful Service
- Step 26 - Versioning RESTful Services - Basic Approach with URIs
- Step 27 - Versioning RESTful Services - Header and Content Negotiation Approach
- Step 28 - Implementing Basic Authentication with Spring Security

Step 18 - Internationalization for RESTful Services

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/RestfulWebServicesApplication.java Modified

New Lines

```
import java.util.Locale; import
org.springframework.context.annotation.Bean;
import
org.springframework.context.support.ResourceBundleMessageSource;
import org.springframework.web.servlet.LocaleResolver;
import
org.springframework.web.servlet.i18n.SessionLocaleResolver;

  @Bean
  public LocaleResolver localeResolver() {
    SessionLocaleResolver localeResolver = new
SessionLocaleResolver();
    localeResolver.setDefaultLocale(Locale.US);
    return localeResolver;
  }

  @Bean
  public ResourceBundleMessageSource messageSource()  {
    ResourceBundleMessageSource messageSource = new
ResourceBundleMessageSource();
     messageSource.setBasename("messages");
    return messageSource;
  }
```

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/helloworld/HelloWorldController.java Modified

New Lines

```
import java.util.Locale;
import
org.springframework.beans.factory.annotation.Autowired;
import org.springframework.context.MessageSource;
import
org.springframework.web.bind.annotation.RequestHeader;

@Autowired private MessageSource messageSource;

@GetMapping(path = "/hello-world-internationalized")
public String helloWorldInternationalized(
    @RequestHeader(name="Accept-Language", required=false)
Locale locale) {
  return messageSource.getMessage("good.morning.message",
null, locale);
}
```

/src/main/resources/messages.properties New

```
good.morning.message=Good Morning
```

/src/main/resources/messages_fr.properties New

```
good.morning.message=Bonjour
```

/src/main/resources/messages_nl.properties New

```
good.morning.message=Goede Morgen
```

Step 18 Part 2 - Simplifying Internationalization for RESTful Services

Use AcceptHeaderLocaleResolver

```
@SpringBootApplication
public class RestfulWebServicesApplication {

  ....

  @Bean
  public LocaleResolver localeResolver() {
    AcceptHeaderLocaleResolver localeResolver = new
AcceptHeaderLocaleResolver();
    localeResolver.setDefaultLocale(Locale.US);
    return localeResolver;
  }
```

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/helloworld/HelloWorldController.java

```
@GetMapping(path = "/hello-world-internationalized")
  public String helloWorldInternationalized() {
    return messageSource.getMessage("good.morning.message",
null,
                  LocaleContextHolder.getLocale());
  }
```

Use MessageSource configuration from application.properties

```
spring.messages.basename=messages
```

Step 19 - Content Negotiation - Implementing Support for XML

/pom.xml Modified

New Lines

```
     <dependency>
      <groupId>com.fasterxml.jackson.dataformat</groupId>
      <artifactId>jackson-dataformat-xml</artifactId>
    </dependency>
```

Step 20 - Configuring Auto Generation of Swagger Documentation

Step 21 - Introduction to Swagger Documentation Format

Step 22 - Enhancing Swagger Documentation with Custom Annotations

/pom.xml Modified

New Lines

```
     <dependency>
      <groupId>io.springfox</groupId>
      <artifactId>springfox-swagger2</artifactId>
      <version>2.4.0</version>
    </dependency>

    <dependency>
      <groupId>io.springfox</groupId>
      <artifactId>springfox-swagger-ui</artifactId>
      <version>2.4.0</version>
    </dependency>
```

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/SwaggerConfig.java New

```
package
com.in28minutes.rest.webservices.restfulwebservices;
 import java.util.Arrays; import java.util.HashSet;
import java.util.Set;

import org.springframework.context.annotation.Bean;
import
org.springframework.context.annotation.Configuration;

import springfox.documentation.service.ApiInfo;
```

```
import springfox.documentation.service.Contact;
import springfox.documentation.spi.DocumentationType;
import springfox.documentation.spring.web.plugins.Docket;
import
springfox.documentation.swagger2.annotations.EnableSwagger2
;

@Configuration
@EnableSwagger2
public class SwaggerConfig {

  public static final Contact DEFAULT_CONTACT = new
Contact(
      "Ranga Karanam", "http://www.in28minutes.com",
"in28minutes@gmail.com");

  public static final ApiInfo DEFAULT_API_INFO = new
ApiInfo(
      "Awesome API Title", "Awesome API Description",
"1.0",
      "urn:tos", DEFAULT_CONTACT,
      "Apache 2.0",
"http://www.apache.org/licenses/LICENSE-2.0");

  private static final Set<String>
DEFAULT_PRODUCES_AND_CONSUMES =
      new HashSet<String>(Arrays.asList("application/json",
            "application/xml"));

  @Bean
  public Docket api() {
    return new Docket(DocumentationType.SWAGGER_2)
        .apiInfo(DEFAULT_API_INFO)
        .produces(DEFAULT_PRODUCES_AND_CONSUMES)
        .consumes(DEFAULT_PRODUCES_AND_CONSUMES);
  }
```

```
}
```

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/UserApiDocumentationConfig.java New

```
package
com.in28minutes.rest.webservices.restfulwebservices;

import io.swagger.annotations.Contact;
import io.swagger.annotations.ExternalDocs;
import io.swagger.annotations.Info;
import io.swagger.annotations.License; import
io.swagger.annotations.SwaggerDefinition;

@SwaggerDefinition(
        info = @Info(
                description = "Awesome Resources",
                version = "V12.0.12",
                title = "Awesome Resource API",
                contact = @Contact(
                   name = "Ranga Karanam",
                   email = "ranga.karanam@in28minutes.com",
                   url = "http://www.in28minutes.com"
                ),
                license = @License(
                   name = "Apache  2.0",
                   url =
"http://www.apache.org/licenses/LICENSE-2.0"
                )
        ),
        consumes = {"application/json", "application/xml"},
        produces = {"application/json", "application/xml"},
        schemes = {SwaggerDefinition.Scheme.HTTP,
SwaggerDefinition.Scheme.HTTPS},
        externalDocs = @ExternalDocs(value = "Read This For
Sure", url = "http://in28minutes.com")
```

```
)
public interface UserApiDocumentationConfig {

}
```

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/user/User.java Modified

```
@ApiModel(description="All details about the user. ")
public class User  {

  private Integer id;

  @Size(min=2, message="Name should have atleast 2
characters")
  @ApiModelProperty(notes="Name should have atleast 2
characters")
  private String name;

  @Past
  @ApiModelProperty(notes="Birth date should be in the
past")
  private Date birthDate;
```

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/user/UserResource.java Modified

```
   @GetMapping("/users/{id}")
  public Resource<User> retrieveUser(@PathVariable int id)
{
    User user = service.findOne(id);

    if(user==null)
      throw new UserNotFoundException("id-"+ id);


    //"all-users", SERVER_PATH +
```

```
 "/users"
    //retrieveAllUsers
    Resource<User> resource = new Resource<User>(user);

    ControllerLinkBuilder linkTo =

linkTo(methodOn(this.getClass()).retrieveAllUsers());

    resource.add(linkTo.withRel("all-users"));

    //HATEOAS

    return resource;
  }
```

Step 23 - Monitoring APIs with Spring Boot Actuator

/pom.xml Modified

New Lines

```
    <dependency>
       <groupId>org.springframework.boot</groupId>
      <artifactId>spring-boot-starter-actuator</artifactId>
    </dependency>

     <dependency>
      <groupId>org.springframework.data</groupId>
      <artifactId>spring-data-rest-hal-browser</artifactId>
    </dependency>
```

application.properties Modified

```
management.endpoints.web.exposure.include=*
```

Step 24 - Implementing Static Filtering for RESTful Service

Step 25 - Implementing Dynamic Filtering for RESTful Service

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/UserApiDocumentationConfig.java Deleted

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/filtering/FilteringController.java New

```
package
com.in28minutes.rest.webservices.restfulwebservices.filteri
ng;

import java.util.Arrays;
import java.util.List;

import
org.springframework.http.converter.json.MappingJacksonValue
;
import org.springframework.web.bind.annotation.GetMapping;
import
org.springframework.web.bind.annotation.RestController;

import com.fasterxml.jackson.databind.ser.FilterProvider;
import
com.fasterxml.jackson.databind.ser.impl.SimpleBeanPropertyF
ilter; import
com.fasterxml.jackson.databind.ser.impl.SimpleFilterProvide
r;

@RestController public class FilteringController {

  // field1,field2
  @GetMapping("/filtering")
  public MappingJacksonValue retrieveSomeBean() {
    SomeBean someBean = new SomeBean("value1", "value2",
"value3");

    SimpleBeanPropertyFilter filter =
SimpleBeanPropertyFilter.filterOutAllExcept("field1",
```

```
 "field2");

    FilterProvider filters = new
SimpleFilterProvider().addFilter("SomeBeanFilter", filter);

    MappingJacksonValue mapping = new
MappingJacksonValue(someBean);

    mapping.setFilters(filters);

    return mapping;
  }

  // field2, field3
  @GetMapping("/filtering-list")
  public MappingJacksonValue retrieveListOfSomeBeans() {
    List<SomeBean> list = Arrays.asList(new
SomeBean("value1", "value2", "value3"),
        new SomeBean("value12", "value22", "value32"));

    SimpleBeanPropertyFilter filter =
SimpleBeanPropertyFilter.filterOutAllExcept("field2",
"field3");

    FilterProvider filters = new
SimpleFilterProvider().addFilter("SomeBeanFilter", filter);

    MappingJacksonValue mapping = new
MappingJacksonValue(list);

    mapping.setFilters(filters);

    return mapping;
  }

}
```

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/filtering/SomeBean.java New

```
package
com.in28minutes.rest.webservices.restfulwebservices.filteri
ng;

import com.fasterxml.jackson.annotation.JsonFilter;
 @JsonFilter("SomeBeanFilter")
public class SomeBean {

  private String field1;

  private String field2;

  private String field3;

  public SomeBean(String field1, String field2, String
field3) {
    super();
    this.field1 = field1;
    this.field2 =  field2;
    this.field3 = field3;
  }

  public String getField1() {
    return field1;
   }

  public void setField1(String field1) {
    this.field1 = field1;
  }

  public String getField2() {
    return field2;
```

```
 }

  public void setField2(String field2) {
    this.field2 = field2;
  }

  public String getField3()  {
    return field3;
  }

  public void setField3(String field3) {
    this.field3 = field3;
  }

}
```

Step 26 - Versioning RESTful Services - Basic Approach with URIs

Step 27 - Versioning RESTful Services - Header and Content Negotiation Approach

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/versioning/Name.java New

```
package
com.in28minutes.rest.webservices.restfulwebservices.version
ing;

public class Name  {
  private String firstName;
  private String lastName;

  public Name() {
  }

  public Name(String firstName, String lastName) {
```

```
 super();
    this.firstName = firstName;
    this.lastName = lastName;
   }

  public String getFirstName() {
    return firstName;
  }

  public void setFirstName(String firstName) {
    this.firstName = firstName;
  }

  public String getLastName() {
    return lastName;
  }

  public void setLastName(String lastName) {
    this.lastName =  lastName;
  }

}
```

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/versioning/PersonV1.java New

```
package
com.in28minutes.rest.webservices.restfulwebservices.versioning;
 public class PersonV1 {
  private String name;

  public PersonV1() {
    super();
  }

  public PersonV1(String name)
```

```
 {


 super();
    this.name =  name;
  }

  public String getName() {
    return name;
  }

  public void setName(String name) {
    this.name = name;
  }


}
```

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/versioning/PersonV2.java New

```
package
com.in28minutes.rest.webservices.restfulwebservices.version
ing;

public class PersonV2 {
  private Name name;

  public PersonV2() {
    super();
  }

  public PersonV2(Name name)  {
    super();
    this.name = name;
  }

  public Name getName()
```

```
 {
    return name;


 }

  public void setName(Name name) {
    this.name = name;
  }

}
```

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/versioning/PersonVersioningController.java New

```
package
com.in28minutes.rest.webservices.restfulwebservices.versioning;

import org.springframework.web.bind.annotation.GetMapping;
import
org.springframework.web.bind.annotation.RestController;
 @RestController
public class PersonVersioningController {

  @GetMapping("v1/person")
  public PersonV1 personV1() {
    return new PersonV1("Bob Charlie");
  }

  @GetMapping("v2/person")
  public PersonV2 personV2() {
    return new PersonV2(new Name("Bob", "Charlie"));
   }

  @GetMapping(value = "/person/param", params =
"version=1")
  public PersonV1 paramV1()
```

```
 {
    return new PersonV1("Bob Charlie");


 }

  @GetMapping(value = "/person/param", params =
"version=2")
  public PersonV2 paramV2() {
    return new PersonV2(new Name("Bob", "Charlie"));
  }

  @GetMapping(value = "/person/header", headers = "X-API-
VERSION=1")
  public PersonV1 headerV1() {
    return new PersonV1("Bob Charlie");
  }

  @GetMapping(value = "/person/header", headers = "X-API-
VERSION=2")
  public PersonV2 headerV2()  {
    return new PersonV2(new Name("Bob", "Charlie"));
  }

  @GetMapping(value = "/person/produces", produces =
"application/vnd.company.app-v1+json")
  public PersonV1 producesV1() {
    return new PersonV1("Bob Charlie");
  }

  @GetMapping(value = "/person/produces", produces =
"application/vnd.company.app-v2+json")
  public PersonV2 producesV2() {
    return new PersonV2(new Name("Bob",  "Charlie"));
  }
```

```
}
```

Step 28 - Implementing Basic Authentication with Spring Security

/pom.xml Modified

New Lines

```
    <dependency>
      <groupId>org.springframework.boot</groupId>
      <artifactId>spring-boot-starter-security</artifactId>
    </dependency>
```

/src/main/resources/application.properties Modified

New Lines

```
spring.security.filter.dispatcher-types=request
spring.security.user.name=username
spring.security.user.password=password
```

Step 29 - Overview of Connecting RESTful Service to JPA

- Step 30 - Creating User Entity and some test data
- Step 31 - Updating GET methods on User Resource to use JPA
- Step 32 - Updating POST and DELETE methods on User Resource to use JPA
- Step 33 - Creating Post Entity and Many to One Relationship with User Entity
- Step 34 - Implementing a GET service to retrieve all Posts of a User
- Step 35 - Implementing a POST service to create a Post for a User

Step 30 - Creating User Entity and some test data

Step 31 - Updating GET methods on User Resource to use JPA

Step 32 - Updating POST and DELETE methods on User Resource to use JPA

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/user/User.java Modified

New Lines

```
@ApiModel(description="All details about the user. ")

@Entity
public class User {

  @Id
  @GeneratedValue
  private Integer id;
```

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/user/UserJPAResource.java New

```
package
com.in28minutes.rest.webservices.restfulwebservices.user;

import static
org.springframework.hateoas.mvc.ControllerLinkBuilder.linkT
o; import static
org.springframework.hateoas.mvc.ControllerLinkBuilder.metho
dOn;

import java.net.URI;
import java.util.List;
import java.util.Optional;

import javax.validation.Valid;

import
org.springframework.beans.factory.annotation.Autowired;
import org.springframework.hateoas.Resource; import
org.springframework.hateoas.mvc.ControllerLinkBuilder;
import org.springframework.http.ResponseEntity;
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.RequestBody;

import
org.springframework.web.bind.annotation.RestController;
import
org.springframework.web.servlet.support.ServletUriComponent
sBuilder;

@RestController
public class UserJPAResource {

  @Autowired
  private UserDaoService service;

  @Autowired
  private UserRepository  userRepository;

  @GetMapping("/jpa/users")
  public List<User> retrieveAllUsers() {
    return userRepository.findAll();
  }

  @GetMapping("/jpa/users/{id}")
  public Resource<User> retrieveUser(@PathVariable int id)
{
    Optional<User> user = userRepository.findById(id);

    if(!user.isPresent())
      throw new UserNotFoundException("id-"+  id);

    //"all-users", SERVER_PATH + "/users"
    //retrieveAllUsers
    Resource<User> resource = new
```

```
 Resource<User>(user.get());

    ControllerLinkBuilder linkTo =


 linkTo(methodOn(this.getClass()).retrieveAllUsers());

    resource.add(linkTo.withRel("all-users"));

    //HATEOAS

    return resource;
  }

  @DeleteMapping("/jpa/users/{id}")
  public void deleteUser(@PathVariable int id) {
    User user =  service.deleteById(id);

    if(user==null)
      throw new UserNotFoundException("id-"+ id);
  }

  //
  // input - details of user
  // output - CREATED & Return the created URI

  //HATEOAS

  @PostMapping("/jpa/users")
  public ResponseEntity<Object> createUser(@Valid
@RequestBody User user) {
    User savedUser =  service.save(user);

    URI location = ServletUriComponentsBuilder
      .fromCurrentRequest()
```

```
 .path("/{id}")
      .buildAndExpand(savedUser.getId()).toUri();

    return ResponseEntity.created(location).build();

  }

}
```

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/user/UserRepository.java New

```
package
com.in28minutes.rest.webservices.restfulwebservices.user;

import
org.springframework.data.jpa.repository.JpaRepository;
import org.springframework.stereotype.Repository;
 @Repository
public interface UserRepository extends JpaRepository<User,
Integer>{

}
```

/src/main/resources/application.properties Modified

New Lines

```
management.endpoints.web.exposure.include=*
spring.jpa.show-sql=true
spring.h2.console.enabled=true
```

/src/main/resources/data.sql New

```
insert into user values(1, sysdate(), 'AB'); insert into
user values(2, sysdate(), 'Jill');
insert into user values(3, sysdate(), 'Jam');
```

Step 33 - Creating Post Entity and Many to One Relationship

with User Entity

Step 34 - Implementing a GET service to retrieve all Posts of a User

Step 35 - Implementing a POST service to create a Post for a User

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/user/Post.java New

```
package
com.in28minutes.rest.webservices.restfulwebservices.user;

import javax.persistence.Entity;
import javax.persistence.FetchType;
import javax.persistence.GeneratedValue; import
javax.persistence.Id;
import javax.persistence.ManyToOne;

import com.fasterxml.jackson.annotation.JsonIgnore;

@Entity
public class Post {

  @Id
  @GeneratedValue
  private Integer id;
  private String description;

  @ManyToOne(fetch=FetchType.LAZY)
  @JsonIgnore
  private User  user;

  public Integer getId() {
    return
```

```
 id;
  }

  public void setId(Integer id) {
    this.id = id;


 }

  public String getDescription()  {
    return description;
  }

  public void setDescription(String description) {
    this.description = description;
  }

  public User getUser()  {
    return user;
  }

  public void setUser(User user) {
    this.user = user;
  }

  @Override
  public String toString() {
    return String.format("Post [id=%s, description=%s]",
id, description);
  }

}
```

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/user/PostRepository.java New

```
package
```

```
 com.in28minutes.rest.webservices.restfulwebservices.user;

import
org.springframework.data.jpa.repository.JpaRepository;
import org.springframework.stereotype.Repository;

@Repository

public interface PostRepository extends JpaRepository<Post,
Integer>{

}
```

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/user/User.java Modified

```
   @OneToMany(mappedBy="user")
  private List<Post> posts;
```

/src/main/java/com/in28minutes/rest/webservices/restfulwebservices/user/UserJPAResource.java Modified

```
@RestController
public class UserJPAResource {

  @Autowired
  private UserRepository userRepository;

  @Autowired
  private PostRepository postRepository;

  @GetMapping("/jpa/users")
  public List<User> retrieveAllUsers() {
    return userRepository.findAll();
```

```
 }

  @GetMapping("/jpa/users/{id}")
  public Resource<User> retrieveUser(@PathVariable int id)
{
    Optional<User> user = userRepository.findById(id);

    if (!user.isPresent())
      throw new UserNotFoundException("id-" +

 id);

    // "all-users", SERVER_PATH + "/users"
    // retrieveAllUsers
    Resource<User> resource = new Resource<User>
(user.get());

    ControllerLinkBuilder linkTo =
linkTo(methodOn(this.getClass()).retrieveAllUsers());

    resource.add(linkTo.withRel("all-users"));

    // HATEOAS

    return resource;
  }

  @DeleteMapping("/jpa/users/{id}")
  public void deleteUser(@PathVariable int id) {
    userRepository.deleteById(id);
  }

  //
  // input - details of user
  // output - CREATED & Return the created
```

```
 URI

  //  HATEOAS

  @PostMapping("/jpa/users")
  public ResponseEntity<Object> createUser(@Valid
@RequestBody User user) {
    User savedUser = userRepository.save(user);

    URI location =
ServletUriComponentsBuilder.fromCurrentRequest().path("/{id
}").buildAndExpand(savedUser.getId())


 .toUri();

    return ResponseEntity.created(location).build();

  }

   @GetMapping("/jpa/users/{id}/posts")
  public List<Post> retrieveAllUsers(@PathVariable int id)
{
    Optional<User> userOptional =
userRepository.findById(id);

    if(!userOptional.isPresent()) {
      throw new UserNotFoundException("id-" + id);
    }

    return userOptional.get().getPosts();
  }


  @PostMapping("/jpa/users/{id}/posts")
  public ResponseEntity<Object> createPost(@PathVariable
int id, @RequestBody Post post)
```

```
 {

    Optional<User> userOptional =
userRepository.findById(id);

    if(!userOptional.isPresent()) {
      throw new UserNotFoundException("id-" + id);
    }

    User user = userOptional.get();

    post.setUser(user);



 postRepository.save(post);

    URI location =
ServletUriComponentsBuilder.fromCurrentRequest().path("/{id
}").buildAndExpand(post.getId())
          .toUri();

    return ResponseEntity.created(location).build();

  }

}
```

/src/main/resources/data.sql Modified

New Lines

```
insert into user values(10001, sysdate(), 'AB');
insert into user values(10002, sysdate(), 'Jill');
insert into user values(10003, sysdate(), 'Jam');
insert into post values(11001, 'My First Post', 10001);
insert into post values(11002, 'My Second Post', 10001);
```

Best Practices with REST

Richardson Maturity Model

Level 0

Expose SOAP web services in REST style

- http://server/getPosts
- http://server/deletePosts
- http://server/doThis

Level 1

- Expose Resources with proper URI
  - http://server/accounts
  - http://server/accounts/10

- Improper use of HTTP Methods

Level 2

- Level 1 + HTTP Methods

Level 3

- Level 2 + HATEOAS
  - Data + Next Possible Actions

Best Practices in RESTful Design

- Consumer First
- Make best use of HTTP
  - Request Methods
    - GET
    - POST
    - PUT

- DELETE

- Response Status
  - 200 - SUCCESS
  - 404 - RESOURCE NOT FOUND
  - 400 - BAD REQUEST
  - 201 - CREATED
  - 401 - UNAUTHORIZED
  - 500 - SERVER ERROR

- No Secure Info in URI
- Use Plurals
  - Prefer /users to /user
  - Prefer /users/1 to /user/1

- Use Nouns for Resources
- For Exceptions
  - Define a Consistent Approach
    - /search
    - PUT /gists/{id}/star
    - DELETE /gists/{id}/star

- Consumer First
- Define Organizational Standards
  - YARAS - https://github.com/darrin/yaras
    - Naming Resources
    - Request Response Structures
    - Common Features Standardization
      - Error Handling
      - Versioning
      - Searching
      - Filtering
      - Support for Mock Responses
      - HATEOAS

- Build a Framework
- Focus on Decentralized Governance

Microservices with Spring Cloud

Microservices with Spring Cloud

- REST
- & Small Well Chosen Deployable Units
- & Cloud Enabled

URLs

Application	URL
Limits Service	http://localhost:8080/limits
Spring Cloud Config Server	http://localhost:8888/limits-service/default http://localhost:8888/limits-service/dev
Currency Converter Service - Direct Call	http://localhost:8100/currency-converter/from/USD/to/INR/
Currency Converter Service - Feign	http://localhost:8100/currency-converter-feign/from/EUR/to/INR/quantity/10000
Currency Exchange Service	http://localhost:8000/currency-exchange/from/EUR/to/INR http://localhost:8001/currency-exchange/from/USD/to/INR
Eureka	http://localhost:8761/
Zuul - Currency Exchange & Exchange Services	http://localhost:8765/currency-exchange-service/currency-exchange/from/EUR/to/INR http://localhost:8765/currency-conversion-service/currency-converter-feign/from/USD/to/INR/quantity/10

VM Argument

-Dserver.port=8001

Zipkin Installation

Quick Start Page

- https://zipkin.io/pages/quickstart

Downloading Zipkin Jar

- https://search.maven.org/remote_content?g=io.zipkin.java&a=zipkin-server&v=LATEST&c=exec

Command to run

```
RABBIT_URI=amqp://localhost java -jar zipkin-server-2.5.2-exec.jar
```

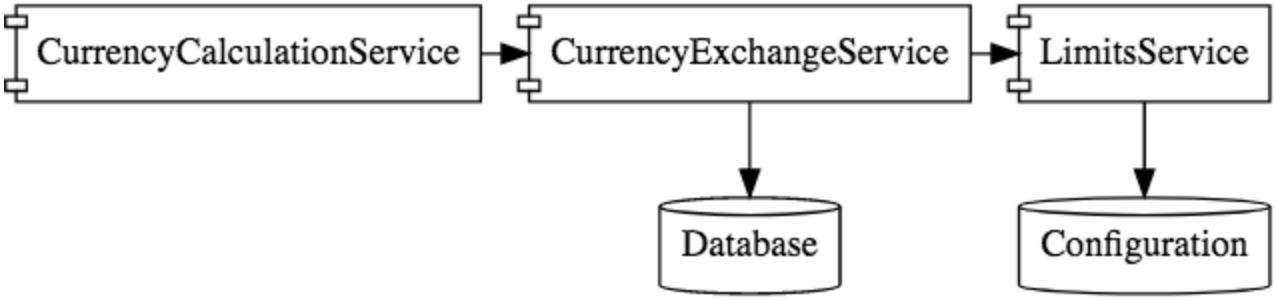
Commands

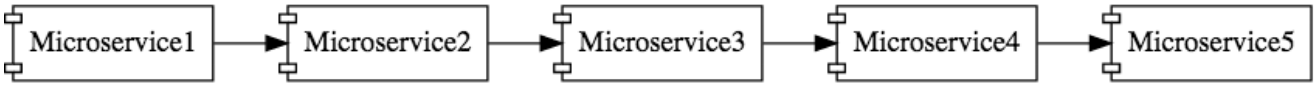
- mkdir git-configuration-repo
- cd git-configuration-repo/
- git init
- git add -A
- git commit -m “first commit”

Ports

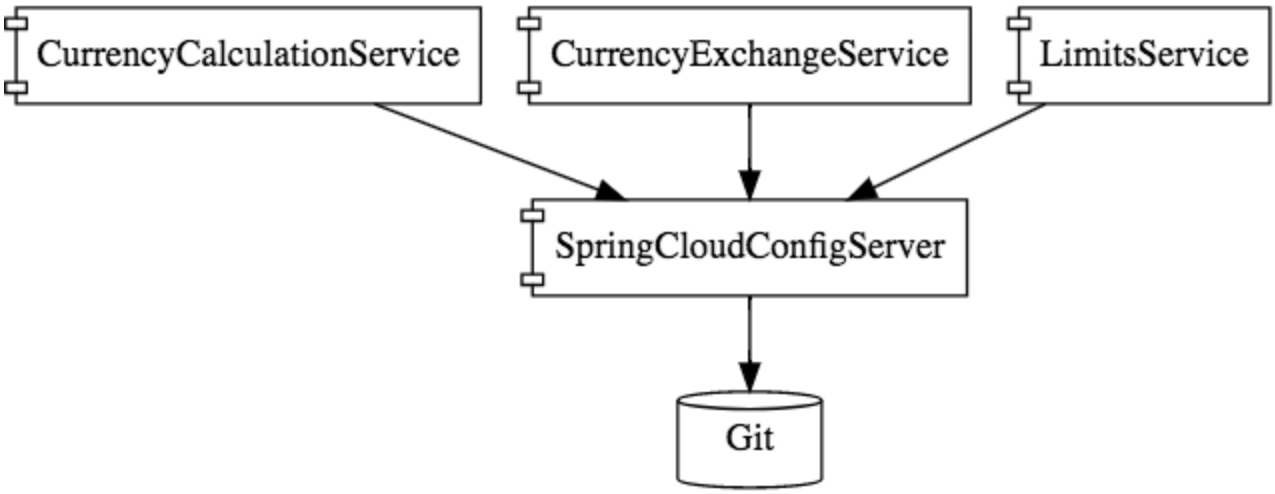
Application	Port
Limits Service	8080, 8081, …
Spring Cloud Config Server	8888
Currency Exchange Service	8000, 8001, 8002, ..
Currency Conversion Service	8100, 8101, 8102, …
Netflix Eureka Naming Server	8761
Netflix Zuul API Gateway Server	8765
Zipkin Distributed Tracing Server	9411

Step by Step Details


CurrencyCalculationService
CurrencyExchangeService
LimitsService
Database
Configuration


Microservice1
Microservice2
Microservice3
Microservice4
Microservice5

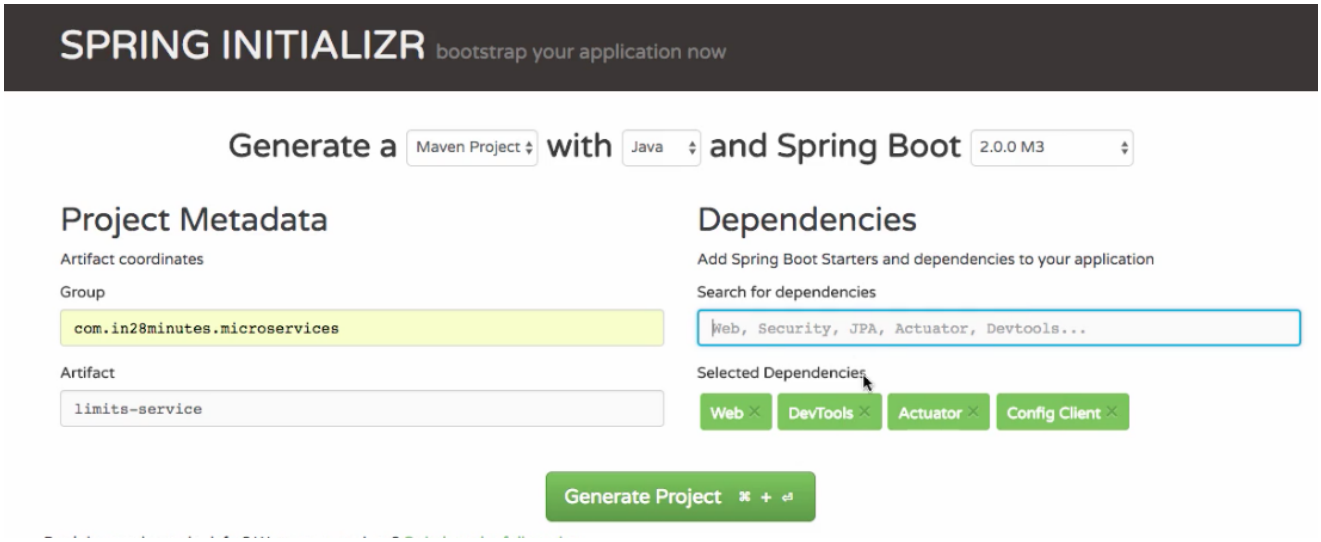
Step 01 - Part 1 - Introduction to Limits Microservice and Spring Cloud Config Server



Step 01 - Part 2 - Setting up Limits Microservice

Creating a Spring Project with Spring Initializr is a cake walk.

> *Spring Initializr http://start.spring.io/ is great tool to bootstrap your Spring Boot projects.*



- Launch Spring Initializr and choose the following
  - Choose Version 2.0.0.RELEASE or greater
  - Choose Group as shown in the figure
  - Choose Artifact as shown in the figure
  - Choose Dependencies as shown in the figure

- Click Generate Project.
- Import the project into Eclipse.

- If you want to understand all the files that are part of this project, you can go here.

Step 02 - Creating a hard coded limits service

Step 03 - Enhance limits service to pick up configuration from application properties

/limits-service/src/main/java/com/in28minutes/microservices/limitsservice/Configuration.java New

```
package com.in28minutes.microservices.limitsservice;

import

 org.springframework.boot.context.properties.ConfigurationProperties;
import org.springframework.stereotype.Component;
```

```
@Component

@ConfigurationProperties("limits-service") public class
Configuration {

  private int minimum;
  private int maximum;

  public void setMinimum(int minimum) {
    this.minimum = minimum;
  }

  public void setMaximum(int maximum) {
    this.maximum = maximum;
  }

  public int getMinimum() {
    return minimum;
  }

  public int getMaximum() {
    return  maximum;
  }

}
```

/limits-service/src/main/java/com/in28minutes/microservices/limitsservice/LimitsConfigurationController.java New

```
package com.in28minutes.microservices.limitsservice;
 import
org.springframework.beans.factory.annotation.Autowired;
import org.springframework.web.bind.annotation.GetMapping;

 import
org.springframework.web.bind.annotation.RestController;
```

```
import
com.in28minutes.microservices.limitsservice.bean.LimitConfi
guration;

 @RestController public class LimitsConfigurationController
{

  @Autowired
  private Configuration configuration;

  @GetMapping("/limits")
  public LimitConfiguration
retrieveLimitsFromConfigurations() {
    return new
LimitConfiguration(configuration.getMaximum(),
        configuration.getMinimum());
  }

}
```

/limits-service/src/main/java/com/in28minutes/microservices/limitsservice/bean/LimitConfiguration.java New

```
package com.in28minutes.microservices.limitsservice.bean;

public class LimitConfiguration {
  private int maximum;
  private int minimum;

  protected LimitConfiguration()  {

  }

  public LimitConfiguration(int maximum, int minimum)  {


 super();
    this.maximum =
```

```
 maximum;
    this.minimum = minimum;


 }

  public int getMaximum()   {
    return  maximum;
  }

  public int getMinimum() {
    return minimum;
  }

}
```

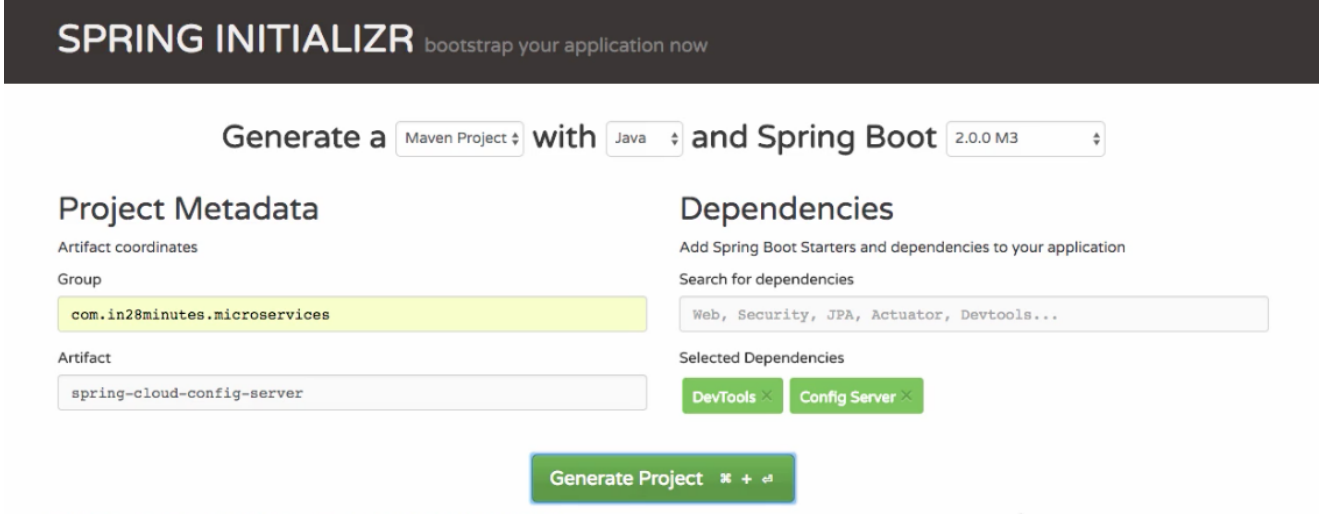
/limits-service/src/main/resources/application.properties Modified
New Lines

```
spring.application.name=limits-service
limits-service.minimum=9
limits-service.maximum=999
```

Step 04 - Setting up Spring Cloud Config Server

Creating a Spring Project with Spring Initializr is a cake walk.

> *Spring Initializr http://start.spring.io/ is great tool to bootstrap your Spring Boot projects.*



- Launch Spring Initializr and choose the following
  - Choose Version 2.0.0.RELEASE or greater
  - Choose Group as shown in the figure
  - Choose Artifact as shown in the figure
  - Choose Dependencies as shown in the figure

- Click Generate Project.
- Import the project into Eclipse.
- If you want to understand all the files that are part of this project, you can go here.

Step 05 - Installing Git

Step 06 - Creating Local Git Repository

Step 07 - Connect Spring Cloud Config Server to Local Git Repository

Step 08 - Configuration for Multiple Environments in Git Repository

/git-localconfig-repo/limits-service-dev.properties New

```
limits-service.minimum=1
limits-service.maximum=111
```

/git-localconfig-repo/limits-service-qa.properties New

```
limits-service.minimum=2 limits-service.maximum=222
```

/git-localconfig-repo/limits-service.properties New

```
limits-service.minimum=8
limits-service.maximum=888
```

/spring-cloud-config-server/src/main/java/com/in28minutes/microservices/springcloudconfigserver/SpringCloudConfigServerApplication.java Modified

```
package
com.in28minutes.microservices.springcloudconfigserver;
 import org.springframework.boot.SpringApplication;
import
org.springframework.boot.autoconfigure.SpringBootApplicatio
n;
```

```
import
org.springframework.cloud.config.server.EnableConfigServer;

@EnableConfigServer
@SpringBootApplication
public class SpringCloudConfigServerApplication {

  public static void main(String[] args) {

SpringApplication.run(SpringCloudConfigServerApplication.cl
ass, args);
  }
}
```

/spring-cloud-config-server/src/main/resources/application.properties New

```
spring.application.name=spring-cloud-config-server
server.port=8888
spring.cloud.config.server.git.uri=file:///in28Minutes/git/
spring-micro-services/03.microservices/git-localconfig-repo
```

Step 09 - Connect Limits Service to Spring Cloud Config Server

/limits-service/src/main/resources/application.properties Deleted

/limits-service/src/main/resources/bootstrap.properties New

```
spring.application.name=limits-service
spring.cloud.config.uri=http://localhost:8888
```

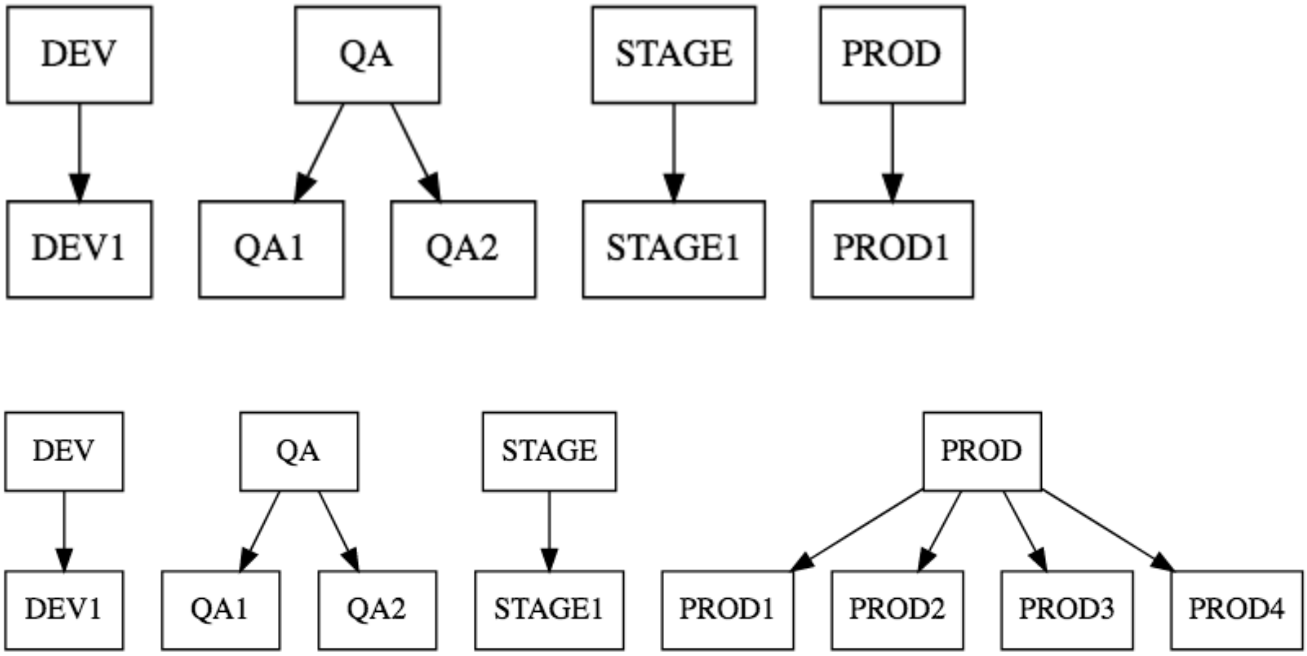
Step 10 - Configuring Profiles for Limits Service

Step 11 - A review of Spring Cloud Config Server

/limits-service/src/main/resources/bootstrap.properties Modified New Lines

```
spring.profiles.active=qa
```

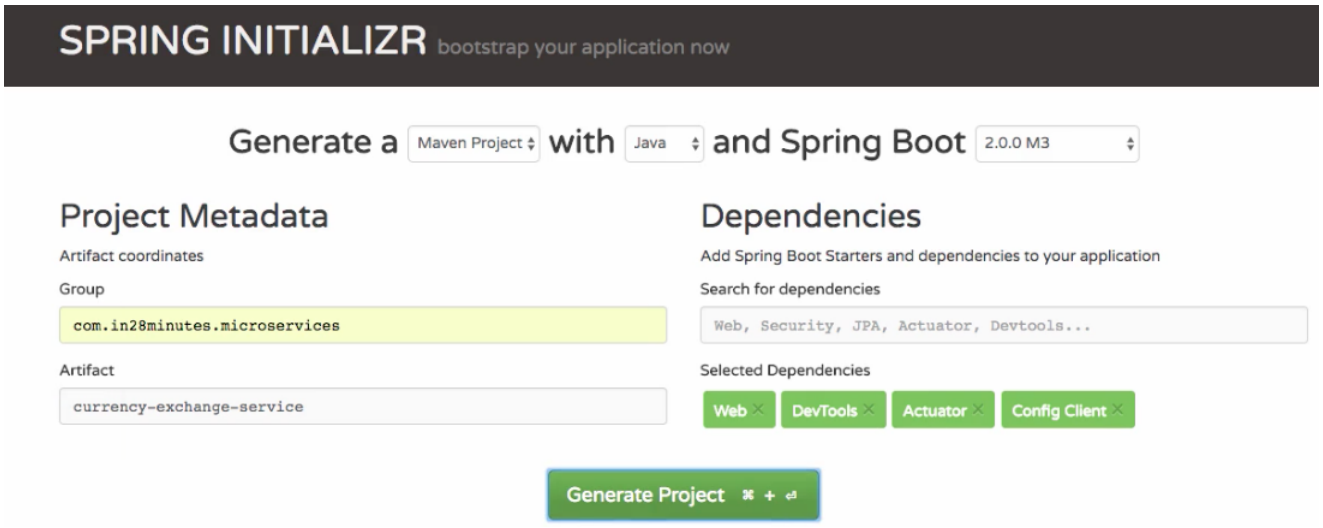
Step 12 - Introduction to Currency Conversion and Currency Exchange Microservices



Step 13 - Setting up Currency Exchange Microservice

Creating a Spring Project with Spring Initializr is a cake walk.

> *Spring Initializr http://start.spring.io/ is great tool to bootstrap your Spring Boot projects.*



- Launch Spring Initializr and choose the following
  - Choose Version 2.0.0.RELEASE or greater
  - Choose Group as shown in the figure

    - Choose Artifact as shown in the figure
    - Choose Dependencies as shown in the figure

- Click Generate Project.
- Import the project into Eclipse.
- If you want to understand all the files that are part of this project, you can go here.

Step 14 - Create a simple hard coded currency exchange service

Step 15 - Setting up Dynamic Port in the the Response

Step 16 - Configure JPA and Initialized Data

Step 17 - Create a JPA Repository

/currency-exchange-service/pom.xml New

```
<?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.xsd">
   <modelVersion>4.0.0</modelVersion>

  <groupId>com.in28minutes.microservices</groupId>
  <artifactId>currency-exchange-service</artifactId>
  <version>0.0.1-SNAPSHOT</version>
  <packaging>jar</packaging>

  <name>currency-exchange-service</name>
  <description>Demo project for Spring Boot</description>

  <parent>
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-starter-parent</artifactId>
    <version>2.0.0.RELEASE</version>
    <relativePath/> <!-- lookup parent from repository -->
  </parent>

  <properties>
    <project.build.sourceEncoding>UTF-
8</project.build.sourceEncoding>
    <project.reporting.outputEncoding>UTF-
8</project.reporting.outputEncoding>


 <java.version>1.8</java.version>
     <spring-cloud.version>Finchley.M8</spring-
cloud.version>
  </properties>

  <dependencies>
    <dependency>
      <groupId>org.springframework.boot</groupId>
```

```
<artifactId>spring-boot-starter-actuator</artifactId>
    </dependency>


<dependency>
     <groupId>org.springframework.cloud</groupId>
     <artifactId>spring-cloud-starter-config</artifactId>
    </dependency>
   <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>com.h2database</groupId>
     <artifactId>h2</artifactId>
   </dependency>


   <dependency>
     <groupId>org.springframework.boot</groupId>
     <artifactId>spring-boot-devtools</artifactId>
     <scope>runtime</scope>
   </dependency>


<dependency>
     <groupId>org.springframework.boot</groupId>
     <artifactId>spring-boot-starter-test</artifactId>
     <scope>test</scope>
    </dependency>
 </dependencies>
```

```
 <dependencyManagement>
    <dependencies>
      <dependency>
        <groupId>org.springframework.cloud</groupId>
         <artifactId>spring-cloud-dependencies</artifactId>


 <version>${spring-cloud.version}</version>
        <type>pom</type>
        <scope>import</scope>
       </dependency>
    </dependencies>
  </dependencyManagement>

  <build>
    <plugins>
      <plugin>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-maven-plugin</artifactId>
      </plugin>
    </plugins>
  </build>



</project>
```

/currency-exchange-service/src/main/java/com/in28minutes/microservices/currencyexchangeservice/CurrencyExchangeController.java New

```
package
com.in28minutes.microservices.currencyexchangeservice;

import java.math.BigDecimal;
 import
org.springframework.beans.factory.annotation.Autowired;
```

```
import org.springframework.core.env.Environment;
import org.springframework.web.bind.annotation.GetMapping;
import
org.springframework.web.bind.annotation.PathVariable;
import
org.springframework.web.bind.annotation.RestController;
 @RestController public class CurrencyExchangeController

 {

  @Autowired
  private Environment  environment;

  @Autowired
  private ExchangeValueRepository repository;

  @GetMapping("/currency-exchange/from/{from}/to/{to}")
  public ExchangeValue retrieveExchangeValue
    (@PathVariable String from, @PathVariable String to){

    ExchangeValue exchangeValue =
        repository.findByFromAndTo(from, to);

    exchangeValue.setPort(

Integer.parseInt(environment.getProperty("local.server.port
")));

    return exchangeValue;
  }
}
```

/currency-exchange-service/src/main/java/com/in28minutes/microservices/currencyexchangeservice/CurrencyExchangeServiceApplication.java New

```
package
com.in28minutes.microservices.currencyexchangeservice;
```

```
import org.springframework.boot.SpringApplication;
import
org.springframework.boot.autoconfigure.SpringBootApplicatio
n;

@SpringBootApplication
public class CurrencyExchangeServiceApplication

 {

  public static void main(String[] args) {

SpringApplication.run(CurrencyExchangeServiceApplication.cl
ass,  args);
  }
}
```

/currency-exchange-service/src/main/java/com/in28minutes/microservices/currencyexchangeservice/ExchangeValue.java New

```
package
com.in28minutes.microservices.currencyexchangeservice;

import java.math.BigDecimal;

import javax.persistence.Column;
import javax.persistence.Entity;
import javax.persistence.Id;

@Entity
public class ExchangeValue

 {

  @Id
  private Long id;
```

```
 @Column(name="currency_from")
  private String  from;

  @Column(name="currency_to")
  private String to;

  private BigDecimal conversionMultiple;
  private int port;

  public ExchangeValue()

 {

   }


  public ExchangeValue(Long id, String from, String to,
BigDecimal conversionMultiple) {
    super();
    this.id = id;
    this.from = from;
    this.to = to;
    this.conversionMultiple = conversionMultiple;
  }

  public Long getId() {
    return id;
  }

  public String getFrom() {
    return

 from;
  }

  public String getTo() {
    return
```

```
 to;
  }

  public BigDecimal getConversionMultiple() {
    return  conversionMultiple;
  }

  public int getPort() {
    return port;
  }

  public void setPort(int port) {
    this.port =

 port;
  }
 }
```

/currency-exchange-service/src/main/java/com/in28minutes/microservices/currencyexchangeservice/ExchangeValueRepository.java New

```
package
com.in28minutes.microservices.currencyexchangeservice;

import
org.springframework.data.jpa.repository.JpaRepository;

public interface ExchangeValueRepository extends
    JpaRepository<ExchangeValue, Long>{
  ExchangeValue findByFromAndTo(String from, String to);
}
```

/currency-exchange-service/src/main/resources/application.properties New

```
spring.application.name=currency-exchange-service
server.port=8000
```

```
spring.jpa.show-sql=true
spring.h2.console.enabled=true
```

/currency-exchange-service/src/main/resources/data.sql New

```
insert into
exchange_value(id,currency_from,currency_to,conversion_mult
iple,port)
values(10001,'USD','INR',65,0);
insert into
exchange_value(id,currency_from,currency_to,conversion_mult
iple,port)
values(10002,'EUR','INR',75,0);
insert into
exchange_value(id,currency_from,currency_to,conversion_mult
iple,port) values(10003,'AUD','INR',25,0);
```

/currency-exchange-service/src/test/java/com/in28minutes/microservices/currencyexchangeservice/CurrencyExchangeServiceApplicationTests.java New

```
package
com.in28minutes.microservices.currencyexchangeservice;

import org.junit.Test;
import org.junit.runner.RunWith;
import
org.springframework.boot.test.context.SpringBootTest;
import
org.springframework.test.context.junit4.SpringRunner;

@RunWith(SpringRunner.class)
@SpringBootTest
public class CurrencyExchangeServiceApplicationTests {

  @Test
  public void contextLoads()

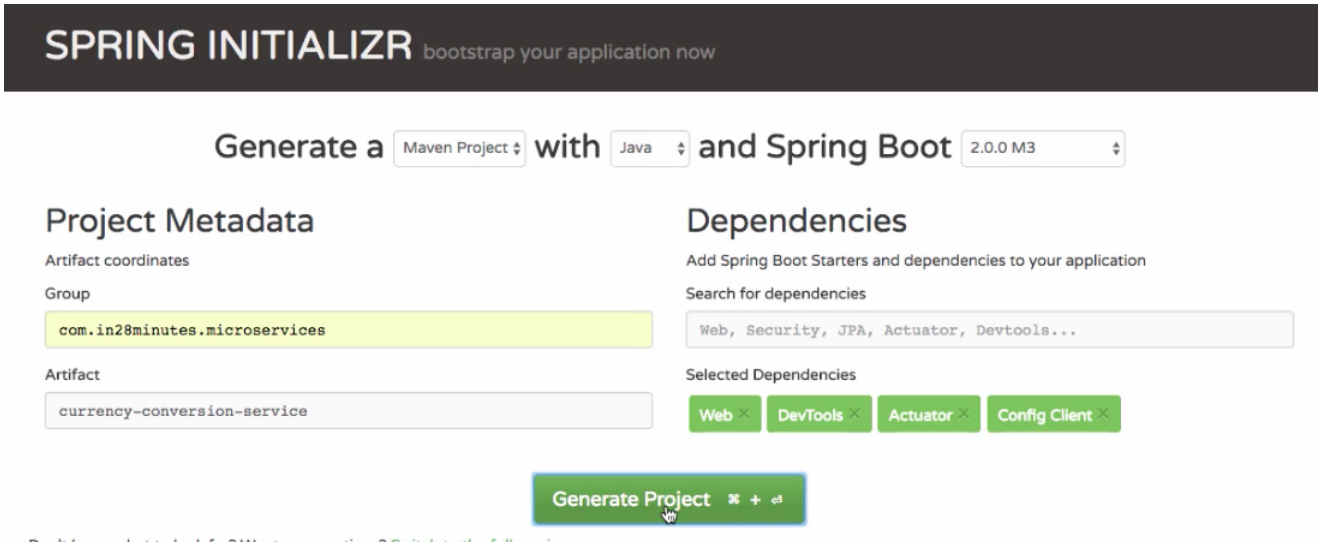
 {
  }
```

```
}
```

Step 18 - Setting up Currency Conversion Microservice

Creating a Spring Project with Spring Initializr is a cake walk.

> *Spring Initializr http://start.spring.io/ is great tool to bootstrap your Spring Boot projects.*



- Launch Spring Initializr and choose the following
  - Choose Version 2.0.0.RELEASE or greater
  - Choose Group as shown in the figure
  - Choose Artifact as shown in the figure
  - Choose Dependencies as shown in the figure

- Click Generate Project.
- Import the project into Eclipse.
- If you want to understand all the files that are part of this project, you can go here.

Step 19 - Creating a service for currency conversion

Step 20 - Invoking Currency Exchange Microservice from Currency Conversion Microservice

/currency-conversion-service/pom.xml New

```
<?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.xsd">

 <modelVersion>4.0.0</modelVersion>
```

```
 <groupId>com.in28minutes.microservices</groupId>
  <artifactId>currency-conversion-service</artifactId>


 <version>0.0.1-SNAPSHOT</version>
  <packaging>jar</packaging>

  <name>currency-conversion-service</name>
  <description>Demo project for Spring Boot</description>

  <parent>
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-starter-parent</artifactId>
    <version>2.0.0.RELEASE</version>
    <relativePath/> <!-- lookup parent from repository -->
  </parent>

  <properties>
    <project.build.sourceEncoding>UTF-
8</project.build.sourceEncoding>
    <project.reporting.outputEncoding>UTF-
8</project.reporting.outputEncoding>
    <java.version>1.8</java.version>
    <spring-cloud.version>Finchley.M8</spring-
cloud.version>
  </properties>

  <dependencies>
    <dependency>
      <groupId>org.springframework.boot</groupId>
      <artifactId>spring-boot-starter-actuator</artifactId>
    </dependency>
    <dependency>


 <groupId>org.springframework.cloud</groupId>
```

```
<artifactId>spring-cloud-starter-config</artifactId>
   </dependency>
   <dependency>
     <groupId>org.springframework.boot</groupId>
     <artifactId>spring-boot-starter-web</artifactId>


</dependency>

   <dependency>
     <groupId>org.springframework.boot</groupId>
     <artifactId>spring-boot-devtools</artifactId>
     <scope>runtime</scope>
   </dependency>
   <dependency>
     <groupId>org.springframework.boot</groupId>
     <artifactId>spring-boot-starter-test</artifactId>
     <scope>test</scope>
   </dependency>
 </dependencies>

 <dependencyManagement>
   <dependencies>
     <dependency>
       <groupId>org.springframework.cloud</groupId>
       <artifactId>spring-cloud-dependencies</artifactId>
       <version>${spring-cloud.version}</version>
       <type>pom</type>
       <scope>import</scope>
     </dependency>
   </dependencies>
 </dependencyManagement>

 <build>
```

```
 <plugins>
      <plugin>
        <groupId>org.springframework.boot</groupId>
         <artifactId>spring-boot-maven-plugin</artifactId>
      </plugin>
    </plugins>
  </build>



</project>
```

/currency-conversion-service/src/main/java/com/in28minutes/microservices/currencyconversionservice/CurrencyConversionBean.java New

```
package
com.in28minutes.microservices.currencyconversionservice;

import java.math.BigDecimal;

public class CurrencyConversionBean {
  private Long id;
  private String from;
  private String to;
  private BigDecimal conversionMultiple;
  private BigDecimal quantity;
  private BigDecimal totalCalculatedAmount;
  private int port;

  public CurrencyConversionBean() {

  }

  public CurrencyConversionBean(Long id, String from,
String to, BigDecimal conversionMultiple, BigDecimal
quantity,
      BigDecimal totalCalculatedAmount, int port)
```

```
{
   super();
   this.id = id;
   this.from =  from;
   this.to = to;
   this.conversionMultiple = conversionMultiple;
   this.quantity = quantity;
   this.totalCalculatedAmount = totalCalculatedAmount;
   this.port = port;


}

 public Long getId() {
   return id;
 }

 public void setId(Long id) {
   this.id = id;
 }

 public String getFrom() {
   return from;
 }

 public void setFrom(String from) {
   this.from = from;
 }

 public String getTo() {
   return to;
 }

 public void setTo(String to) {
   this.to = to;
```

```
 }

  public BigDecimal getConversionMultiple() {
    return conversionMultiple;
   }

  public void setConversionMultiple(BigDecimal
conversionMultiple) {
    this.conversionMultiple = conversionMultiple;
  }

  public BigDecimal getQuantity()

 {
    return quantity;
  }

  public void setQuantity(BigDecimal quantity) {
    this.quantity = quantity;
  }

  public BigDecimal getTotalCalculatedAmount() {
    return totalCalculatedAmount;
  }

  public void setTotalCalculatedAmount(BigDecimal
totalCalculatedAmount) {
    this.totalCalculatedAmount = totalCalculatedAmount;
  }

  public int getPort() {
    return port;
  }

  public void setPort(int port) {
    this.port =
```

```
 port;
  }

}
```

/currency-conversion-service/src/main/java/com/in28minutes/microservices/currencyconversionservice/CurrencyConversionController.java New

```
package
com.in28minutes.microservices.currencyconversionservice;

import java.math.BigDecimal;
import java.util.HashMap;
import java.util.Map;

import org.springframework.http.ResponseEntity;
import org.springframework.web.bind.annotation.GetMapping;
import
org.springframework.web.bind.annotation.PathVariable;
import
org.springframework.web.bind.annotation.RestController;
import org.springframework.web.client.RestTemplate;

@RestController
public class CurrencyConversionController {

  @GetMapping("/currency-
converter/from/{from}/to/{to}/quantity/{quantity}")
  public CurrencyConversionBean
convertCurrency(@PathVariable String from,
      @PathVariable String to,
      @PathVariable BigDecimal quantity
      ){

    Map<String, String> uriVariables = new HashMap<>();
    uriVariables.put("from",
```

```
 from);
    uriVariables.put("to", to);

    ResponseEntity<CurrencyConversionBean> responseEntity =
new RestTemplate().getForEntity(
        "http://localhost:8000/currency-
exchange/from/{from}/to/{to}",
        CurrencyConversionBean.class,
        uriVariables  );

    CurrencyConversionBean response =
responseEntity.getBody();

    return new
CurrencyConversionBean(response.getId(),from,to,response.ge
tConversionMultiple(),


 quantity,quantity.multiply(response.getConversionMultiple(
)),response.getPort());
  }

}
```

/currency-conversion-service/src/main/java/com/in28minutes/microservices/currencyconversionservice/CurrencyConversionServiceApplication.java New

```
package
com.in28minutes.microservices.currencyconversionservice;

import org.springframework.boot.SpringApplication;
import
org.springframework.boot.autoconfigure.SpringBootApplicatio
n;

@SpringBootApplication
public class CurrencyConversionServiceApplication
```

```
 {

  public static void main(String[] args) {

SpringApplication.run(CurrencyConversionServiceApplication.
class, args);
  }
}
```

/currency-conversion-service/src/main/resources/application.properties New

```
spring.application.name=currency-conversion-service
server.port=8100
```

/currency-conversion-service/src/test/java/com/in28minutes/microservices/currencyconversionservice/CurrencyConversionServiceApplicationTests.java New

```
package
com.in28minutes.microservices.currencyconversionservice;
 import org.junit.Test;

import org.junit.runner.RunWith;
import
org.springframework.boot.test.context.SpringBootTest;
import
org.springframework.test.context.junit4.SpringRunner;

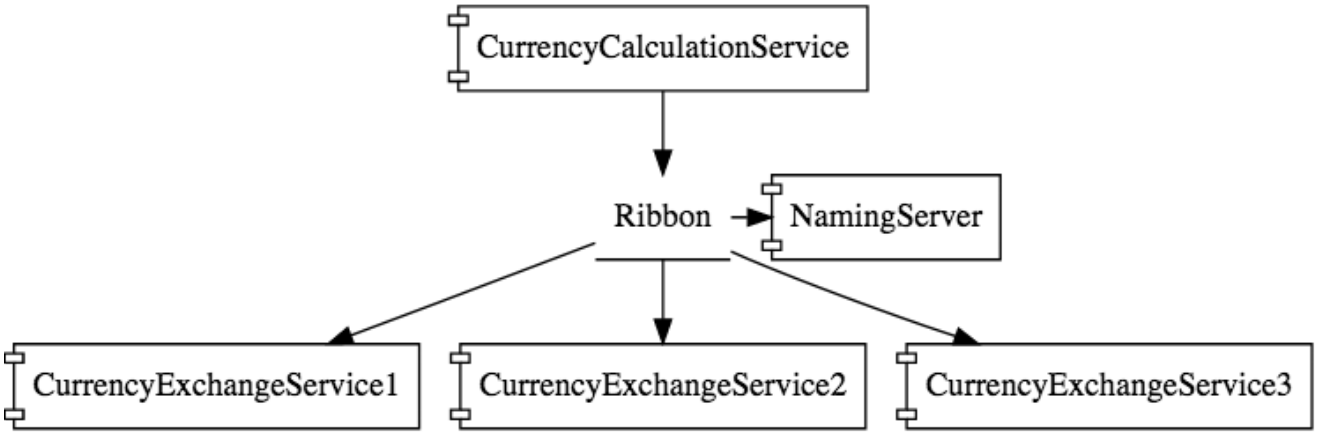
@RunWith(SpringRunner.class)
@SpringBootTest
public class CurrencyConversionServiceApplicationTests {

  @Test
  public void contextLoads() {
  }

}
```

Step 21 - Using Feign REST Client for Service Invocation

Step 22 - Setting up client side load balancing with Ribbon



Step 23 - Running client side load balancing with Ribbon

/currency-conversion-service/pom.xml Modified New Lines

```
     <dependency>
      <groupId>org.springframework.cloud</groupId>


 <artifactId>spring-cloud-starter-openfeign</artifactId>
    </dependency>

    <dependency>
      <groupId>org.springframework.cloud</groupId>
      <artifactId>spring-cloud-starter-netflix-
ribbon</artifactId>
    </dependency>
```

/currency-conversion-service/src/main/java/com/in28minutes/microservices/currencyconversionservice/CurrencyConversionController.java Modified

```
@RestController
public class CurrencyConversionController {

  @Autowired
  private CurrencyExchangeServiceProxy proxy;
```

```
  @GetMapping("/currency-
converter/from/{from}/to/{to}/quantity/{quantity}")
  public CurrencyConversionBean
convertCurrency(@PathVariable String from, @PathVariable
String
```

```
 to,
      @PathVariable BigDecimal quantity) {

    // Feign - Problem 1
    Map<String, String> uriVariables = new HashMap<>();
    uriVariables.put("from",  from);
    uriVariables.put("to", to);

    ResponseEntity<CurrencyConversionBean> responseEntity =
new RestTemplate().getForEntity(
        "http://localhost:8000/currency-
exchange/from/{from}/to/{to}",
CurrencyConversionBean.class,


 uriVariables);

    CurrencyConversionBean response =
responseEntity.getBody();

    return new CurrencyConversionBean(response.getId(),
from, to, response.getConversionMultiple(), quantity,

quantity.multiply(response.getConversionMultiple()),
response.getPort());
  }

  @GetMapping("/currency-converter-
feign/from/{from}/to/{to}/quantity/{quantity}")
  public CurrencyConversionBean
convertCurrencyFeign(@PathVariable String from,
@PathVariable String to,
      @PathVariable BigDecimal quantity) {

    CurrencyConversionBean response =
proxy.retrieveExchangeValue(from, to);

    return new CurrencyConversionBean(response.getId(),
from, to, response.getConversionMultiple(),
```

```
 quantity,

quantity.multiply(response.getConversionMultiple()),
response.getPort());
  }

}
```

/currency-conversion-service/src/main/java/com/in28minutes/microservices/currencyconversionservice/CurrencyConversionServiceApplication.java Modified New Lines

```
@SpringBootApplication
@EnableFeignClients("com.in28minutes.microservices.currency
conversionservice")
public class CurrencyConversionServiceApplication {


```

/currency-conversion-service/src/main/java/com/in28minutes/microservices/currencyconversionservice/CurrencyExchangeServiceProxy.java New

```
package
com.in28minutes.microservices.currencyconversionservice;

import org.springframework.cloud.openfeign.FeignClient;
import
org.springframework.cloud.netflix.ribbon.RibbonClient;
import org.springframework.web.bind.annotation.GetMapping;
import
org.springframework.web.bind.annotation.PathVariable;

//@FeignClient(name="currency-exchange-service",
url="localhost:8000")
@FeignClient(name="currency-exchange-service")
@RibbonClient(name="currency-exchange-service")
public interface CurrencyExchangeServiceProxy {

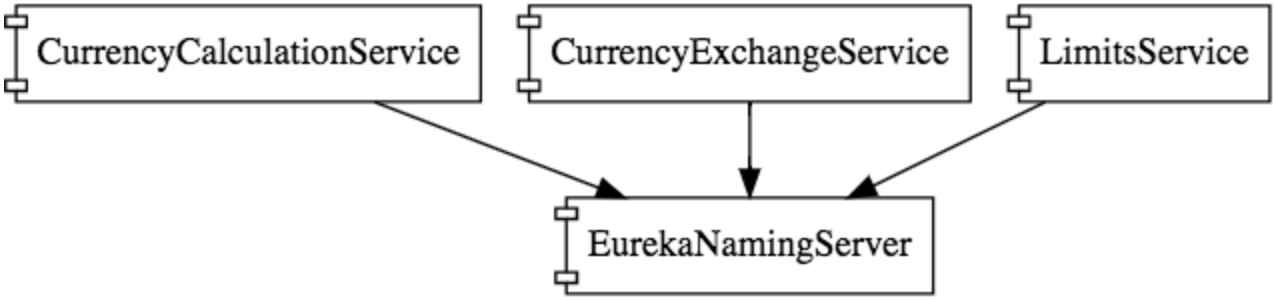

```

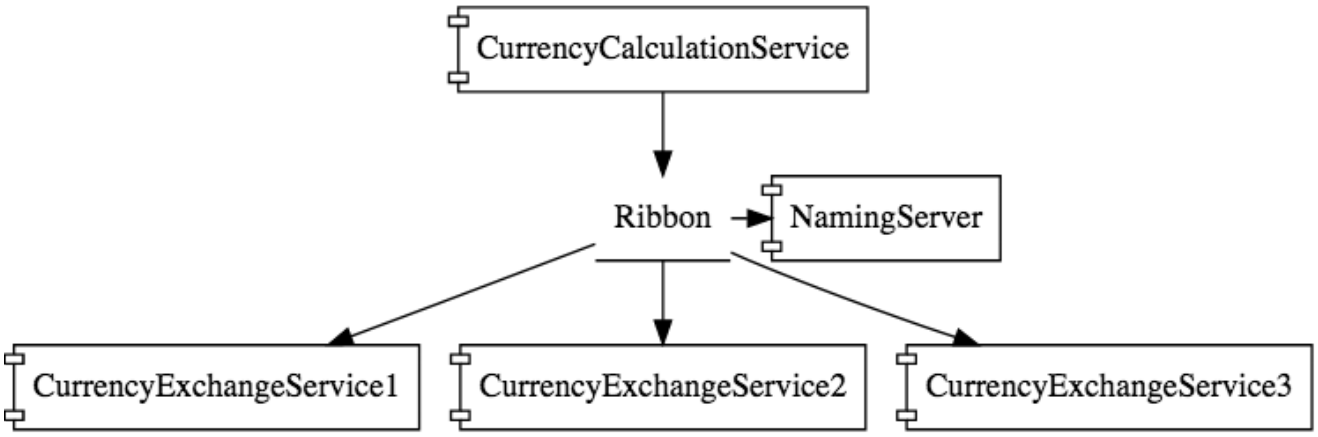
```
 @GetMapping("/currency-exchange/from/{from}/to/{to}")
  public CurrencyConversionBean retrieveExchangeValue
    (@PathVariable("from") String from, @PathVariable("to")
String to);
}
```

/currency-conversion-service/src/main/resources/application.properties Modified New Lines

```
currency-exchange-
service.ribbon.listOfServers=http://localhost:8000,http://l
ocalhost:8001
```

Step 24 - Understand the need for a Naming Server

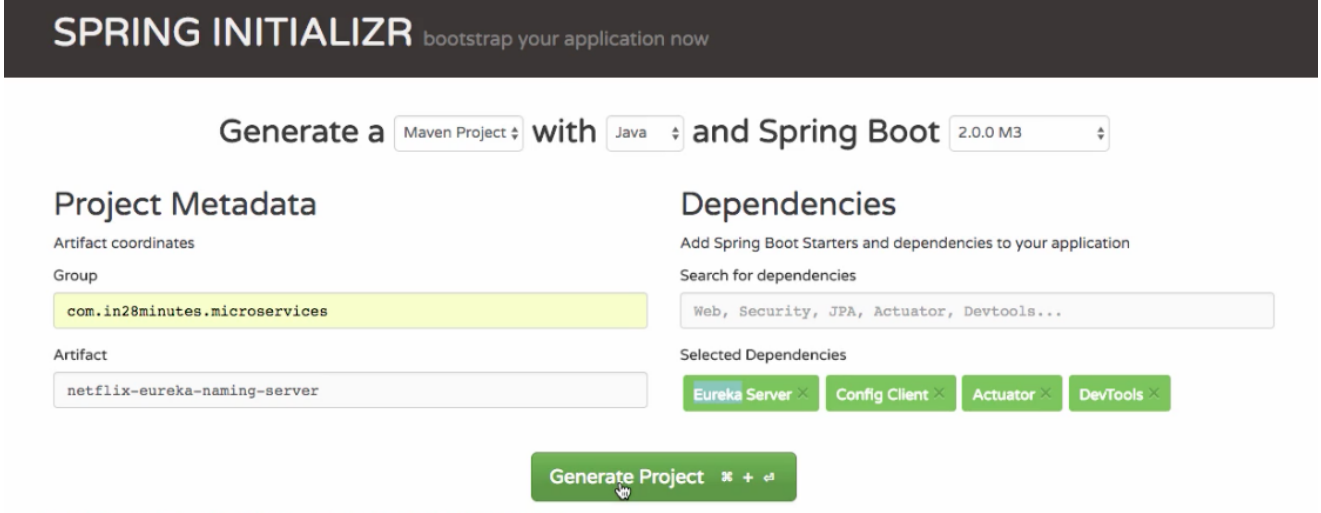




Step 25 - Setting up Eureka Naming Server

Creating a Spring Project with Spring Initializr is a cake walk.

> *Spring Initializr http://start.spring.io/ is great tool to bootstrap your Spring Boot projects.*



- Launch Spring Initializr and choose the following
  - Choose Version 2.0.0.RELEASE or greater

-
  - Choose Group as shown in the figure
  - Choose Artifact as shown in the figure
  - Choose Dependencies as shown in the figure

- Click Generate Project.
- Import the project into Eclipse.
- If you want to understand all the files that are part of this project, you can go here.

/netflix-eureka-naming-server/pom.xml New

```
<?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.xsd">
  <modelVersion>4.0.0</modelVersion>

  <groupId>com.in28minutes.microservices</groupId>
  <artifactId>netflix-eureka-naming-server</artifactId>
  <version>0.0.1-SNAPSHOT</version>
  <packaging>jar</packaging>

  <name>netflix-eureka-naming-server</name>
  <description>Demo project for Spring  Boot</description>

  <parent>
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-starter-parent</artifactId>
    <version>2.0.0.RELEASE</version>
    <relativePath/> <!-- lookup parent from repository -->
  </parent>

  <properties>
    <project.build.sourceEncoding>UTF-
8</project.build.sourceEncoding>


 <project.reporting.outputEncoding>UTF-
8</project.reporting.outputEncoding>
    <java.version>1.8</java.version>
    <spring-cloud.version>Finchley.M8</spring-
cloud.version>
  </properties>

  <dependencies>
```

```
 <dependency>
      <groupId>org.springframework.boot</groupId>
      <artifactId>spring-boot-starter-actuator</artifactId>
    </dependency>
    <dependency>
      <groupId>org.springframework.cloud</groupId>
      <artifactId>spring-cloud-starter-config</artifactId>
    </dependency>
    <dependency>
      <groupId>org.springframework.cloud</groupId>
      <artifactId>spring-cloud-starter-netflix-eureka-
server</artifactId>
    </dependency>

    <dependency>
       <groupId>org.springframework.boot</groupId>
      <artifactId>spring-boot-devtools</artifactId>
      <scope>runtime</scope>
    </dependency>
    <dependency>
      <groupId>org.springframework.boot</groupId>
      <artifactId>spring-boot-starter-test</artifactId>
      <scope>test</scope>
    </dependency>
  </dependencies>

  <dependencyManagement>


 <dependencies>
      <dependency>
        <groupId>org.springframework.cloud</groupId>
        <artifactId>spring-cloud-dependencies</artifactId>
        <version>${spring-cloud.version}</version>
        <type>pom</type>
```

```
 <scope>import</scope>
      </dependency>
    </dependencies>
  </dependencyManagement>

  <build>
    <plugins>
      <plugin>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-maven-plugin</artifactId>
      </plugin>
    </plugins>
  </build>



</project>
```

/netflix-eureka-naming-server/src/main/java/com/in28minutes/microservices/netflixeurekanamingserver/NetflixEurekaNamingServerApplication.java New

```
package
com.in28minutes.microservices.netflixeurekanamingserver;

import org.springframework.boot.SpringApplication;
import
org.springframework.boot.autoconfigure.SpringBootApplicatio
n;
import

 org.springframework.cloud.netflix.eureka.server.EnableEure
kaServer;

@SpringBootApplication
@EnableEurekaServer
```

```
public class NetflixEurekaNamingServerApplication {

  public static void main(String[] args) {

SpringApplication.run(NetflixEurekaNamingServerApplication.
class, args);
  }
}
```

/netflix-eureka-naming-server/src/main/resources/application.properties New

```
spring.application.name=netflix-eureka-naming-server
server.port=8761

eureka.client.register-with-eureka=false
eureka.client.fetch-registry=false
```

/netflix-eureka-naming-server/src/test/java/com/in28minutes/microservices/netflixeurekanamingserver/NetflixEurekaNamingServerApplicationTests.java New

```
package
com.in28minutes.microservices.netflixeurekanamingserver;

import org.junit.Test;
import org.junit.runner.RunWith;
import
org.springframework.boot.test.context.SpringBootTest;
import
org.springframework.test.context.junit4.SpringRunner;

@RunWith(SpringRunner.class)
@SpringBootTest
public class NetflixEurekaNamingServerApplicationTests
```

```
 {

  @Test
  public void contextLoads() {
  }

}
```

Step 26 - Connecting Currency Conversion Microservice to Eureka

/currency-conversion-service/pom.xml Modified New Lines

```
    <dependency>
      <groupId>org.springframework.cloud</groupId>
      <artifactId>spring-cloud-starter-netflix-eureka-
client</artifactId>
    </dependency>
```

/currency-conversion-service/src/main/resources/application.properties Modified New Lines

```
eureka.client.service-url.default-
zone=http://localhost:8761/eureka
#currency-exchange-
service.ribbon.listOfServers=http://localhost:8000,http://l
ocalhost:8001
```

/currency-conversion-service/src/main/java/com/in28minutes/microservices/currencyconversionservice/CurrencyConversionServiceApplication.java Modified New Lines

```
@SpringBootApplication
@EnableDiscoveryClient
public class CurrencyConversionServiceApplication {
```

Step 27 - Connecting Currency Exchange Microservice to Eureka

/currency-exchange-service/pom.xml Modified New Lines

```
    <dependency>
      <groupId>org.springframework.cloud</groupId>
      <artifactId>spring-cloud-starter-netflix-eureka-
client</artifactId>
    </dependency>
```

/currency-exchange-service/src/main/java/com/in28minutes/microservices/currencyexchangeservice/CurrencyExchangeServiceApplication.java Modified New Lines

```
@SpringBootApplication
@EnableDiscoveryClient
public class CurrencyExchangeServiceApplication {
```

/currency-exchange-service/src/main/resources/application.properties Modified New Lines

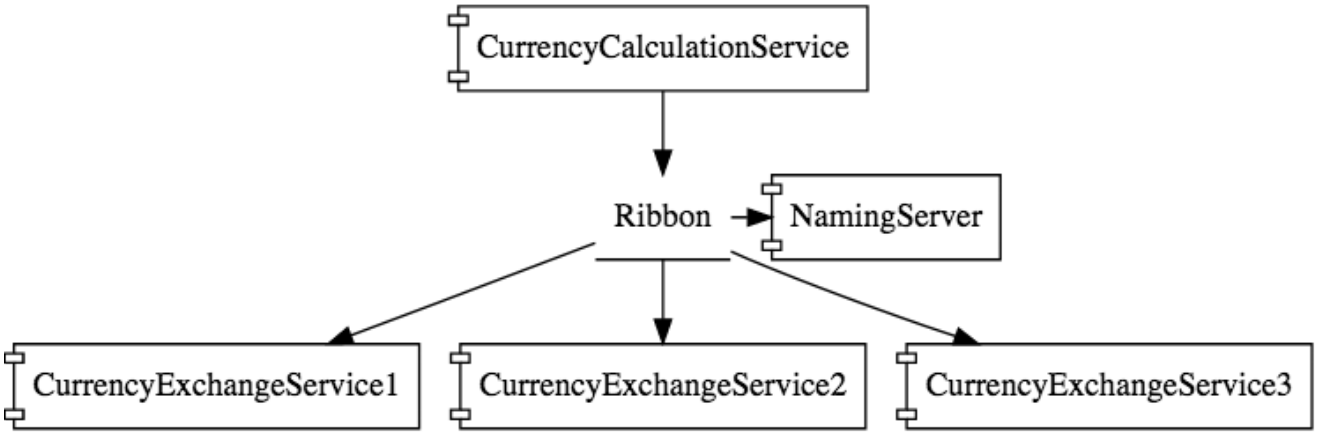
```
eureka.client.service-url.default-
zone=http://localhost:8761/eureka
```

Step 28 - Distributing calls using Eureka and Ribbon

/currency-conversion-service/src/main/java/com/in28minutes/microservices/currencyconversionservice/CurrencyConversionServiceApplication.java Modified New Lines

```
@SpringBootApplication
@EnableFeignClients("com.in28minutes.microservices.currency
conversionservice")
@EnableDiscoveryClient
public class CurrencyConversionServiceApplication {
```

Step 29 - A review of implementing Eureka, Ribbon and Feign



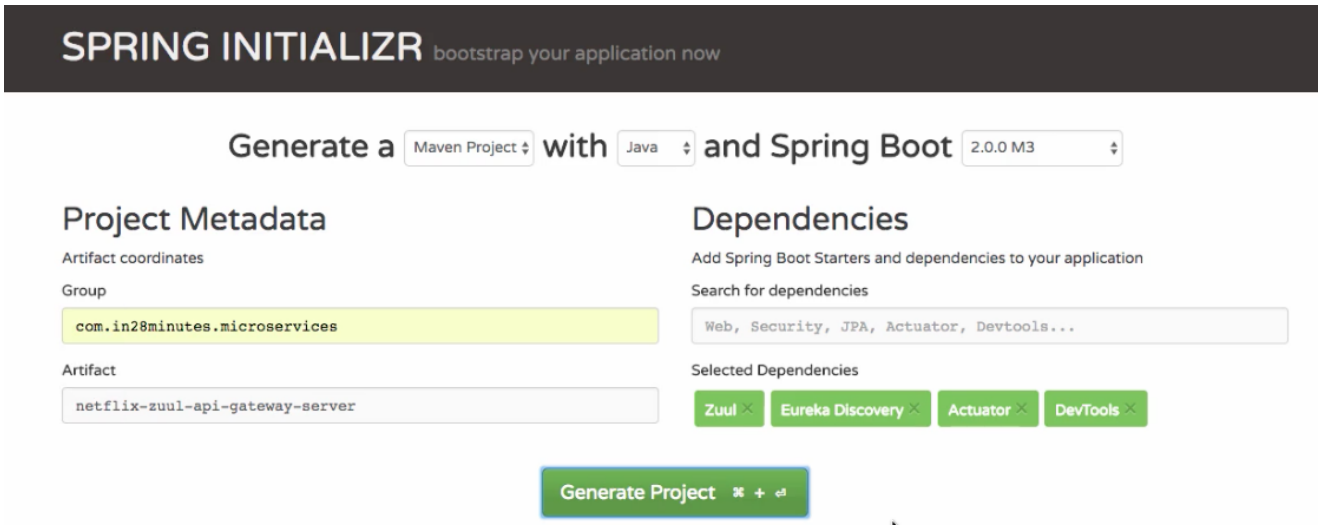
Step 30 - Introduction to API Gateways

- Authentication, authorization and security
- Rate Limits
- Fault Tolerance
- Service Aggregation

Step 31 - Setting up Zuul API Gateway

Creating a Spring Project with Spring Initializr is a cake walk.

> *Spring Initializr http://start.spring.io/ is great tool to bootstrap your Spring Boot projects.*



- Launch Spring Initializr and choose the following
  - Choose Version 2.0.0.RELEASE or greater
  - Choose Group as shown in the figure
  - Choose Artifact as shown in the figure
  - Choose Dependencies as shown in the figure

- Click Generate Project.
- Import the project into Eclipse.
- If you want to understand all the files that are part of this project, you can go here.

Step 32 - Implementing Zuul Logging Filter

Step 33 - Executing a request through Zuul API Gateway

Step 34 - Setting up Zuul API Gateway between microservice invocations

/currency-conversion-service/src/main/java/com/in28minutes/microservices/currencyconversionservice/CurrencyConversionController.java Modified

New Lines

```
@RestController public class CurrencyConversionController
```

```
 {

  private Logger logger =
LoggerFactory.getLogger(this.getClass());

  @GetMapping("/currency-
converter/from/{from}/to/{to}/quantity/{quantity}")
  public CurrencyConversionBean
convertCurrency(@PathVariable String from, @PathVariable
String to,
      @PathVariable BigDecimal quantity) {

    // Feign - Problem 1
    Map<String, String> uriVariables = new HashMap<>();
    uriVariables.put("from", from);
    uriVariables.put("to",

 to);

    ResponseEntity<CurrencyConversionBean> responseEntity =
new RestTemplate().getForEntity(
        "http://localhost:8000/currency-
exchange/from/{from}/to/{to}",
CurrencyConversionBean.class,
        uriVariables);

    CurrencyConversionBean response =
responseEntity.getBody();

    return new CurrencyConversionBean(response.getId(),
from, to, response.getConversionMultiple(), quantity,

quantity.multiply(response.getConversionMultiple()),
response.getPort());
  }

  @GetMapping("/currency-converter-
feign/from/{from}/to/{to}/quantity/{quantity}")
  public CurrencyConversionBean
```

```
 convertCurrencyFeign(@PathVariable String from,
@PathVariable String to,
      @PathVariable BigDecimal quantity)  {

    CurrencyConversionBean response =
proxy.retrieveExchangeValue(from, to);

    logger.info("{}", response);

    return new CurrencyConversionBean(response.getId(),
from, to, response.getConversionMultiple(), quantity,

quantity.multiply(response.getConversionMultiple()),
response.getPort());
  }

}
```

/currency-conversion-service/src/main/java/com/in28minutes/microservices/currencyconversionservice/CurrencyExchangeServiceProxy.java Modified

New Lines

```
//@FeignClient(name="currency-exchange-service",
url="localhost:8000")
//@FeignClient(name="currency-exchange-service")
@FeignClient(name="netflix-zuul-api-gateway-server")
@RibbonClient(name="currency-exchange-service")
public interface CurrencyExchangeServiceProxy {
  //@GetMapping("/currency-exchange/from/{from}/to/{to}")
  @GetMapping("/currency-exchange-service/currency-
exchange/from/{from}/to/{to}")
  public CurrencyConversionBean retrieveExchangeValue
    (@PathVariable("from") String from, @PathVariable("to")
String to);
}
```

/currency-exchange-service/src/main/java/com/in28minutes/microservices/currencyexchangeservice/CurrencyExchangeController.java Modified

New Lines

```
import org.slf4j.Logger;
import org.slf4j.LoggerFactory;

private Logger logger =
LoggerFactory.getLogger(this.getClass());

logger.info("{}", exchangeValue);
```

/netflix-zuul-api-gateway-server/pom.xml New

```
<?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.xsd">
  <modelVersion>4.0.0</modelVersion>

  <groupId>com.in28minutes.microservices</groupId>
  <artifactId>netflix-zuul-api-gateway-server</artifactId>
  <version>0.0.1-SNAPSHOT</version>
  <packaging>jar</packaging>

  <name>netflix-zuul-api-gateway-server</name>
  <description>Demo project for Spring Boot</description>

  <parent>
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-starter-parent</artifactId>
    <version>2.0.0.RELEASE</version>
    <relativePath/> <!-- lookup parent from repository -->
```

```
 </parent>

  <properties>
     <project.build.sourceEncoding>UTF-
8</project.build.sourceEncoding>
    <project.reporting.outputEncoding>UTF-
8</project.reporting.outputEncoding>
    <java.version>1.8</java.version>
    <spring-cloud.version>Finchley.M8</spring-
cloud.version>
  </properties>

  <dependencies>
    <dependency>
      <groupId>org.springframework.cloud</groupId>
      <artifactId>spring-cloud-starter-netflix-eureka-
client</artifactId>


 </dependency>

    <dependency>
      <groupId>org.springframework.cloud</groupId>
      <artifactId>spring-cloud-starter-netflix-
zuul</artifactId>
    </dependency>

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

  <dependencyManagement>
```

```
 <dependencies>
      <dependency>
        <groupId>org.springframework.cloud</groupId>
        <artifactId>spring-cloud-dependencies</artifactId>
        <version>${spring-cloud.version}</version>
         <type>pom</type>
        <scope>import</scope>
      </dependency>
    </dependencies>
  </dependencyManagement>

  <build>
    <plugins>
      <plugin>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-maven-plugin</artifactId>
      </plugin>
    </plugins>
  </build>



</project>
```

/netflix-zuul-api-gateway-server/src/main/java/com/in28minutes/microservices/netflixzuulapigatewayserver/NetflixZuulApiGatewayServerApplication.java New

```
package
com.in28minutes.microservices.netflixzuulapigatewayserver;

import org.springframework.boot.SpringApplication;
import
org.springframework.boot.autoconfigure.SpringBootApplicatio
n;
import
org.springframework.cloud.client.discovery.EnableDiscoveryC
lient;
import
```

```
 org.springframework.cloud.netflix.zuul.EnableZuulProxy;

@EnableZuulProxy
@EnableDiscoveryClient
@SpringBootApplication public class
NetflixZuulApiGatewayServerApplication {

  public static void main(String[] args) {

SpringApplication.run(NetflixZuulApiGatewayServerApplicatio
n.class, args);
  }
}
```

/netflix-zuul-api-gateway-server/src/main/java/com/in28minutes/microservices/netflixzuulapigatewayserver/ZuulLoggingFilter.java New

```
package
com.in28minutes.microservices.netflixzuulapigatewayserver;

import javax.servlet.http.HttpServletRequest;

import org.slf4j.Logger; import org.slf4j.LoggerFactory;

import org.springframework.stereotype.Component;

import com.netflix.zuul.ZuulFilter;
import com.netflix.zuul.context.RequestContext;

@Component
public class ZuulLoggingFilter extends ZuulFilter{

  private Logger logger =
LoggerFactory.getLogger(this.getClass());

  @Override
  public boolean shouldFilter()
```

```
 {
    return true;
  }

  @Override
  public Object run()  {
    HttpServletRequest request =
        RequestContext.getCurrentContext().getRequest();
    logger.info("request -> {} request uri -> {}",
        request, request.getRequestURI());
    return null;
  }

  @Override
  public String filterType() {
    return "pre";
  }

  @Override
  public int filterOrder() {
    return 1;
  }
}
```

/netflix-zuul-api-gateway-server/src/main/resources/application.properties

New

```
spring.application.name=netflix-zuul-api-gateway-server
server.port=8765
eureka.client.service-url.default-
zone=http://localhost:8761/eureka
```

/netflix-zuul-api-gateway-server/src/test/java/com/in28minutes/microservices/netflixzuulapigatewayserver/NetflixZuulApiGatewayServerApplicationTests.java New

```
package
com.in28minutes.microservices.netflixzuulapigatewayserver;
```

```
import org.junit.Test;
import org.junit.runner.RunWith;
import
org.springframework.boot.test.context.SpringBootTest;
import
org.springframework.test.context.junit4.SpringRunner;

@RunWith(SpringRunner.class)
@SpringBootTest
public class NetflixZuulApiGatewayServerApplicationTests {

  @Test
  public void contextLoads() {
  }

}
```

Step 35 - Introduction to Distributed Tracing

Step 36 - Implementing Spring Cloud Sleuth

/currency-conversion-service/pom.xml Modified New Lines

```
     <dependency>


 <groupId>org.springframework.cloud</groupId>
      <artifactId>spring-cloud-starter-sleuth</artifactId>
    </dependency>
```

/currency-conversion-service/src/main/java/com/in28minutes/microservices/currencyconversionservice/CurrencyConversionServiceApplication.java Modified New Lines

```
  @Bean
  public Sampler
```

```
defaultSampler(){
   return Sampler.ALWAYS_SAMPLE;
 }
```

/currency-exchange-service/pom.xml Modified New Lines

```
    <dependency>
     <groupId>org.springframework.cloud</groupId>
     <artifactId>spring-cloud-starter-sleuth</artifactId>
   </dependency>
```

/currency-exchange-service/src/main/java/com/in28minutes/microservices/currencyexchangeservice/CurrencyExchangeServiceApplication.java Modified New Lines

```
  @Bean
  public Sampler defaultSampler(){
    return Sampler.ALWAYS_SAMPLE;
  }
```

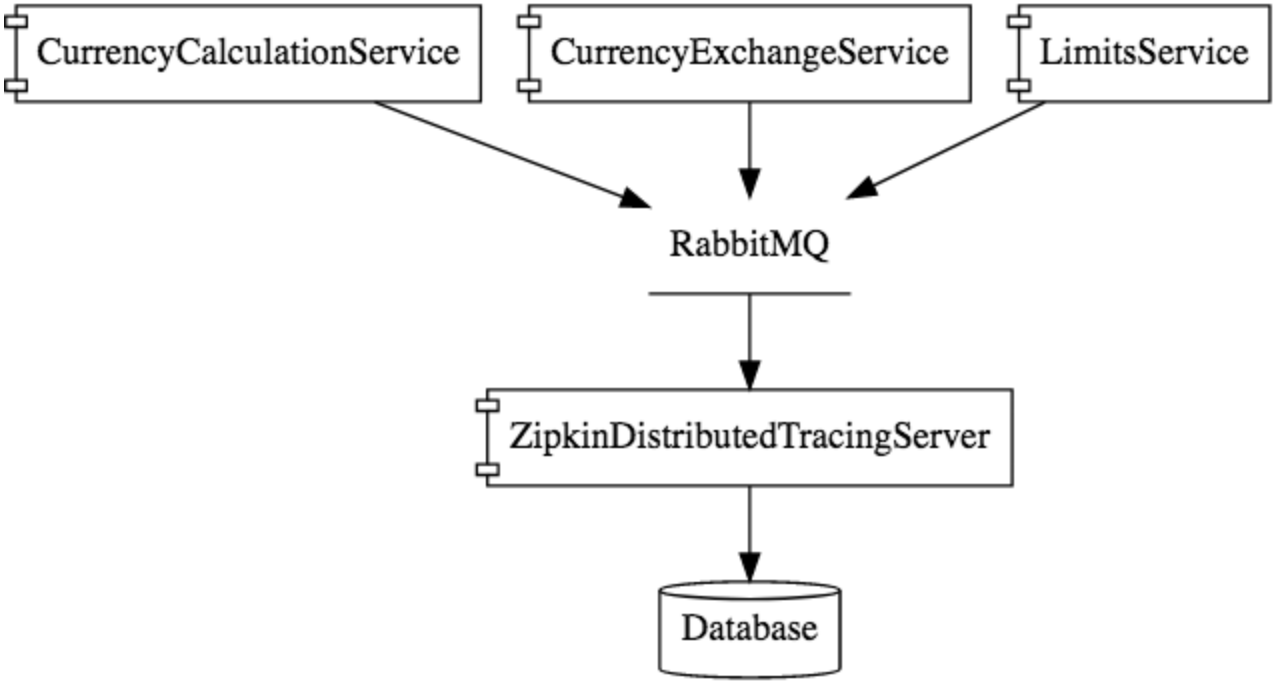
/netflix-zuul-api-gateway-server/pom.xml Modified New Lines

```
    <dependency>
      <groupId>org.springframework.cloud</groupId>
       <artifactId>spring-cloud-starter-sleuth</artifactId>
    </dependency>
```

/netflix-zuul-api-gateway-server/src/main/java/com/in28minutes/microservices/netflixzuulapigatewayserver/NetflixZuulApiGatewayServerApplication.java Modified New Lines

```
  @Bean
  public AlwaysSampler defaultSampler(){
    return new AlwaysSampler();
  }
```

Step 37 - Introduction to Distributed Tracing with Zipkin



Step 38 - Installing Rabbit MQ

Windows

- https://www.rabbitmq.com/install-windows.html
- https://www.rabbitmq.com/which-erlang.html
- http://www.erlang.org/downloads
- Video - https://www.youtube.com/watch?v=gKzKUmtOwR4

Mac

- https://www.rabbitmq.com/install-homebrew.html

Step 39 - Setting up Distributed Tracing with Zipkin

Quick Start Page

- https://zipkin.io/pages/quickstart

Downloading Zipkin Jar

- https://search.maven.org/remote_content?g=io.zipkin.java&a=zipkin-server&v=LATEST&c=exec

Command to run

```
RABBIT_URI=amqp://localhost java -jar zipkin-server-2.5.2-exec.jar
```

Step 40 - Connecting microservices to Zipkin

Step 41 - Using Zipkin UI Dashboard to trace requests

/currency-conversion-service/pom.xml Modified New Lines

```
    <dependency>
      <groupId>org.springframework.cloud</groupId>
      <artifactId>spring-cloud-sleuth-zipkin</artifactId>
```

```
 </dependency>

    <dependency>
      <groupId>org.springframework.cloud</groupId>
      <artifactId>spring-cloud-starter-bus-
amqp</artifactId>
    </dependency>
```

/currency-exchange-service/pom.xml Modified New Lines

```
     <dependency>
      <groupId>org.springframework.cloud</groupId>
      <artifactId>spring-cloud-sleuth-zipkin</artifactId>


 </dependency>

    <dependency>
      <groupId>org.springframework.cloud</groupId>
      <artifactId>spring-cloud-starter-bus-
amqp</artifactId>
    </dependency>
```

/netflix-zuul-api-gateway-server/pom.xml Modified New Lines

```
    <dependency>
       <groupId>org.springframework.cloud</groupId>
      <artifactId>spring-cloud-sleuth-zipkin</artifactId>
    </dependency>

    <dependency>
      <groupId>org.springframework.cloud</groupId>
      <artifactId>spring-cloud-starter-bus-
amqp</artifactId>
    </dependency>
```

Step 43 - Implementing Spring Cloud Bus

Step 44 - Fault Tolerance with Hystrix

/03.microservices/limits-service/pom.xml Modified New Lines

```
    <dependency>
      <groupId>org.springframework.cloud</groupId>
      <artifactId>spring-cloud-starter-netflix-
hystrix</artifactId>
    </dependency>
```

/03.microservices/limits-service/src/main/java/com/in28minutes/microservices/limitsservice/LimitsConfigurationController.java Modified New Lines

```
@RestController
public class LimitsConfigurationController {


  @GetMapping("/fault-tolerance-example")

@HystrixCommand(fallbackMethod="fallbackRetrieveConfiguration")
  public LimitConfiguration retrieveConfiguration() {
    throw new RuntimeException("Not available");
   }

  public LimitConfiguration fallbackRetrieveConfiguration() {
    return new LimitConfiguration(999, 9);
  }

}
```

/03.microservices/limits-service/src/main/java/com/in28minutes/microservices/limitsservice/LimitsServiceApplication.java Modified New Lines

```
@SpringBootApplication
@EnableHystrix
public class LimitsServiceApplication {
```

More Reading about Microservices

- Design and Governance of Microservices
  - https://martinfowler.com/microservices/
- 12 Factor App
  - https://12factor.net/
  - https://dzone.com/articles/the-12-factor-app-a-java-developers-perspective
- Spring Cloud
-
  - http://projects.spring.io/spring-cloud/

Bonus Introduction Sections

2 Bonus Sections - Introduction to Spring Boot and JPA

Title	Category	Github
Spring Boot in 10 Steps	Introduction	Project Folder on Github
JPA in 10 Steps	Introduction	Project Folder on Github

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