MICROSERVICES

Monolithic Application: - A Project which holds all modules together and converted as one Service (one .war file).

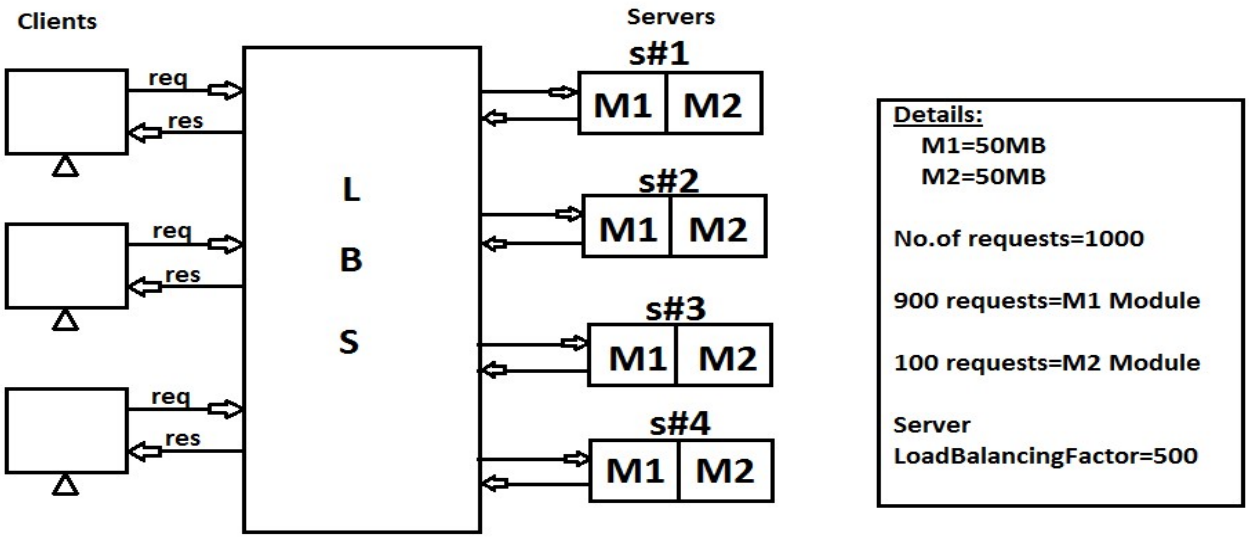
➔In this case, if no. of users is getting increased, then to handle multiple request (load) use LBS (Load Balancing Server).

➔But few modules need Extra load, not all. In this case other modules get memory which is waste (no use). Hence reduces performance of server (application).

➔Consider Project P1 is having 2 modules M1, M2 and their runtime memories are M1=50 MB, M2=50 MB.

➔Load Balancing is done using Servers looks like.

Diagram:--



➔In above example, M2 Module is getting less requests from Client. So, max 2 instances are may be enough. Other 2 instances (memories) are no use. It means near 100MB memory is not used, which impacts server performance.

Microservices: It is an independent deployment component.

➔It is a combination of one (or more) modules of a Projects runs as one Service.

Nature of Microservices:

1.Every Service must be implemented using Webservices concept.

2.Each service should be independent.

3.Services should able to communicate with each other. It is also called as **"Intra Communication**".

4.Required Services must be supported for **Load Balancing** (i.e. one service runs in multiple instances).

5.Every service should able to read input data (____.properties/_____.yml) from External **Configuration Server** [Config Server].

6.Service communication (Chain of execution) problems should be able to solve using **CircuitBreaker** [Find other possible…].

7.All Servers must be accessed to Single Entry known as **Gateway Service** [Proxy Gateway or API Gateway], It supports **securing**, **metering** and **Routing**.

Netflix Component Names:

1.Service Registry and Discovery = Eureka
2.Load Balancing Server = Ribbon
3.Circuite Breaker = Hystrix
4.API Gateway = Zuul
5.Config Server = Github
6.Secure Server = OAuth2
7.Log and Trace = Zipkin + Sleuth
8.Message Queues = Kafka
9.Integration Service = Camel
10.Metrics UI = Admin (Server/Client)
11.Cloud Platform with Deploy services = PCF, Docker

SOA (Service Oriented Architecture):

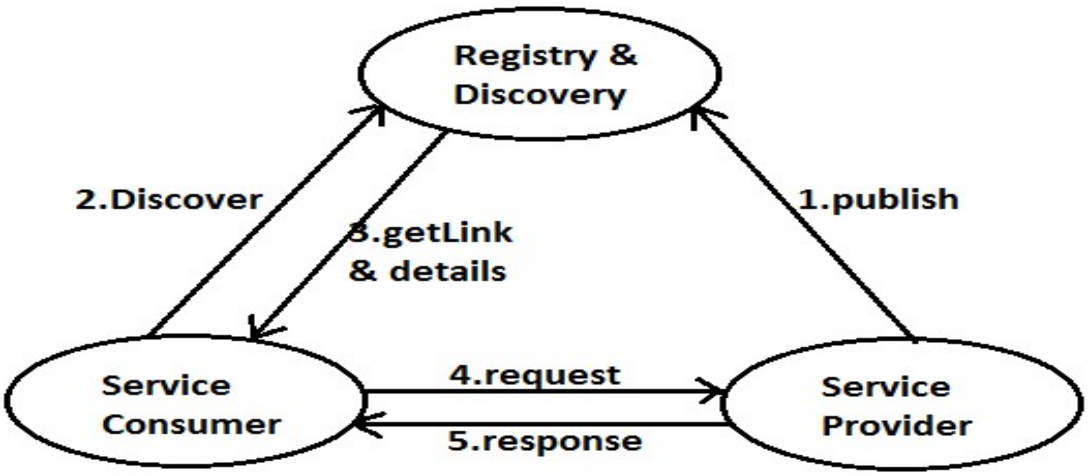
➔It is a Design Pattern used to create communication links between multiple services providers and users.

Components of SOA:

a. Service Registry and Discovery [Eureka]
b. Service Provider [Webservice Provider]
c. Service Consumer [Webservice Client]

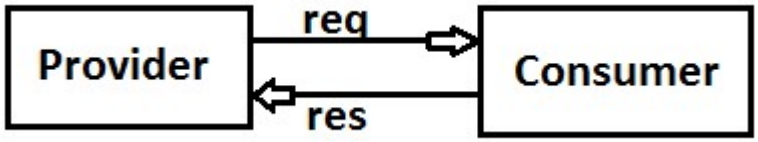
Operations:

1.Publish
2.Discover
3.Link Details of Provider
4.Query Description (Make Http Request).
5.Access Service (Http Response).



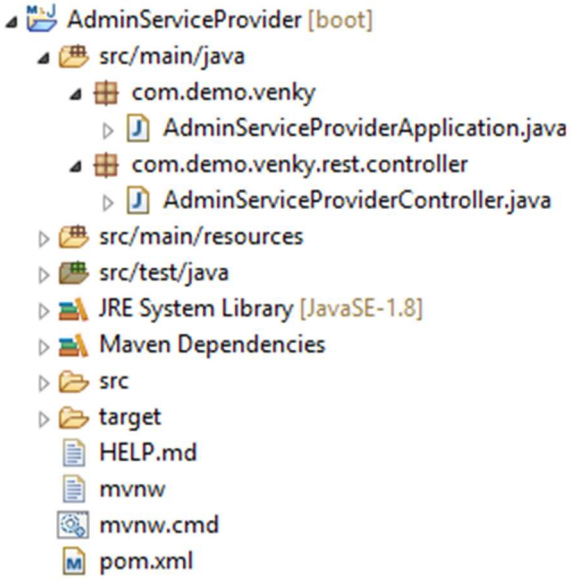
Implementing MicroService Application Using Spring Cloud:

Design #1 A Simple Rest WebService using Spring Boot.



➔This application is implemented using Spring Boot Restful webservices which provides Tightly coupled design. It means any changes in Provider application effects Consumer application, specially server changes, port number changes, context changes etc…,
➔This design will not support LoadBalancing.
➔It is implemented using RestController and RestTemplate.

Step #1 Create Provider Application (Dependencies: web only)
Group Id: com.demo.venky
ArtifactId: AdminServiceProvider
Version: 1.0
Folder Structure of AdminServiceProvider:



StarterClass(AdminServiceProviderApplication.java)

```
package com.demo.venky;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;

@SpringBootApplication
public class AdminServiceProviderApplication {
```

```
	public static void main(String[] args) {
		SpringApplication.run(AdminServiceProviderApplication.class, args);
		System.out.println("=-=-=-Hello From AdminServiceProvider=-=-=-");
	}
}
```

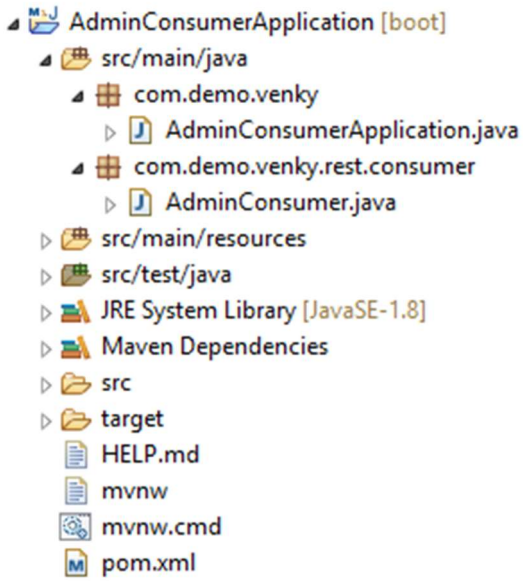
Step #2 Define one RestController

```
package com.demo.venky.rest.controller;
import org.springframework.web.bind.annotation.GetMapping;
import org.springframework.web.bind.annotation.RequestMapping;
import org.springframework.web.bind.annotation.RestController;

@RestController
@RequestMapping("/provider")
public class AdminServiceProviderController {
	@GetMapping("/show")
	public String showMsg() {
		return"Hello Venky";
	}
}
=--=-=application.properties=-=-=-=-=-
	server.port=8900
```

Step #3 Create Consumer Application (Dependencies: web only)

GroupId: com.demo.venky
ArtifactId: AdminServiceConsumer
Version: 1.0

Folder Structure of AdminConsumerApplication:



Starterclass(AdminConsumerApplication.java)

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

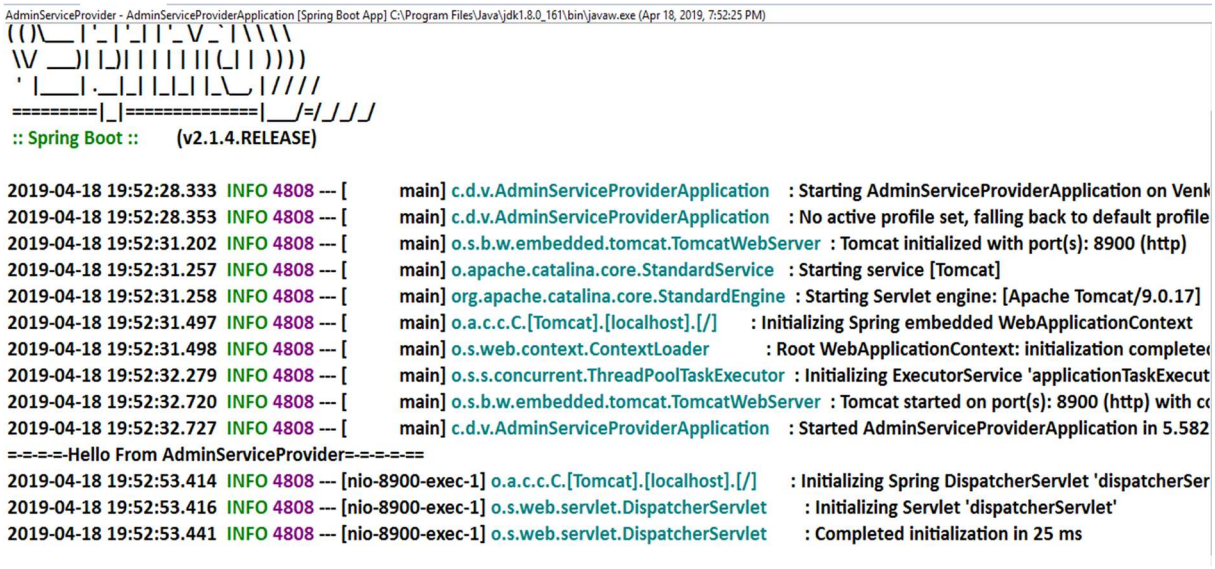
Step #4 Define Consumer (call) code (AdminConsumer.java)

```
package com.demo.venky.rest.consumer;
import org.springframework.boot.CommandLineRunner;
import org.springframework.http.ResponseEntity;
import org.springframework.stereotype.Component;
import org.springframework.web.client.RestTemplate;
@Component
public class AdminConsumer implements CommandLineRunner {
	@Override
	public void run(String... args) throws Exception {
		RestTemplate rt=new RestTemplate();
	ResponseEntity<String>resp=rt.getForEntity("http://localhost:8900/provider/show",String.class);
		System.out.println(resp.getBody());
		System.out.println("=-=-=-=-=-=-Message From Admin Consumer=-=-=-=-=-");
		System.exit(0);
	}
}
```

Execution flow Screen:

➔First Run ProviderApplication (Starter), then ConsumerApplication(Starter)

PROVIDER SCREEEN:-



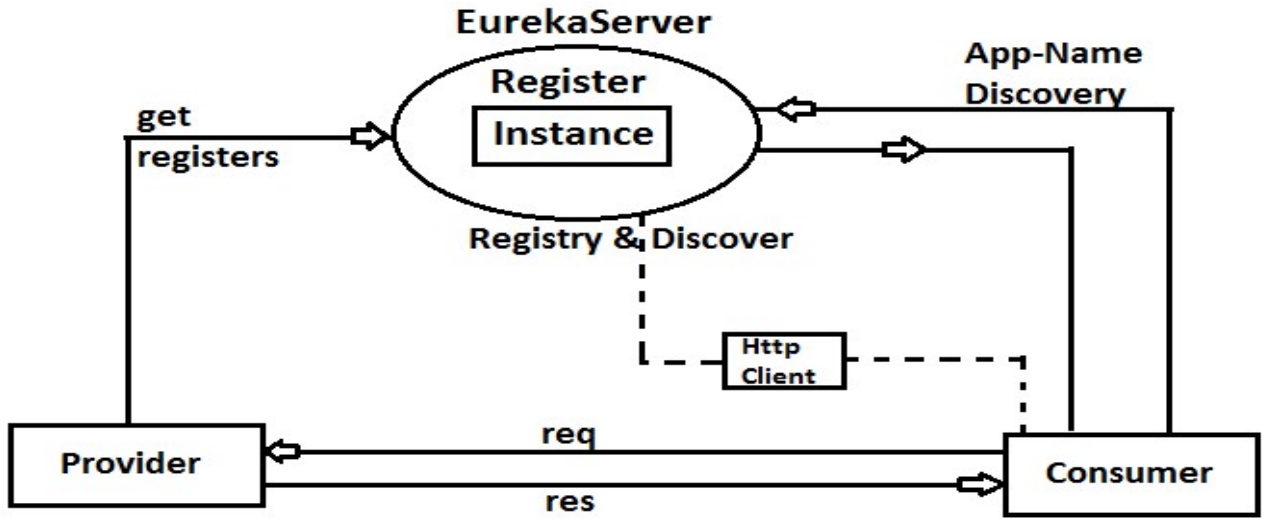
```
AdminServiceProvider - AdminServiceProviderApplication [Spring Boot App] C:\Program Files\Java\jdk1.8.0_161\bin\javaw.exe (Apr 18, 2019, 7:52:25 PM)
( ( )\___ | '_ | '_| | '_ \/ _` | \ \ \ \
 \\/  ___)| |_)| | | | | || (_| |  ) ) ) )
  '  |____| .__|_| |_|_| |_\__, | / / / /
 =========|_|==============|___/=/_/_/_/
 :: Spring Boot ::        (v2.1.4.RELEASE)

2019-04-18 19:52:28.333  INFO 4808 --- [           main] c.d.v.AdminServiceProviderApplication    : Starting AdminServiceProviderApplication on Venk
2019-04-18 19:52:28.353  INFO 4808 --- [           main] c.d.v.AdminServiceProviderApplication    : No active profile set, falling back to default profile
2019-04-18 19:52:31.202  INFO 4808 --- [           main] o.s.b.w.embedded.tomcat.TomcatWebServer  : Tomcat initialized with port(s): 8900 (http)
2019-04-18 19:52:31.257  INFO 4808 --- [           main] o.apache.catalina.core.StandardService   : Starting service [Tomcat]
2019-04-18 19:52:31.258  INFO 4808 --- [           main] org.apache.catalina.core.StandardEngine  : Starting Servlet engine: [Apache Tomcat/9.0.17]
2019-04-18 19:52:31.497  INFO 4808 --- [           main] o.a.c.c.C.[Tomcat].[localhost].[/]       : Initializing Spring embedded WebApplicationContext
2019-04-18 19:52:31.498  INFO 4808 --- [           main] o.s.web.context.ContextLoader            : Root WebApplicationContext: initialization complete
2019-04-18 19:52:32.279  INFO 4808 --- [           main] o.s.s.concurrent.ThreadPoolTaskExecutor  : Initializing ExecutorService 'applicationTaskExecut
2019-04-18 19:52:32.720  INFO 4808 --- [           main] o.s.b.w.embedded.tomcat.TomcatWebServer  : Tomcat started on port(s): 8900 (http) with co
2019-04-18 19:52:32.727  INFO 4808 --- [           main] c.d.v.AdminServiceProviderApplication    : Started AdminServiceProviderApplication in 5.582
=-=-=-Hello From AdminServiceProvider=-=-=-==
2019-04-18 19:52:53.414  INFO 4808 --- [nio-8900-exec-1] o.a.c.c.C.[Tomcat].[localhost].[/]       : Initializing Spring DispatcherServlet 'dispatcherSer
2019-04-18 19:52:53.416  INFO 4808 --- [nio-8900-exec-1] o.s.web.servlet.DispatcherServlet        : Initializing Servlet 'dispatcherServlet'
2019-04-18 19:52:53.441  INFO 4808 --- [nio-8900-exec-1] o.s.web.servlet.DispatcherServlet        : Completed initialization in 25 ms
```

CONSUMER SCREEN:

```
 /\\ / ___'_ __ _ _(_)_ __  __ _ \ \ \ \
( ( )\___ | '_ | '_| | '_ \/ _` | \ \ \ \
 \\/  ___)| |_)| | | | | || (_| |  ) ) ) )
  '  |____| .__|_| |_|_| |_\__, | / / / /
 =========|_|==============|___/=/_/_/_/
 :: Spring Boot ::        (v2.1.4.RELEASE)

2019-04-18 19:52:48.378  INFO 6700 --- [           main] com.demo.venky.AdminConsumerApplication  : Starting AdminConsumerApplication on Venk
2019-04-18 19:52:48.387  INFO 6700 --- [           main] com.demo.venky.AdminConsumerApplication  : No active profile set, falling back to default p
2019-04-18 19:52:51.330  INFO 6700 --- [           main] o.s.b.w.embedded.tomcat.TomcatWebServer  : Tomcat initialized with port(s): 8080 (http)
2019-04-18 19:52:51.385  INFO 6700 --- [           main] o.apache.catalina.core.StandardService   : Starting service [Tomcat]
2019-04-18 19:52:51.386  INFO 6700 --- [           main] org.apache.catalina.core.StandardEngine  : Starting Servlet engine: [Apache Tomcat/9.0.17]
2019-04-18 19:52:51.739  INFO 6700 --- [           main] o.a.c.c.C.[Tomcat].[localhost].[/]       : Initializing Spring embedded WebApplicationContext
2019-04-18 19:52:51.740  INFO 6700 --- [           main] o.s.web.context.ContextLoader            : Root WebApplicationContext: initialization complete
2019-04-18 19:52:52.506  INFO 6700 --- [           main] o.s.s.concurrent.ThreadPoolTaskExecutor  : Initializing ExecutorService 'applicationTaskExecut
2019-04-18 19:52:53.157  INFO 6700 --- [           main] o.s.b.w.embedded.tomcat.TomcatWebServer  : Tomcat started on port(s): 8080 (http) with co
2019-04-18 19:52:53.164  INFO 6700 --- [           main] com.demo.venky.AdminConsumerApplication  : Started AdminConsumerApplication in 6.134
Hello Venky
=-=-=-=-=-=-Message From Admin Consumer=-=-=-=-=-
2019-04-18 19:52:53.833  INFO 6700 --- [       Thread-5] o.s.s.concurrent.ThreadPoolTaskExecutor  : Shutting down ExecutorService 'applicationTaskE
```

MicroService Design and Implementation using Spring Cloud (Netflix Eureka Registry & Discovery)

Design #1# [Basic – No Load Balancing]

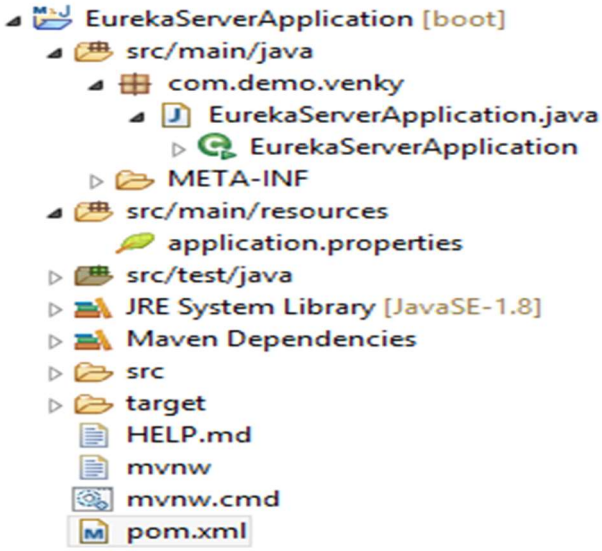


Step #1: Create Eureka Server: Create one Spring Boot Starter Project with
Dependencies: Eureka Server
Eureka Server Dependencies:--

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

GroupId: com.demo.venky
ArtifactId: EurekaServerApp
Version: 1.0

Folder Structure of Eureka Server:



Step #2:- At **Starter class** level add Annotation @EnableEurekaServer Annotation

```
package com.demo.venky;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.netflix.eureka.server.EnableEurekaServer;

@SpringBootApplication
@EnableEurekaServer
public class EurekaServerApplication {
	public static void main(String[] args) {
		SpringApplication.run(EurekaServerApplication.class, args);
	}
}
```

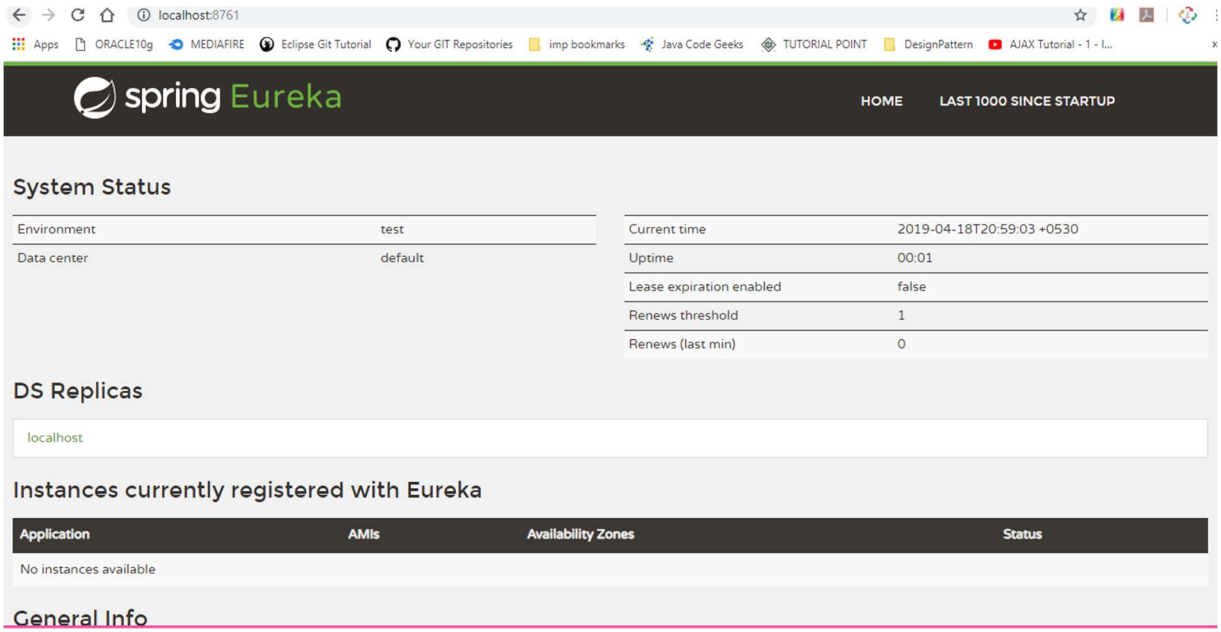
Step #3:- In **application.properties** add keys

```
server.port=8761
eureka.client.register-with-eureka=false
eureka.client.fetch-registry=false
```

Step #4:- Run starter class and Enter URL http://localhost:8761 in browser

NOTE:- Default port no of Eureka Server is 8761.

Screen Short of Eureka Server Dashboard:--



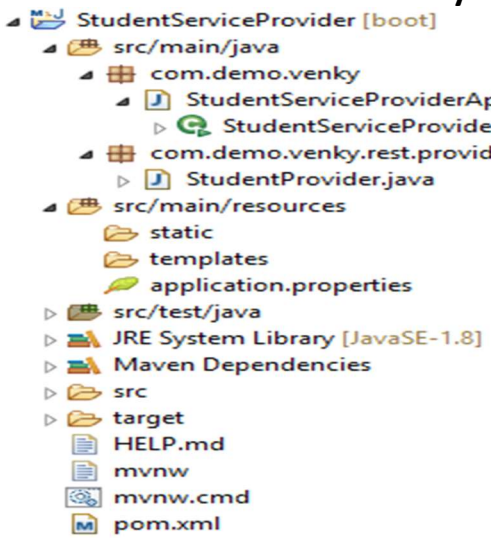
#2# Provider Application:

Step #1: Create one Spring starter App with web and Eureka Discovery dependencies

```
<!-- web Dependencies -->
        <dependency>
                <groupId>org.springframework.boot</groupId>
                <artifactId>spring-boot-starter-web</artifactId>
        </dependency>
                <!-- Eureka Discovery Dependencies -->
        <dependency>
                <groupId>org.springframework.cloud</groupId>
                <artifactId>spring-cloud-starter-netflix-eureka-client</artifactId>
        </dependency>
```

GroupId : com.demo.venky;
ArtifactId : StudentServiceProvider
Version : 1.0

Folder Structure of Eureka Discovery for Provider Application:--



Step #2:- Add below annotation at Starter class level @EnableEurekaClient (given by Netflix) or @EnableDiscoveryClient (given by Spring Cloud) both are optional.

Spring Starter class:--

```
package com.demo.venky;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.netflix.eureka.EnableEurekaClient;
@SpringBootApplication
@EnableEurekaClient
public class StudentServiceProviderApplication {
	public static void main(String[] args) {
		SpringApplication.run(StudentServiceProviderApplication.class, args);
		System.out.println("StudentServiceProvider");
	}
}
```

Step #3:- In application.properties file

```
server.port=9800
spring.application.name=STUDENT-PROVIDER
eureka.client.serviceUrl.defaultZone=http://localhost:8761/eureka
```

Step #4 Define one Provider Controller

```
package com.demo.venky.rest.provider;
import org.springframework.web.bind.annotation.GetMapping;
import org.springframework.web.bind.annotation.RequestMapping;
import org.springframework.web.bind.annotation.RestController;
@RestController
@RequestMapping("/provider")
public class StudentProvider {
	@GetMapping("/show")
	public String showMsg() {
		return"Hello From Provider";
	}
}
```

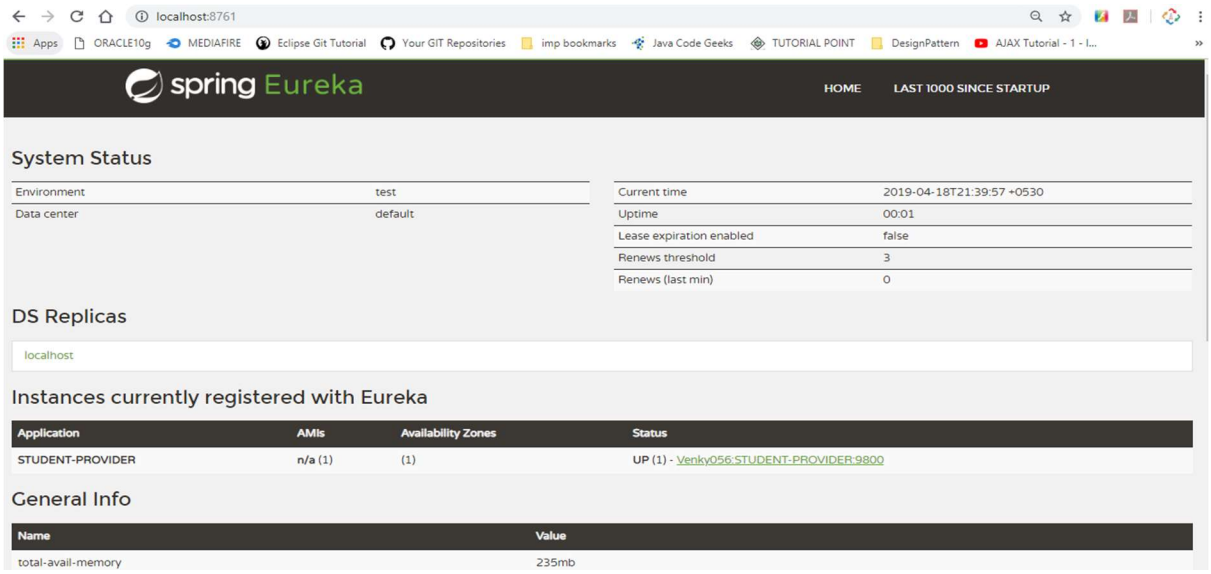
Execution Order: (RUN Starter Classes)

1. EUREKA SEVER
2. PROVIDER APPLICATION

➔GOTO EUREKA Dashboard and CHECK FOR APPLICATION

➔CLICK ON URL and ADD /provider/show➔PATH

#1 Screen Short of Eureka Server Dashboard: --



NOTE:-- Click on URL (Venky056:STUDENT-PROVIDER:9800) then add provider path after URI (http://venky056:9800/provider/show)

#2 Screen Short of Provider Application:--

#3# Consumer Application:

In general Spring Boot application, by using any HTTP Client code, Consumer makes request based on URL (static/hard coded) given in code.

*** **Hard coding:** Providing a direct value to a variable in .java file or fixed for multiple runs.

➔By using RestTemplate with URL (hard coded) we can make request. But it will not support.

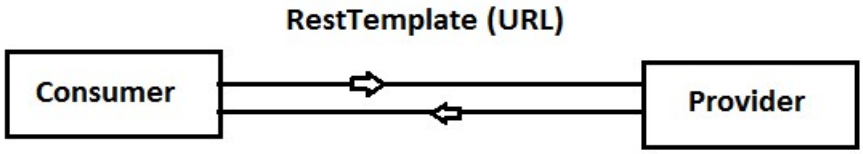
a. If provider IP/PORT number gets changed
b. Load Balancing Implementation

➔so, we should use Dynamic Client that gets URL at runtime based on Application name registered in “Registry and Discovery Server (Eureka)”.

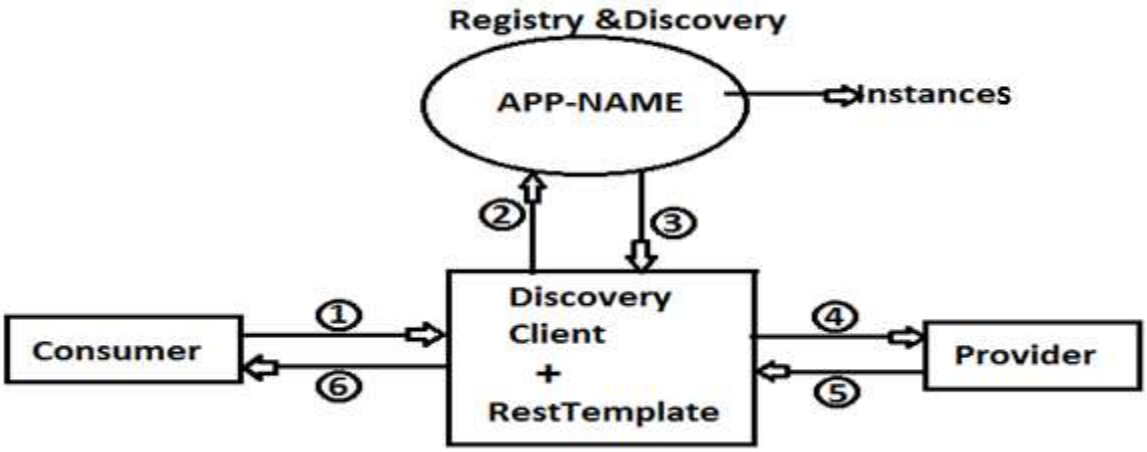
➔DiscoveryClient is used to fetch Instance based on Application Name and we can read URI of provider at runtime.

➔RestTemplate uses URI (+path = URL) and makes Request to Provider and gets ResponseEntity which is given back to the Consumer.

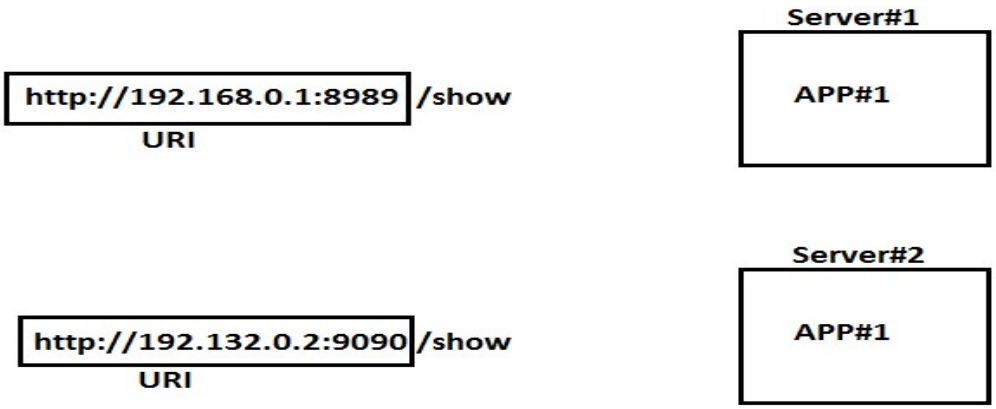
Simple Web Service Example:--



Microservices Example:--



➔If one Application is moved from one Server to another server then URI gets changed (Paths remain same).



Consumer code:--

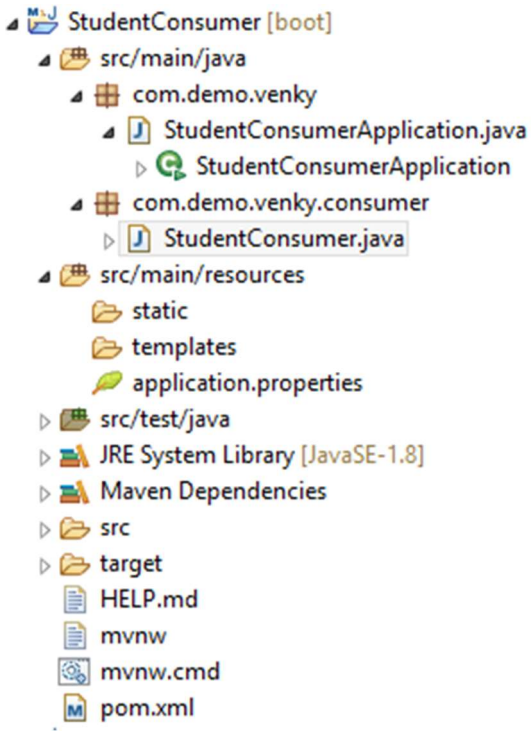
Step #1: -- Create one Spring Starter Project using Dependencies web, Eureka Discovery

GroupId: com.demo.venky

ArtifactId: StudentServiceConsumer

Version: 1.0

 # Folder Structure of Eureka Discovery Consumer Application:--



Step #2:-- At Starter class level add Annotation either @EnableEurekaClient or @EnableDiscoveryClient (both are optional)

```
package com.demo.venky;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.client.discovery.EnableDiscoveryClient;

@SpringBootApplication
//@EnableEurekaClient
//(both are optional Annotations)
@EnableDiscoveryClient
public class StudentConsumerApplication {
	public static void main(String[] args) {
		SpringApplication.run(StudentConsumerApplication.class, args);
	}
}
```

Step #3: in application. Properties file

```
server.port=9852
spring.application.name=STUDENT-CONSUMER
eureka.client.serviceUrl.defaultZone=http://localhost:8761/eureka
```

Step #4: Define Consumer code with RestTemplate and DiscoveryClient

```
package com.demo.venky.consumer;
import java.util.List;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.cloud.client.ServiceInstance;
import org.springframework.cloud.client.discovery.DiscoveryClient;
```

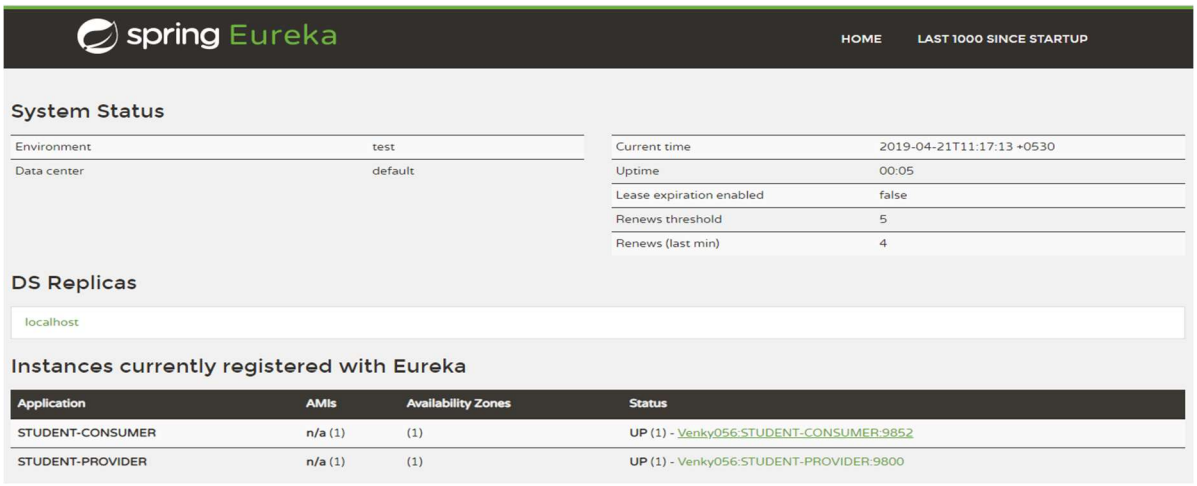
```
import org.springframework.http.ResponseEntity;
import org.springframework.web.bind.annotation.GetMapping;
import org.springframework.web.bind.annotation.RestController;
import org.springframework.web.client.RestTemplate;
@RestController
public class StudentConsumer {
		@Autowired
		private DiscoveryClient client;
		@GetMapping("/consume")
		public String consumeData() {
			RestTemplate rt = new RestTemplate();
			List<ServiceInstance> list=client.getInstances("STUDENT-
PROVIDER");
	ResponseEntity<String> resp
=rt.getForEntity(list.get(0).getUri()+"/provider/show", String.class);
		return "FROM CONSUMER=>" +resp.getBody();
		}
	}
```

Execution order: -

#1 Run Starter classes in order

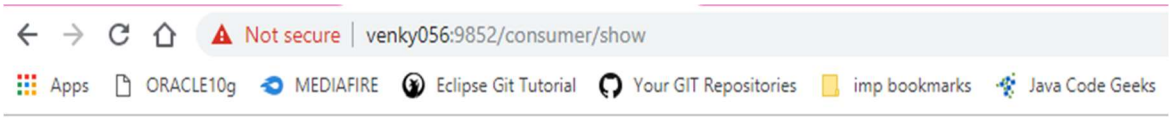
Eureka server, Provider Application, Consumer Application

#2 Go to Eureka and client Consumer URL enter /consumer path after PORT number.



NOTE:-- Click on URL (Venky056:STUDENT-CONSUMER:9852) then add provider path after URI (http://venky056:9800/consumer/show)

Output:



FROM CONSUMER=>Hello From Provider

Declarative ReST Client : [Feign Client]

➔Spring cloud supports any HTTP Client to make communication between (Microservices) Provider and Consumer.

➔RestTemplate is a **legacy style** which is used to make HTTP calls with URL and Extra inputs.

➔RestTemplate with DiscoveryClient makes mask to Provider URL. It means works based on Application Name (Service ID). Even URI gets changed it works without any modification at consumer side.

➔RestTemplate combination always makes Programmer to write manual coding for HTTP calls.

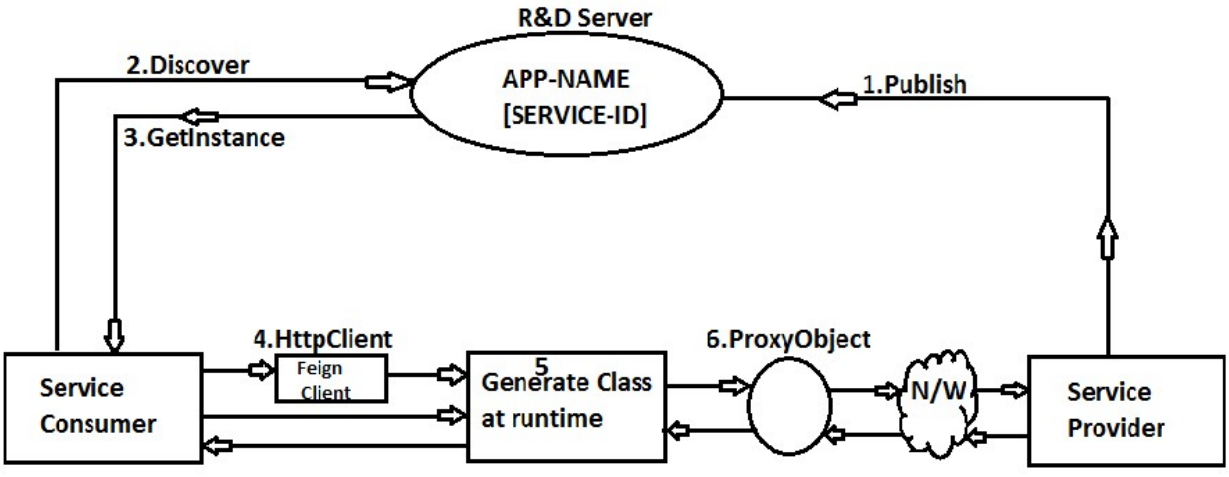
➔Spring Cloud has Provided one ActingClient [which behaves as Client, but not].

It means, Provide **Abstraction** at code level by programmer and Implementation is done at **runtime** by Spring cloud.

➔Feign is **Declarative Client**, which supports generating code at runtime and **proxy Object.** By using **Proxy HTTP Request** calls can be made.

➔It supports even Parameters (Path/Query…)and Global Data Conversion (XML/JSON).

Diagram:



FeignClient is an **Interface** and contains abstraction details, like:

a. Path (Provider paths at class and method).

b. Http Method Type (GET, POST…).

c. ServiceId (Application Name).
d. Input Details and Output Type.

➔We need to apply Annotation at starter class level **@EnableFeignClients.**
➔At interface level apply **@FeignClient(name="serviceId").**

Syntax: Feign Client

```
@FeignClient(name="serviceId")
public interface <ClientName> {

@GetMapping("/path")
//or @RequestMapping("path")
public <return> <method>(<params>);
    ……..
}
```

Example: (Provider Code (SID: EMP-PROV))

```
@RestController
@RequestMapping("/emp")
public class EmpProvider {

@GetMapping("/show")
Public String findMsg () {
……
  }
}
```

Consumer Code: Feign Client

```
@FeignClient (name=" EMP_PROV")
public interface EmpConsumer {
@GetMapping ("/emp/show")
public String getMsg ();     //return type and path must be same as Provider
}
```

(***)➔Consider last Example **Eureka Server** and **Provider Application** (STUDENT PROVIDER)

Step #1 Create one Spring Boot Starter Project for Consumer (using Feign, web, Eureka Discovery)

GroupId: com.demo.venky
ArtifactId: StudentServiceConsumerFeign
Version: 1.0

Step #2 Define one public interface as

```
package com.app.client;
@FeignClient(name=”STUDENT-PROVIDER”)
Public interface StudentFeignClient {
  @GetMapping(“/show”)
Public String getMsg();
}
```

Step #3 Use in any consumer class (HAS-A) and make method call (HTTP CALL)

```
package com.app.consumer;
@RestController
public class StudentConsumer  {

@Autowired
private StudentFeignClient client;
@GetMapping(“/consumer”)
Public String showData () {
System.out.pritln(client.getClass().getName());
Return “CONSUMER=>”+client.getMsg();
}}
```

NOTE: Here client.getMsg() method is nothing but HTTP Request call.

LoadBalancing in SpringCloud(MicroServices)

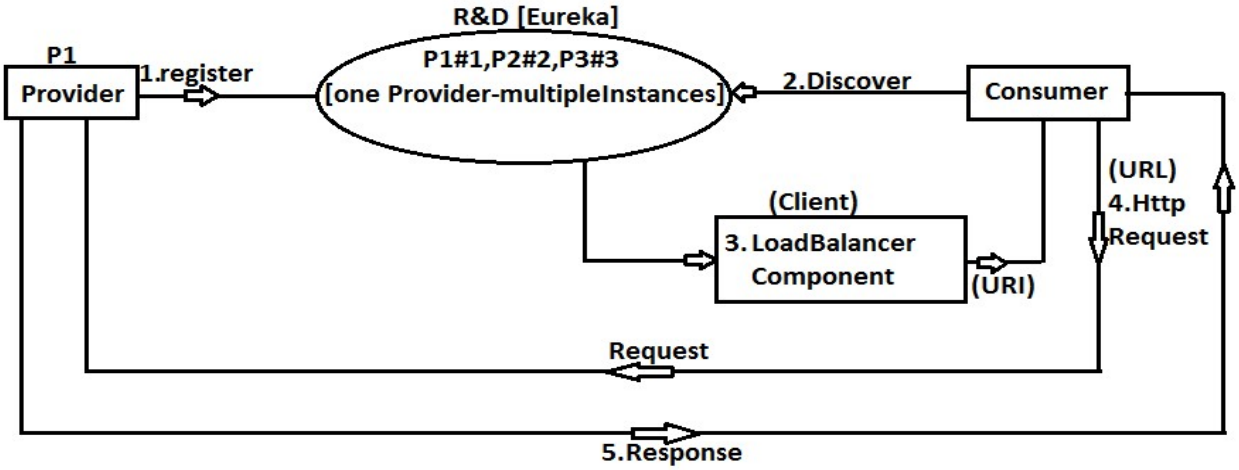
➔To handle Multiple Requests made by any HTTPClient (or consumer) in lesstime, one Provider should **run as multiple instances** and **handle request in parallel** such concept is called as "**LoadBalancing".**

➔LoadBalancing is to make request handling faster (reduce waiting time in queue).

Steps to implement LoadBalancing: -

a. Create one Provider Application
b. Register one Provider as multiple instances in Registry and Discovery [Eureka] server. Every instances with uniqueId.
   Ex: P1-58266, P2-23345, P3-64785 etc...,
c. Define Consumer with anyone LoadBalancerComponent (Ex: Ribbon, Feign)
d. Ribbon chooses one Provider URI, based on InstanceId with help of **LBSRegister** which maintains request count.
e. Consumer will add Paths to URI and makes Request using **"RequestClient".**
   [Ex: LoadBalancerClient(I) or @FeignClient]
f. ResponseEntity is returned by Provider to Consumer.

Diagram:



➔LoadBalancerComponent: Ribbon, Feign

➔Request Component:

(Temporary Memory By Ribbon)
LoadBalanceServer Registry

InstanceId	RequestCount
P1#1	11
P2#2	10
P3#3	10

Ribbon:

➔It is a Netflix component provided for SpringBootCloudLoadBalancing.

➔It is also called as **"ClientSideLoadBalancing".** It means ConsumerApp,reads URI (which one is free) using LBS Register.

➔Ribbon should be enabled by every consumer.

➔spring cloud uses LoadBalancerClient(I) for **"choose and invoke"** process.

➔Its implementation is provided by Ribbon.

=-=-CodingSteps=-=-=

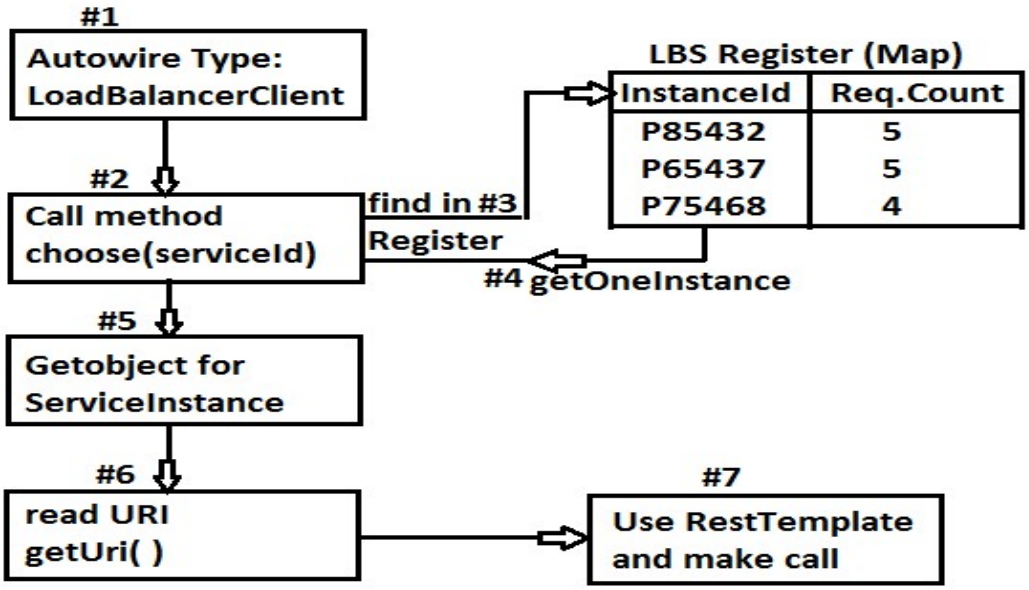
#1 In Provider, define InstanceId for PROVIDER APPLICATION using key "eureka.instance.instance-id"**.** If not provided default is taken as SpringApp name.

eureka.instance.instance-id=${spring.application.name}:${random.value}

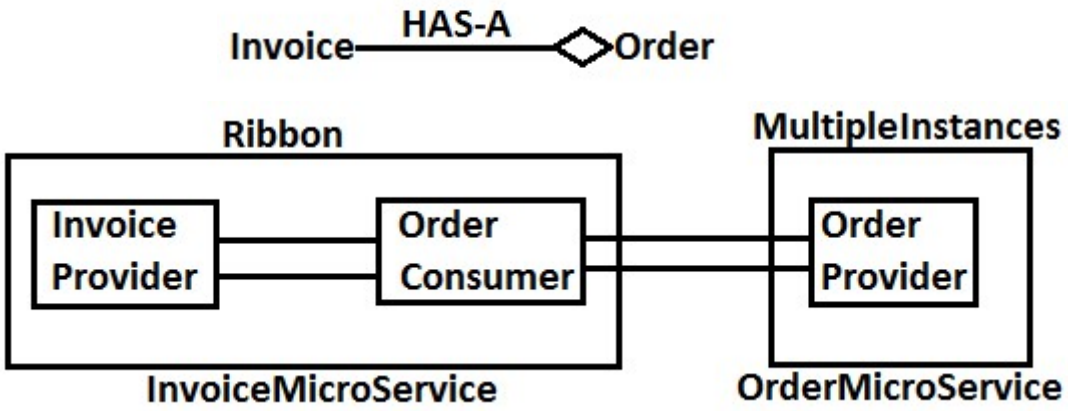
[add in application.properties]

#2 In Consumer, add dependency for Ribbon and use LoadBalancerClient (Autowired) and call choose("APP-NAME") method to get ServiceInstance (for URI)

Consumer Execution flow for Request:

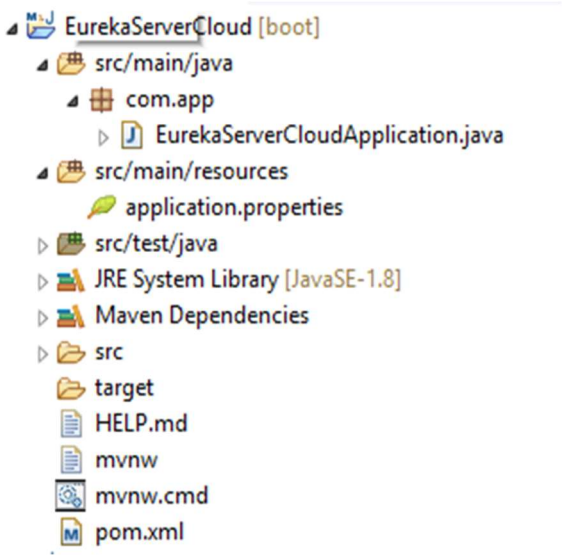


Consider below Example for Ribbon:



Step #1 Configure Eureka Server Dependencies : Eureka Server only

FolderStructure:



EurekaServerCloudApplication.java

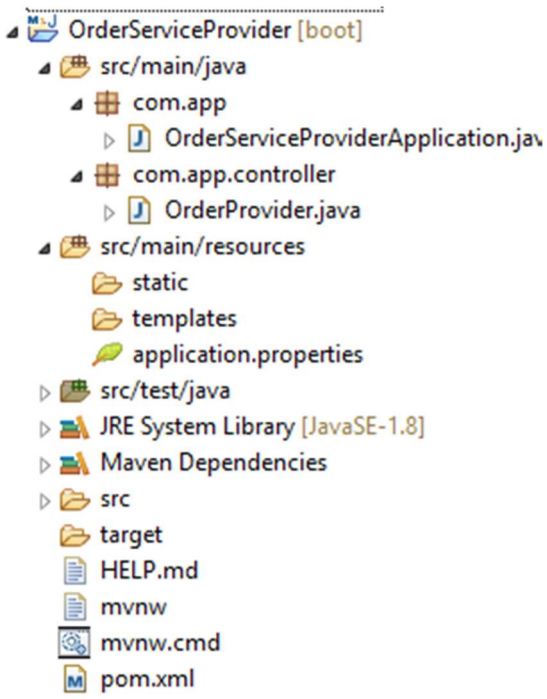
```
package com.app;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.netflix.eureka.server.EnableEurekaServer;

@SpringBootApplication
@EnableEurekaServer
public class EurekaServerCloudApplication {
	public static void main(String[] args) {
		SpringApplication.run(EurekaServerCloudApplication.class, args);
	}
}
```

application.properties

```
server.port=8761
eureka.client.register-with-eureka=false
eureka.client.fetch-registry=false
```

Step #2 Create Order Service Provider Application Dependencies : Eureka Discovery, Web

FolderStructure:



OrderServiceProviderApplication.java:

```
package com.app;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.client.discovery.EnableDiscoveryClient;

@SpringBootApplication
@EnableDiscoveryClient
public class OrderServiceProviderApplication {
	public static void main(String[] args) {
		SpringApplication.run(OrderServiceProviderApplication.class, args);
	}
}
```

OrderProvider.java:

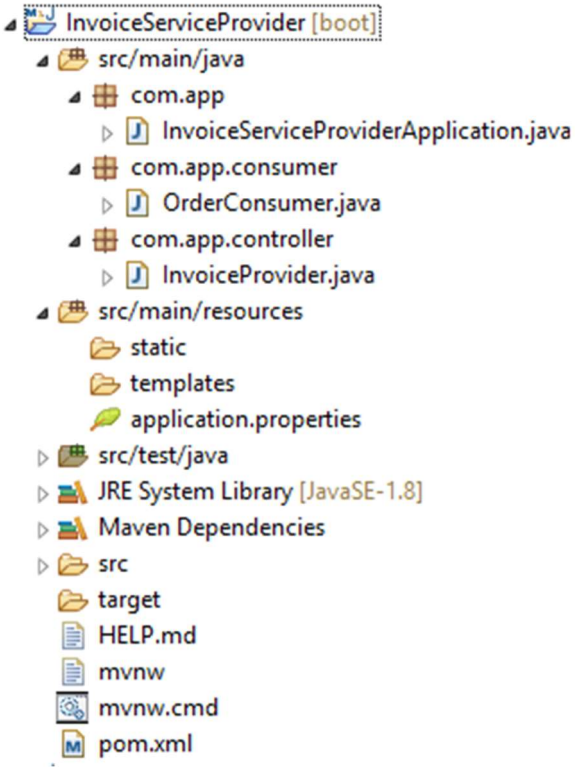
```
package com.app.controller;
import org.springframework.beans.factory.annotation.Value;
import org.springframework.web.bind.annotation.GetMapping;
import org.springframework.web.bind.annotation.RequestMapping;
import org.springframework.web.bind.annotation.RestController;
@RestController
@RequestMapping("/order")
public class OrderProvider {
	@Value("${server.port}")
	private String port;
	@GetMapping("/status")
	public String getOrderStatus() {
		return "FINISHED::"+port;
	 }  }
```

application.properties:

```
server.port=9803
spring.application.name=ORDER-PROVIDER
eureka.client.serviceUrl.defaultZone=http://localhost:8761/eureka
eureka.instance.instance-id=${spring.application.name}:${random.value}
```

➔If no instance-id is provided then application name (service Id) behaves as instance -Id

Step #3 Define Invoice Service Provider
Dependencies : Eureka Discovery, Web, Ribbon
FolderStructure:



InvoiceServiceProviderApplication.java:

```
package com.app;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.client.discovery.EnableDiscoveryClient;
@SpringBootApplication
@EnableDiscoveryClient
public class InvoiceServiceProviderApplication {
	public static void main(String[] args) {
		SpringApplication.run(InvoiceServiceProviderApplication.class, args);
	}

}
```

application.properties:

```
server.port=8800
spring.application.name=INVOICE-PROVIDER
eureka.client.serviceUrl.defaultZone=http://localhost:8761/eureka
```

OrderConsumer.java:

```
package com.app.consumer;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.cloud.client.ServiceInstance;
import org.springframework.cloud.client.loadbalancer.LoadBalancerClient;
import org.springframework.http.ResponseEntity;
import org.springframework.stereotype.Service;
import org.springframework.web.client.RestTemplate;
@Service
public class OrderConsumer {
	@Autowired
	private LoadBalancerClient client;
	public String getStatus() {
		String path="/order/status";
		ServiceInstance instance=client.choose("ORDER-PROVIDER");
		String uri=instance.getUri().toString();
		RestTemplate rt=new RestTemplate();
		ResponseEntity<String> resp=rt.getForEntity(uri+path, String.class);
		return "CONSUMER=>"+resp.getBody();
	}
}
```

InvoiceProvider.java:

```
package com.app.controller;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.web.bind.annotation.GetMapping;
import org.springframework.web.bind.annotation.RequestMapping;
import org.springframework.web.bind.annotation.RestController;
import com.app.consumer.OrderConsumer;
@RestController
@RequestMapping("/invoice")
public class InvoiceProvider {
	@Autowired
	private OrderConsumer consumer;
	@GetMapping("/info")
	public String getOrderSatus() {
		return consumer.getStatus();
	}  }
```

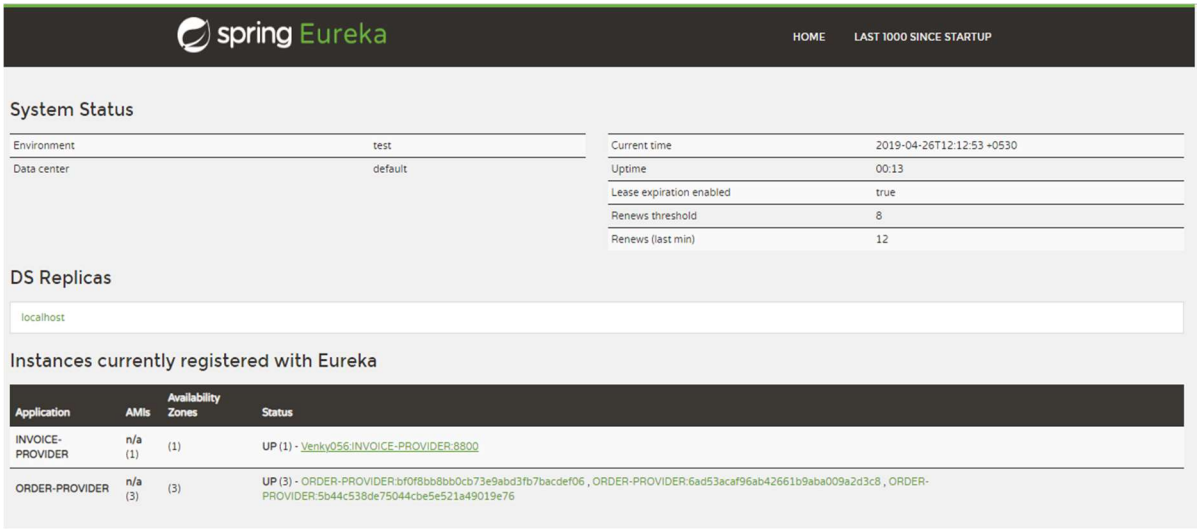
Execution:

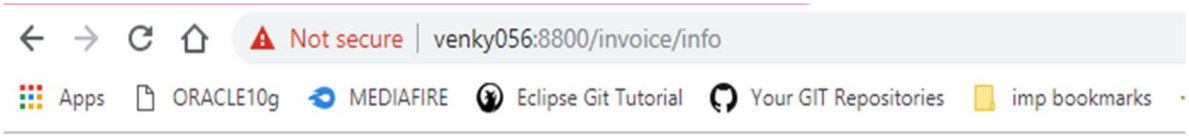
a. start Eureka Server
b. Run OrderProvider starter class 3 times

*** Change every time port number like: 9800,9801, 9802

c. Run InvoiceProvider Starter class
d. Goto Eureka and Execute Invoice Provider Instance type full URL http://localhost:8080/invoice/info

outputs:





CONSUMER=>FINISHED::9802

Load Balancing using Feign Client

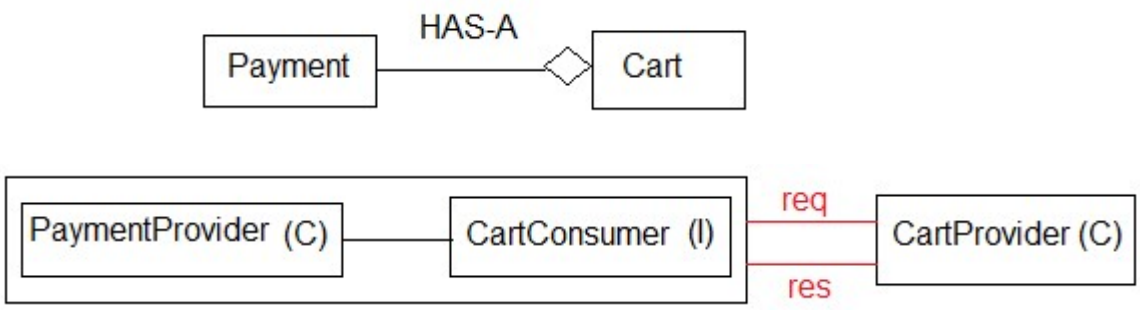
In case of Manual Coding for load Balancing Ribbon Component is used with Type "LoadBalancingClient" (I).

➔Here, using this programmer has to define logic of consumer method.

➔Feign Client reduces coding lines by Programmer, by generating logic/code at runtime.

➔Feign Client uses abstraction Process, means Programmer has to provide path with Http Method Type and also input, output details.

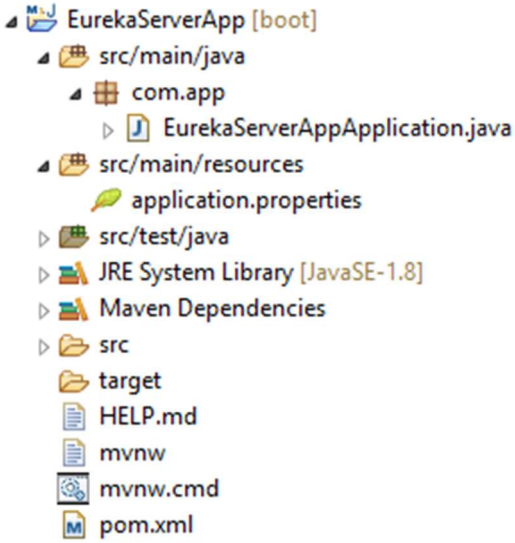
➔At Runtime RibbonLoadBalancerClient instance is used to choose serviceInstance and make HTTP call.



Example:

Step #1: Create Spring Starter Project for Eureka Server with port 8761 and dependency "EurekaServer".

FolderStructure:



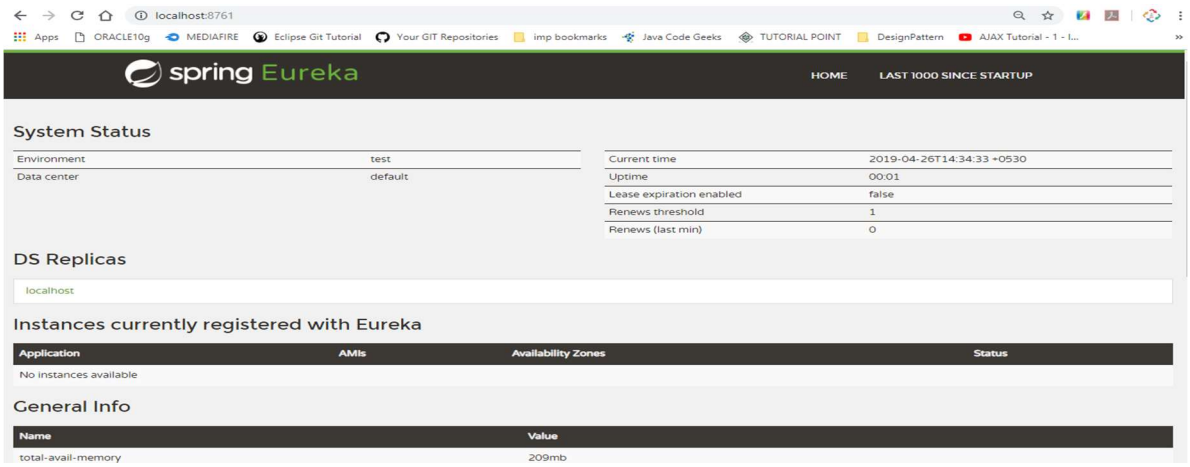
EurekaServerAppApplication.java:

```
package com.app;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.netflix.eureka.server.EnableEurekaServer;
@SpringBootApplication
@EnableEurekaServer
```

```
public class EurekaServerAppApplication {
	public static void main(String[] args) {
		SpringApplication.run(EurekaServerAppApplication.class, args);
	}
}
```

application.properties:

```
server.port=8761
eureka.client.register-with-eureka=false
eureka.client.fetch-registry=false
```

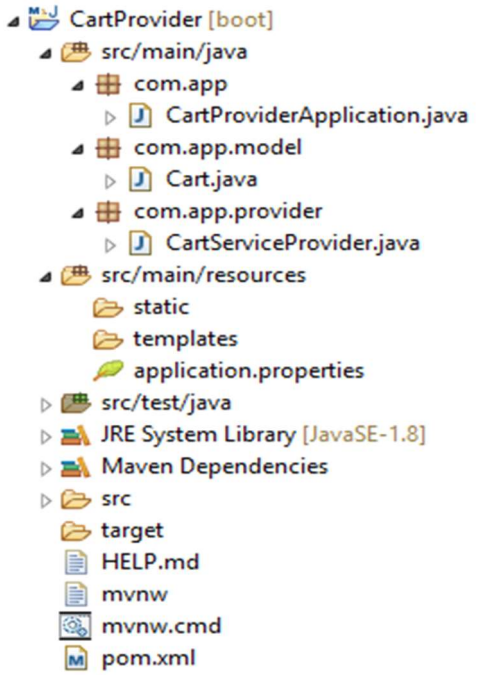


Step #2: Cart provider Application

Dependencies : web, EurekaDiscovery

➔At starter class level : @EnableDiscoveryClient

FolderStructure:



CartProviderApplication.java:

```
package com.app;
```

```
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.client.discovery.EnableDiscoveryClient;
@SpringBootApplication
@EnableDiscoveryClient
public class CartProviderApplication {
	public static void main(String[] args) {
		SpringApplication.run(CartProviderApplication.class, args);
	}
}
```

Cart.java:

```
package com.app.model;
public class Cart {
	private Integer cartId;
	private String cartCode;
	private Double cartFinalCost;
	public Cart() {
		super();
	}
	public Cart(Integer cartId, String cartCode, Double cartFinalCost) {
		super();
		this.cartId = cartId;
		this.cartCode = cartCode;
		this.cartFinalCost = cartFinalCost;
	}
	public Integer getCartId() {
		return cartId;
	}
	public void setCartId(Integer cartId) {
		this.cartId = cartId;
	}
	public String getCartCode() {
		return cartCode;
	}
	public void setCartCode(String cartCode) {
		this.cartCode = cartCode;
	}
	public Double getCartFinalCost() {
		return cartFinalCost;
	}
	public void setCartFinalCost(Double cartFinalCost) {
		this.cartFinalCost = cartFinalCost;
	}
```

```
	@Override
	public String toString() {
		return "Cart [cartId=" + cartId + ", cartCode=" + cartCode + ",
cartFinalCost=" + cartFinalCost + "]";
	}
}
```

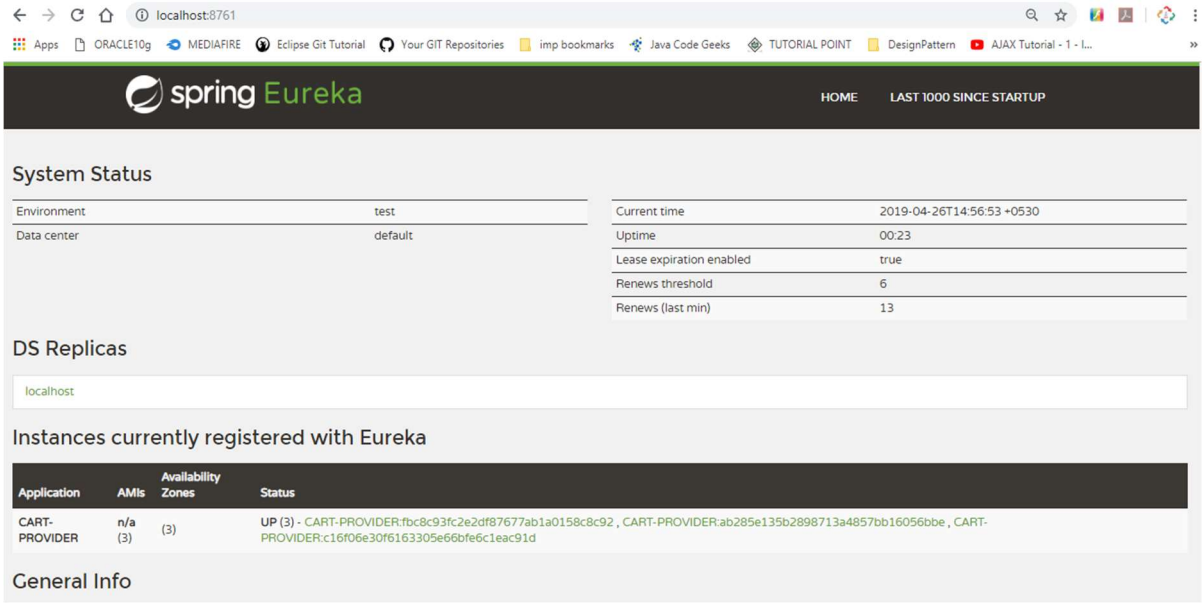
CartServiceProvider.java:

```
package com.app.provider;
import java.util.Arrays;
import java.util.List;
import org.springframework.beans.factory.annotation.Value;
import org.springframework.web.bind.annotation.GetMapping;
import org.springframework.web.bind.annotation.RequestMapping;
import org.springframework.web.bind.annotation.RestController;
import com.app.model.Cart;
@RestController
@RequestMapping("/cart")
public class CartServiceProvider {
	@Value("${server.port}")
	private String port;
	@GetMapping("/info")
	public String getMsg() {
		return "CONSUMER:"+port;
	}
	@GetMapping("/data")
	public Cart getObj() {
		return new Cart(109, "ABC:"+port, 636.36);
	}
	@GetMapping("/list")
	public List<Cart> getBulk() {
		return Arrays.asList(
				new Cart(101, "A:"+port, 636.36),
				new Cart(102, "B:"+port, 526.46),
				new Cart(103, "C:"+port, 839.38)
				);
	}
}
```

application.properties:

```
server.port=8603
spring.application.name=CART-PROVIDER
eureka.client.serviceUrl.defaultZone=http://localhost:8761/eureka
eureka.instance.instance-id=${spring.application.name}:${random.value}
```

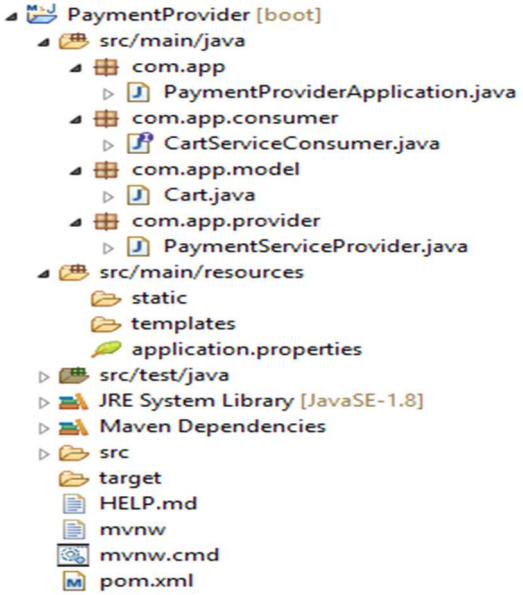
output:



Step #3: Payment Provider App with Cart Consumer code

Dependencies : web, EurekaDiscovery, Feign

FolderStructure:



** At Starter class level : @EnableFeignClients

PaymentProviderApplication.java:

```
package com.app;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.openfeign.EnableFeignClients;
@SpringBootApplication
@EnableFeignClients
public class PaymentProviderApplication {
	public static void main(String[] args) {
		SpringApplication.run(PaymentProviderApplication.class, args);
	}
}
```

CartServiceConsumer.java:

```
package com.app.consumer;
import java.util.List;
import org.springframework.cloud.openfeign.FeignClient;
import org.springframework.web.bind.annotation.GetMapping;
import com.app.model.Cart;

@FeignClient(name="CART-PROVIDER")
public interface CartServiceConsumer {
	@GetMapping("/cart/info")
	public String getMsg() ;
	@GetMapping("/cart/data")
	public Cart getObj() ;
	@GetMapping("/cart/list")
	public List<Cart> getBulk();
}
```

Cart.java:

```
package com.app.model;
public class Cart {
	private Integer cartId;
	private String cartCode;
	private Double cartFinalCost;
	public Cart() {
		super();
	}
	public Cart(Integer cartId, String cartCode, Double cartFinalCost) {
		super();
		this.cartId = cartId;
		this.cartCode = cartCode;
		this.cartFinalCost = cartFinalCost;
	}
	public Integer getCartId() {
		return cartId;
	}
	public void setCartId(Integer cartId) {
		this.cartId = cartId;
	}
	public String getCartCode() {
		return cartCode;
	}
	public void setCartCode(String cartCode) {
		this.cartCode = cartCode;
	}
```

```
	public Double getCartFinalCost() {
		return cartFinalCost;
	}
	public void setCartFinalCost(Double cartFinalCost) {
		this.cartFinalCost = cartFinalCost;
	}
	@Override
	public String toString() {
		return "Cart [cartId=" + cartId + ", cartCode=" + cartCode + ",
cartFinalCost=" + cartFinalCost + "]";
	}
}
```

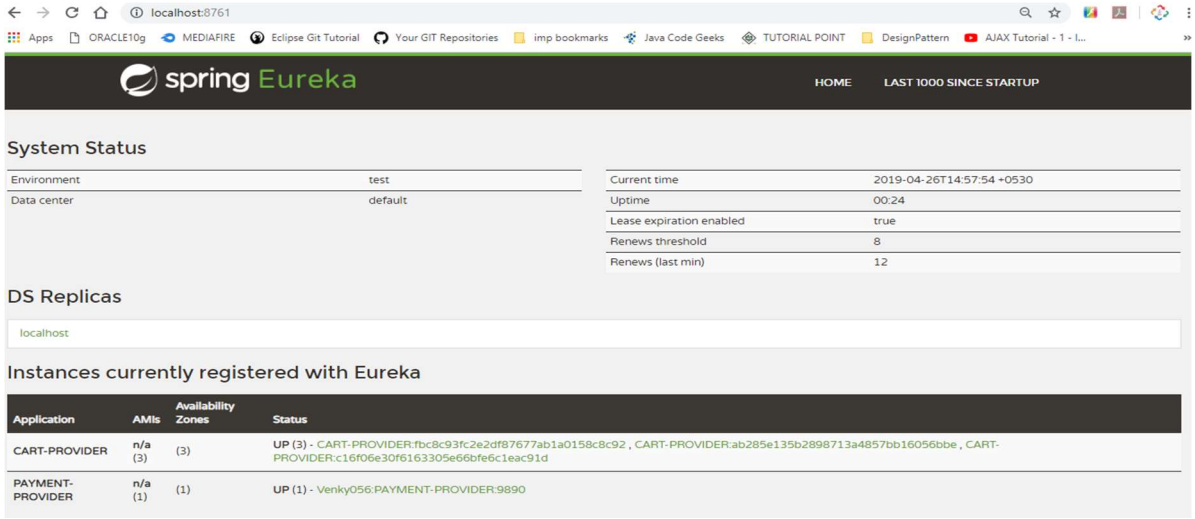
PaymentServiceProvider.java:

```
package com.app.provider;
import java.util.List;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.web.bind.annotation.GetMapping;
import org.springframework.web.bind.annotation.RequestMapping;
import org.springframework.web.bind.annotation.RestController;
import com.app.consumer.CartServiceConsumer;
import com.app.model.Cart;
@RestController
@RequestMapping("/payment")
public class PaymentServiceProvider {
	@Autowired
	private CartServiceConsumer consumer;
	@GetMapping("/message")
	public String getMsg() {
		return consumer.getMsg();
	}
	@GetMapping("/one")
	public Cart getOneRow() {
		return consumer.getObj();
	}
	@GetMapping("/all")
	public List<Cart> getAllRows(){
		return consumer.getBulk();
	}
}
```

application.properties:

```
server.port=9890
spring.application.name=PAYMENT-PROVIDER
eureka.client.serviceUrl.defaultZone=http://localhost:8761/eureka
```

output:



Step #4 Execution Order:

➔Run Eureka Server

➔Run Cart Provider 3 times (with different port)

➔run Payment Provider 1 time

➔Go to Eureka server and Run Payment service

Output:


```
[{"cartId":101,"cartCode":"A:8602","cartFinalCost":636.36},
{"cartId":102,"cartCode":"B:8602","cartFinalCost":526.46},
{"cartId":103,"cartCode":"C:8602","cartFinalCost":839.38}]
```

Spring Cloud Confgi Server

➔It is also called as Configuration Server. In Spring Boot/Cloud Projects, it contains files like : **properties files [application.properties]**

➔In some cases Key=Values need to be changed (or) new key=value need to be added. At this time, we should

--> Stop the Server (Application)
--> Open/find application.properties file
--> Add External key=value pairs or do modifications.
--> Save changes [save file]
--> Re-build file [re-create jar/war]
--> Re-Deploy [re-start server]

➔And this is done in All related Project [multiple microservices] which is repeated task for multiple applications.

#To avoid this repeated (or lengthy) process use **"application.properties"** which is placed outside of your Project. i.e. known as **"ConfigServer"**.

➔Config server process maintains three (3) properties file. Those are:

a. One in = Under Project (Microservice)
b. One in = Config Server (link file)
c. One in = Config server(native) (or) outside ConfigServer(External)also called as Source file.

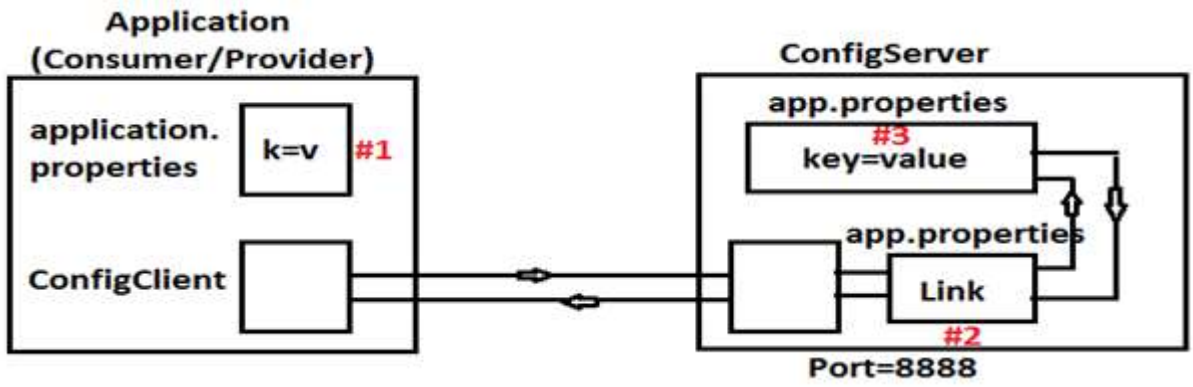
➔Spring cloud Config server can be handled in two ways. Those are

1. Native Config Server
2. External Config Server

1.Native Config Server: It is also called as local file placed in Config server only.
2.External Config Server: In this case properties file is placed outside the Config server. Ex: GIT (github)

➔In Consumer/Producer Project we should add ConfigClient dependency which gets config server details at runtime.

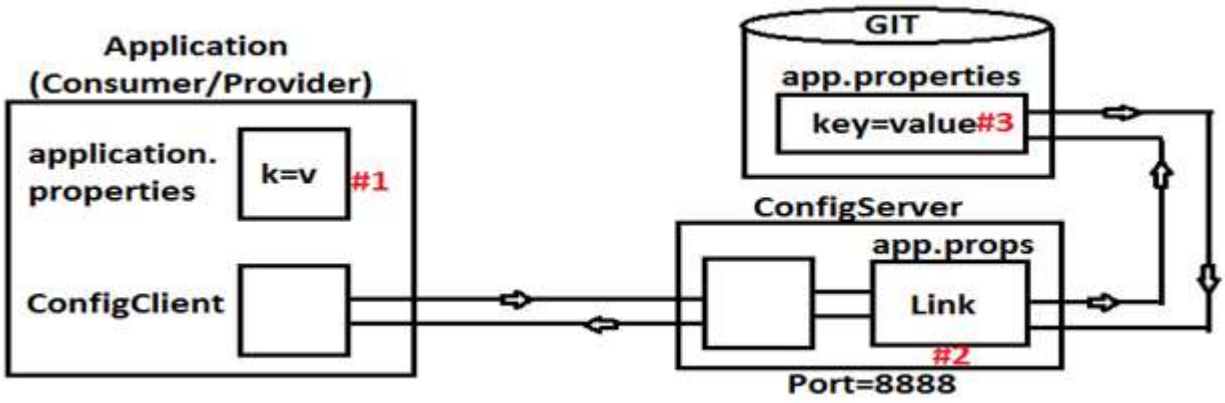
#1(NativeConfigServer)
LocalFileConfigServer



➔Config server runs at default port=8888.

2# (GIT ConfigServer)

ExternalConfigServer



Steps to implement Spring Cloud Config Server (-Native & External-) :-

Step#1 Create SpringBoot Starter Project for **"ConfigServer".**

```
<dependency>
    <groupId>org.springframework.cloud</groupId>
    <artifactId>spring-cloud-config-server</artifactId>
</dependency>
```

Step#2 Provide key value in properties files

Case#a) native

application.properties

```
##link file##
server.port=8888
spring.profiles.active=native
spring.cloud.config.server.native.search-locations=classpath:/myapp-config
```

case#b) External

application.properties

```
server.port=8888
spring.cloud.config.server.git.uri=https://github.com/venkatadri053/config-server-ex
```

Step#3 Create sub folder "myapp-config" in src/main/resources folder.
Create file application.properties inside this folder. It behaves like source
Having ex key:

eureka.client.serviceUrl.defaultZone=http://localhost:8761/eureka

(or)

Create Git Project "configserverex" and create application.properties inside this.
place above key and save file.

Step#4 Provide include resource code in pom.xml
To Consider properties files to be loaded into memory.

```
<resources>
	<resource>
		<filtering>true</filtering>
		<directory>src/main/resources</directory>
		<includes>
		<include>*.properties</include>
		<include>myapp-config</include>
		</includes>
	</resource>
</resources>
```

Step#5 At Starter class of ConfigServer App,add Annotation: **@EnableConfigServer**

Step#6 InConsumer/Provider Projects pom.xml file add dependency: **Config Client** (or copy below dependency)

```
<dependency>
	<groupId>org.springframework.cloud</groupId>
	<artifactId>spring-cloud-config-server</artifactId>
</dependency>
```

---ExecutionOrder----

➔Eureka Server ➔Config Server ➔Producer(Provider) ➔Consumer

Steps for Coding

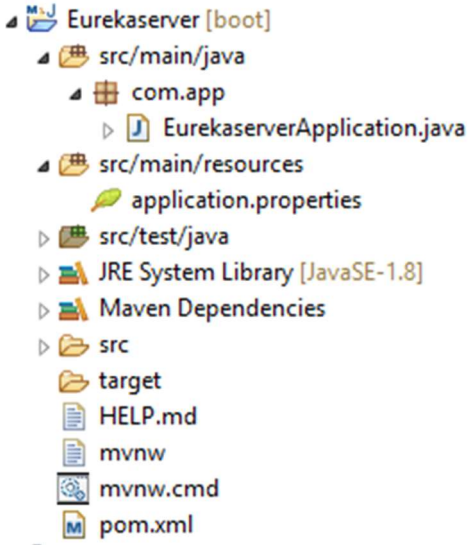
Step#1 Eureka Server Project

➔Dependency: Eureka Server

➔Write application.properties

➔Add @EnableEurekaServer annotation

FolderStructure:



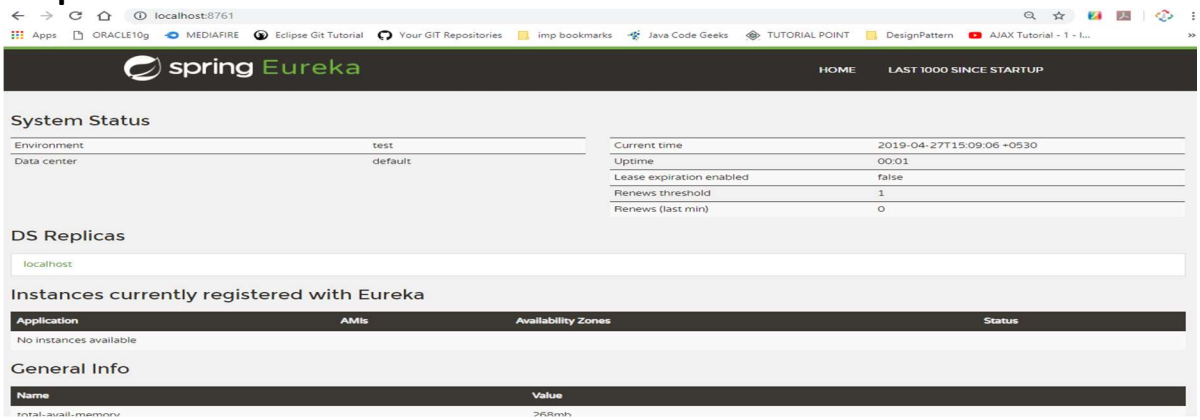
EurekaserverApplication.java:

```
package com.app;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.netflix.eureka.server.EnableEurekaServer;
@SpringBootApplication
@EnableEurekaServer
public class EurekaserverApplication {
	public static void main(String[] args) {
		SpringApplication.run(EurekaserverApplication.class, args);
	}
}
```

application.properties:

```
server.port=8761
eureka.client.register-with-eureka=false
eureka.client.fetch-registry=false
```

output:



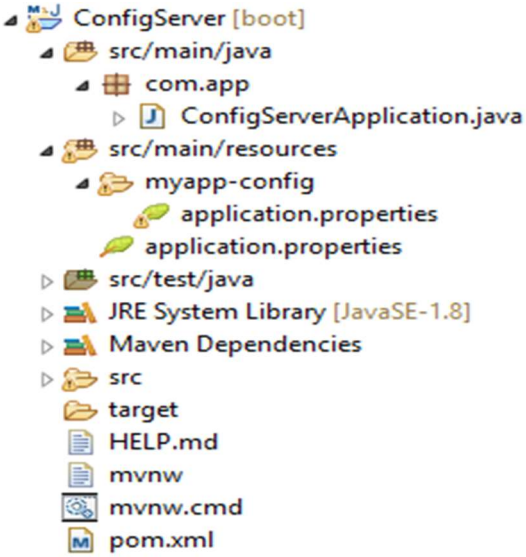
Step#2 Define Config server Project

➔Dependency:Config Server

➔Write application.properties

➔Add @EnableConfigServer annotation

FolderStructure:



ConfigServerApplication.java:

```
package com.app;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.config.server.EnableConfigServer;
@SpringBootApplication
@EnableConfigServer
public class ConfigServerApplication {
	public static void main(String[] args) {
		SpringApplication.run(ConfigServerApplication.class, args);
	}
}
```

myapp.properties:

```
##Source Fie##
eureka.client.serviceUrl.defaultZone=http://localhost:8761/eureka
```

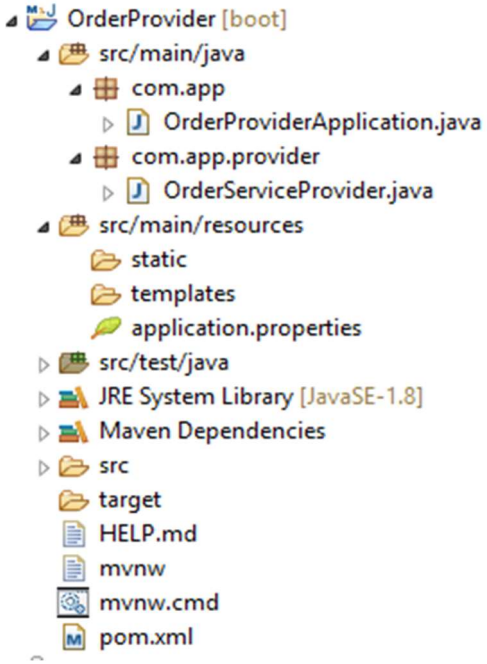
application.properties:

```
##link file##
server.port=8888
spring.profiles.active=native
spring.cloud.config.server.native.search-locations=classpath:/myapp-config
```

Step#3 Create Provider Project (Order)

➔Dependency : web,eureka discovery,Config client
➔Write application.properties
➔Add @EnableDiscoveryClient annotation
➔Writer Provider (RestController)

FolderStructure:



InvoiceProviderApplication.java:

```
package com.app;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.openfeign.EnableFeignClients;
@SpringBootApplication
@EnableFeignClients
public class InvoiceProviderApplication {
	public static void main(String[] args) {
		SpringApplication.run(InvoiceProviderApplication.class, args);
	}
}
```

OrderConsumer.java:

```
package com.app.consumer;
import org.springframework.cloud.openfeign.FeignClient;
import org.springframework.web.bind.annotation.GetMapping;
@FeignClient(name="ORDER-PROVIDER")
public interface OrderConsumer {
	@GetMapping("/order/show")
	public String showMsg();
}
```

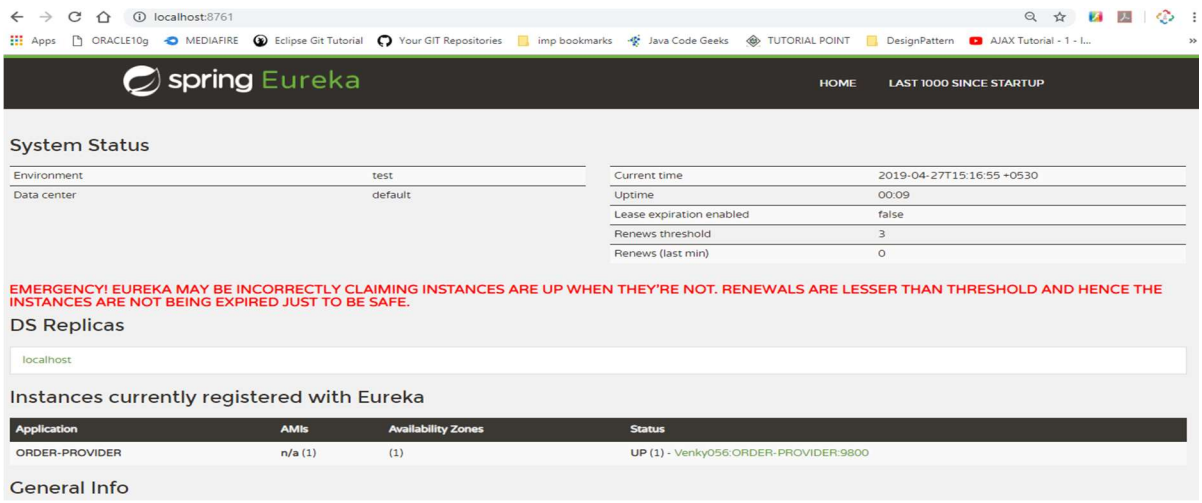
InvoiceServiceProvider.java:

```
package com.app.provider;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.web.bind.annotation.GetMapping;
import org.springframework.web.bind.annotation.RequestMapping;
import org.springframework.web.bind.annotation.RestController;
import com.app.consumer.OrderConsumer;
@RestController
@RequestMapping("/invoce")
public class InvoiceServiceProvider {
	@Autowired
	private OrderConsumer consumer;
	@GetMapping("/info")
	public String getConsumerMsg() {
		return "Consumer=>"+consumer.showMsg();
	}
}
```

application.properties:

```
server.port=9500
spring.application.name=INVOICE-PROVIDER
```

Output:



Step#4 Create Consumer Project (Invoice)

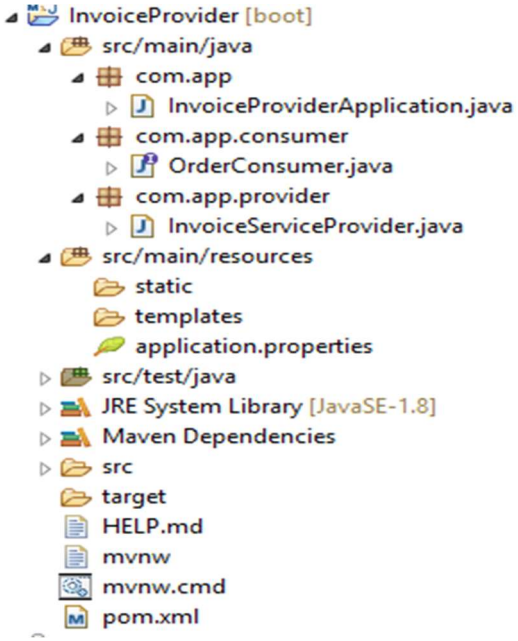
➔Dependency : web,Eureka Discovery,Config client,Feign

➔Write application.properties

➔Add @EnableFeignClient annotation

➔Writer Consumer [Feign Client] and Invoice provider (RestController)

FolderStructure:



InvoiceProviderApplication.java:

```
package com.app;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.openfeign.EnableFeignClients;
@SpringBootApplication
@EnableFeignClients
public class InvoiceProviderApplication {
	public static void main(String[] args) {
		SpringApplication.run(InvoiceProviderApplication.class, args);
	}
}
```

OrderConsumer.java:

```
package com.app.consumer;
import org.springframework.cloud.openfeign.FeignClient;
import org.springframework.web.bind.annotation.GetMapping;
@FeignClient(name="ORDER-PROVIDER")
public interface OrderConsumer {
	@GetMapping("/order/show")
	public String showMsg();
}
```

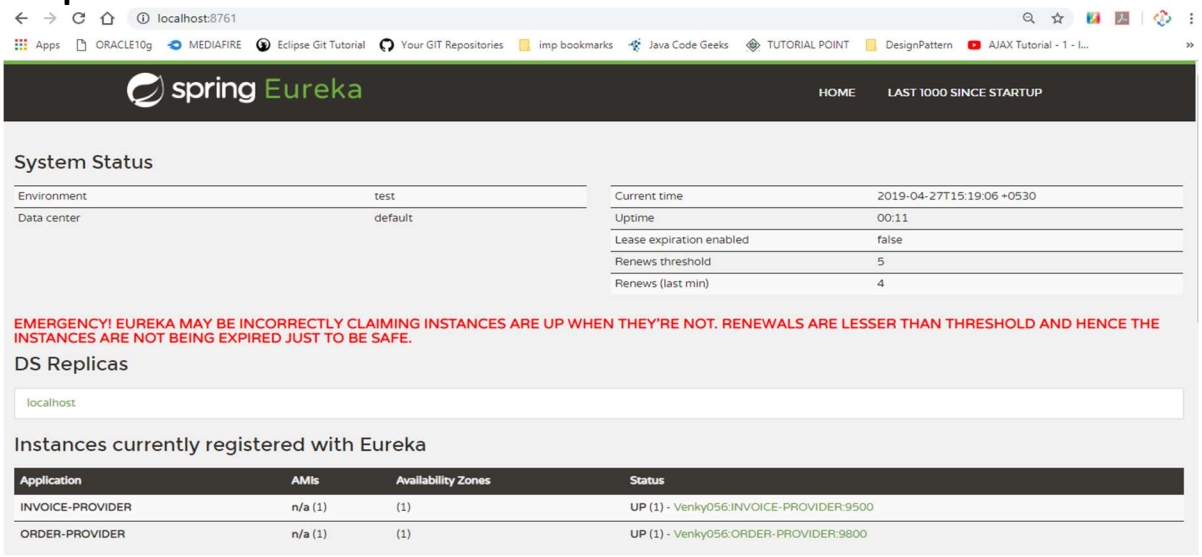
InvoiceServiceProvider.java:

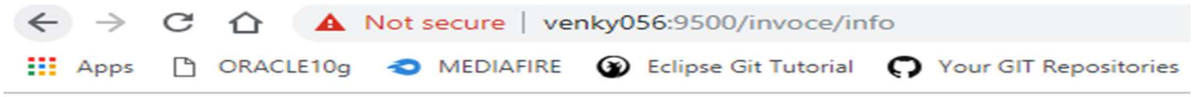
```
package com.app.provider;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.web.bind.annotation.GetMapping;
import org.springframework.web.bind.annotation.RequestMapping;
import org.springframework.web.bind.annotation.RestController;
import com.app.consumer.OrderConsumer;
@RestController
@RequestMapping("/invoce")
public class InvoiceServiceProvider {
	@Autowired
	private OrderConsumer consumer;
	@GetMapping("/info")
	public String getConsumerMsg() {
		return "Consumer=>"+consumer.showMsg();
	}
}
```

application.properties:

```
server.port=9500
spring.application.name=INVOICE-PROVIDER
```

Output:





Consumer=>From Provider

Steps to configure External ConfigServer:(only modifications)

Step#1 in config server project,delete folder myapp-config

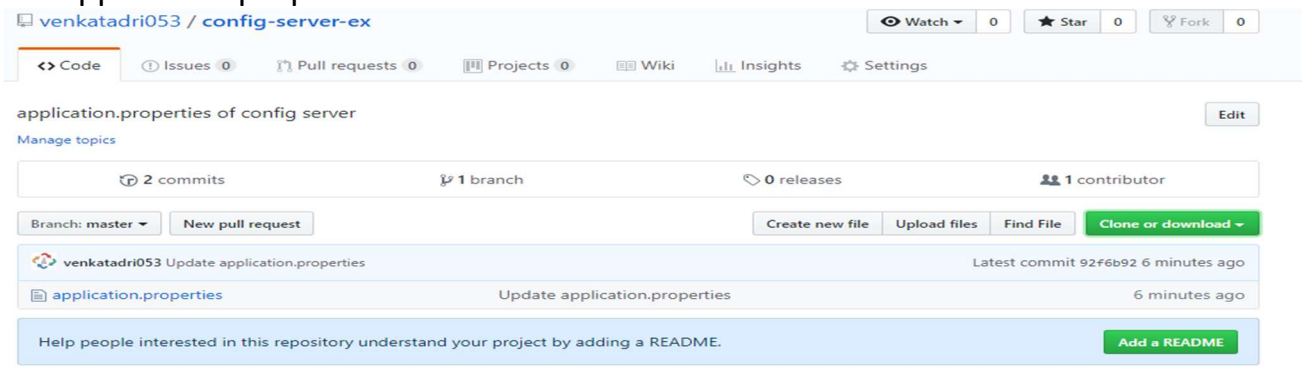
Step#2 in config Server Project modify application.properties with Git URI

```
server.port=8888
spring.cloud.config.server.git.uri=https://github.com/venkatadri053/config-server-ex
```

Step#3 in Config Server Project,in pom.xml delete line

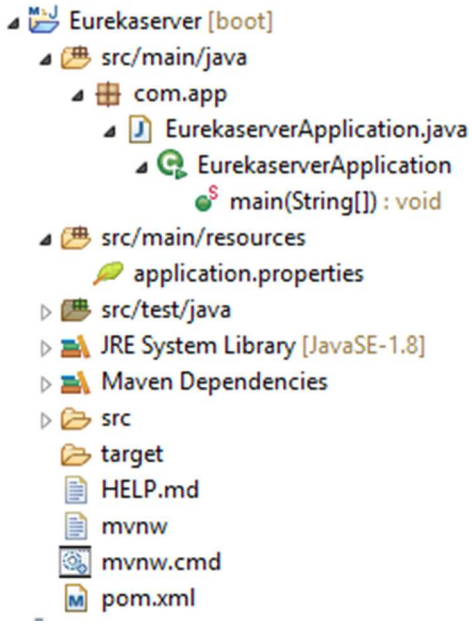
```
<include>myapp-config</include>
```

Step#4 Create git account and create config-server-ex repository. Under this create file application.properties



EurekaServer:

FolderStructure:

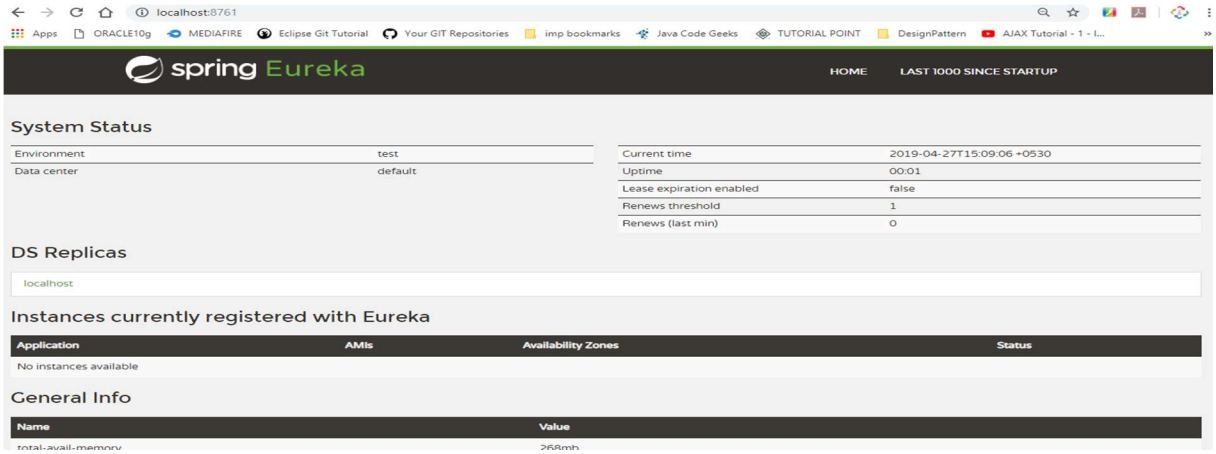


EurekaserverApplication.java:

```
package com.app;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.netflix.eureka.server.EnableEurekaServer;
@SpringBootApplication
@EnableEurekaServer
public class EurekaserverApplication {
	public static void main(String[] args) {
		SpringApplication.run(EurekaserverApplication.class, args);
	}
}
```

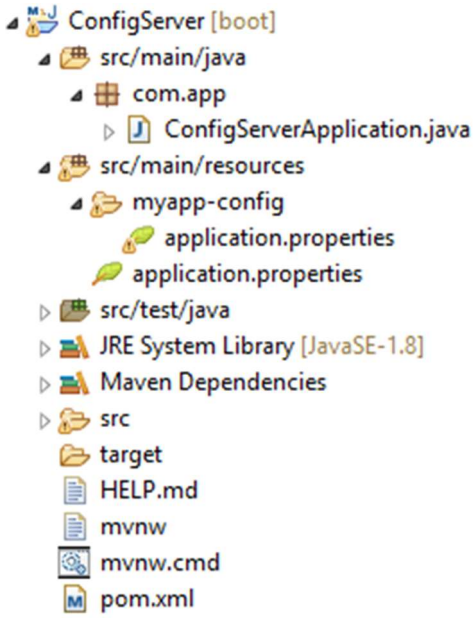
application.properties:

```
server.port=8761
eureka.client.register-with-eureka=false
eureka.client.fetch-registry=false
```



ConfigServer:

FolderStructure:



ConfigServerApplication.java:

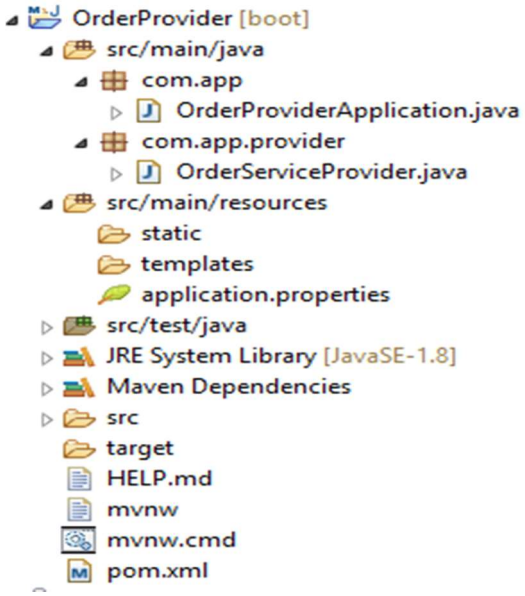
```
package com.app;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.config.server.EnableConfigServer;
@SpringBootApplication
@EnableConfigServer
public class ConfigServerApplication {
	public static void main(String[] args) {
		SpringApplication.run(ConfigServerApplication.class, args);
	}
}
```

application.properties:

```
##link file##
server.port=8888
spring.cloud.config.server.git.uri=https://github.com/venkatadri053/config-server-ex
```

OrderProvider:

FolderStructure:



OrderProviderApplication.java:

```
package com.app;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.client.discovery.EnableDiscoveryClient;
@SpringBootApplication
@EnableDiscoveryClient
public class OrderProviderApplication {
	public static void main(String[] args) {
```

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

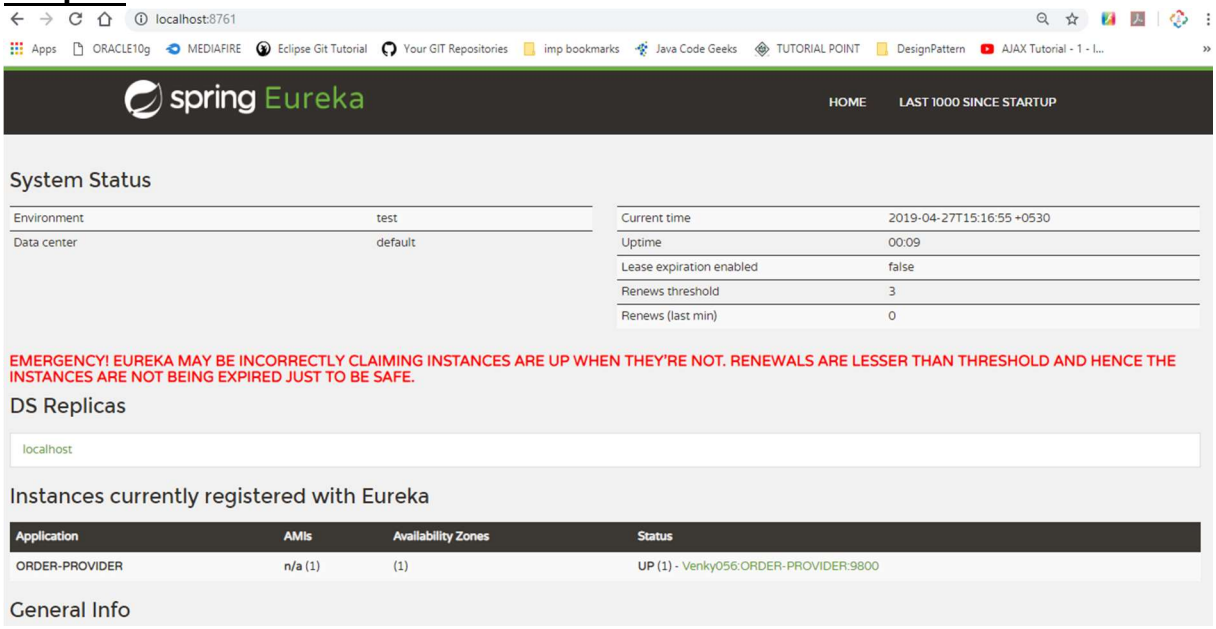
OrderServiceProvider.java:

```
package com.app.provider;
import org.springframework.web.bind.annotation.GetMapping;
import org.springframework.web.bind.annotation.RequestMapping;
import org.springframework.web.bind.annotation.RestController;
@RestController
@RequestMapping("/order")
public class OrderServiceProvider {
        @GetMapping("/show")
        public String showMsg() {
                return "From Provider";
        }
}
```

application.properties:

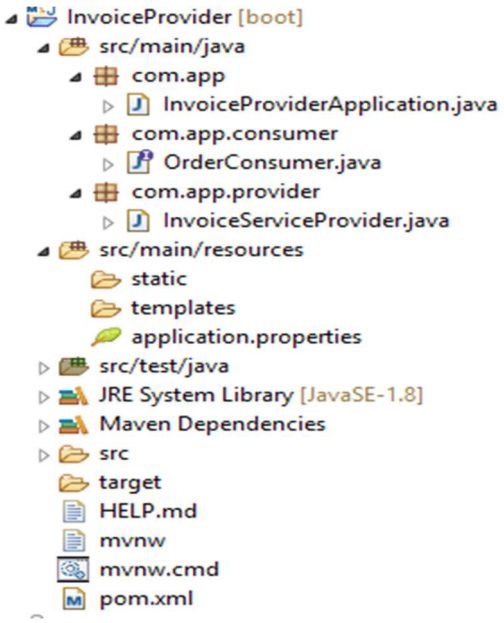
```
server.port=9800
spring.application.name=ORDER-PROVIDER
eureka.instance.instance-id=${spring.application.name}:${random.value}
```

Output:



InvoiceProvider:

FolderStructure:



InvoiceProviderApplication.java:

```
package com.app;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.openfeign.EnableFeignClients;
@SpringBootApplication
@EnableFeignClients
public class InvoiceProviderApplication {
	public static void main(String[] args) {
		SpringApplication.run(InvoiceProviderApplication.class, args);
	}
}
```

OrderConsumer.java:

```
package com.app.consumer;
import org.springframework.cloud.openfeign.FeignClient;
import org.springframework.web.bind.annotation.GetMapping;
@FeignClient(name="ORDER-PROVIDER")
public interface OrderConsumer {
	@GetMapping("/order/show")
	public String showMsg();
}
```

InvoiceServiceProvider.java:

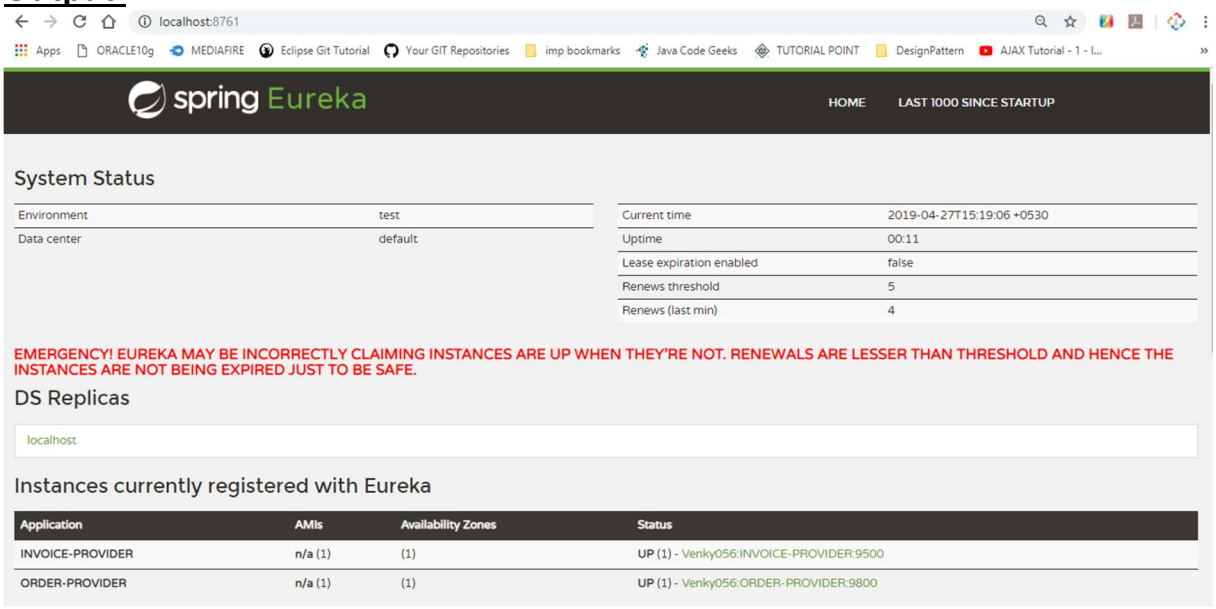
```
package com.app.provider;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.web.bind.annotation.GetMapping;
```

```
import org.springframework.web.bind.annotation.RequestMapping;
import org.springframework.web.bind.annotation.RestController;
import com.app.consumer.OrderConsumer;
@RestController
@RequestMapping("/invoce")
public class InvoiceServiceProvider {
	@Autowired
	private OrderConsumer consumer;
	@GetMapping("/info")
	public String getConsumerMsg() {
		return "Consumer=>"+consumer.showMsg();
	}
}
```

application.properties:

```
server.port=9500
spring.application.name=INVOICE-PROVIDER
```

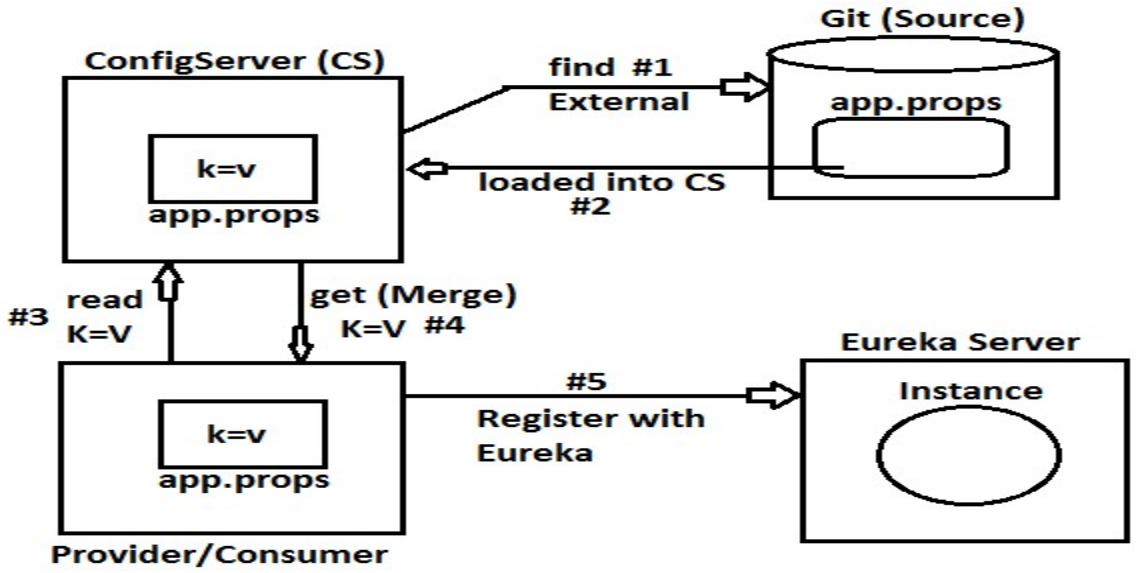
Output:



Consumer=>From Provider

Config Server With Provider/Consumer Execution flow[External Source]

➔On startup ConfigServer(CS) Application it will goto External Source (Git) and read ____.properties (or) ____.yml file having key=value pairs.
➔Then Provider/Consumer Application (on startup) will try to read k=v from config server and merge with our application properties.
➔If same key is found in both Config Server and Provider/Consumer App,then 1st priority is : **ConfigServer.**
➔After **fetching** all required properties then Provider gets Registered with **EurekaServer**.



***) What is bootstrap.properties in SpringBoot (Cloud) Programming?
Ans) Our Project (child Project) contains input keys in application.properties,in same way ParentProject also maintains one Properties file named as:bootstrap.properties which will be loaded before our application.properties.

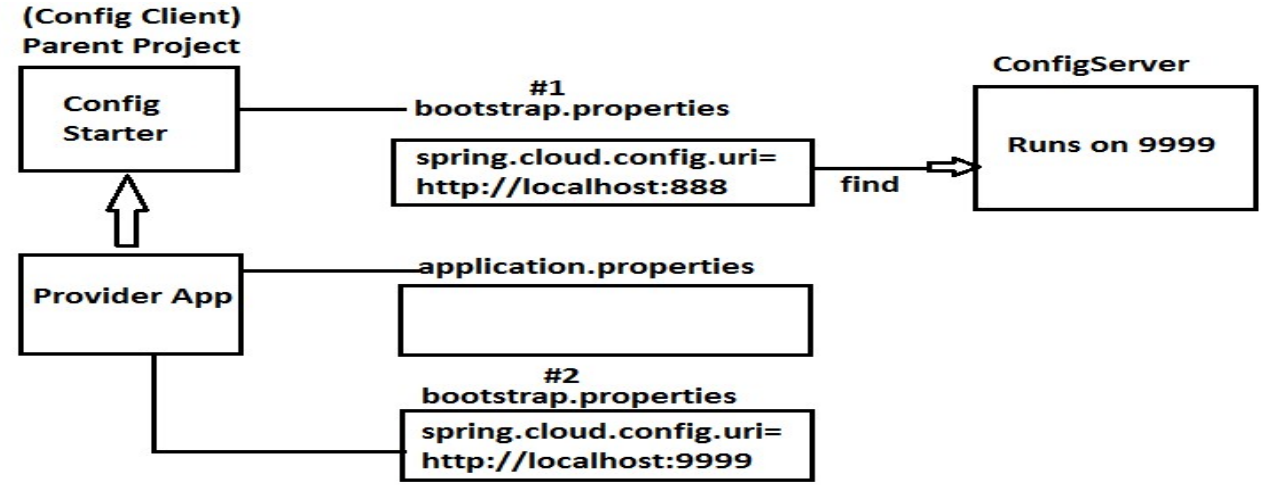
Execution Order:

Parent Project-loads-bootstrap.properties / bootstrap.yml
Our Project-loads-application.properties / application.yml

➔We can override this file in our project to provide key-values to be loaded by Parent Project.

**) by default, Config Server runs on http://localhost:8888 even config client also takes this as default location.
**) To modify this IP/PORT use bootstrap.properties file in Our Project.
) In this bootstrap.properties file override key: **spring.cloud.config.uri to any other location where Config server is running.

DIAGRAM:



Coding changes for Config Server and provider/consumer App:

Step#1 Open application.properties file in ConfigServer project and modify port number.

server.port=9999

Step#2 In Provider /Consumer Project, create file bootstrap.properties under src/main/resources

Step#3 Add key=value in bootstrap.properties file

spring.cloud.config.uri=http://localhost:9999

Q) which class will load bootstrap.properties file for Config Server URI fetching?

A) ConfigServicePropertySourceLocator will read config server input by default from http://localhost:8888.

It is only first execution step in Provider/Consumer Project.

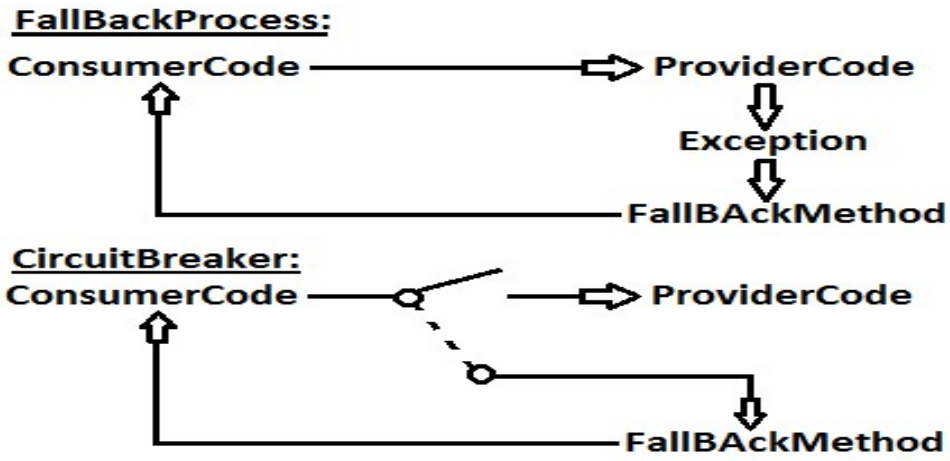
Fault Tolerance API

If any Microservice is continuously throwing Exceptions, then logic must not be executed every time also must be finished with smooth termination. such Process is called as "**Fault Tolerance"**.

➔Fault Tolerance is achieved using **FallBackMethod** and **CircuitBreaker**.

A. FallBackMethod = If Microservice is throwing exception then service method execution is redirected to another supportive method (**FallBackMethod**) which gives dummy output and **"alerts to DashBoard"** (to Dev, MS, Admin teams).

B. CircuitBreaker = If Service is throwing exceptions continuously then Exception flow directly linked to fallback method. After some time gap (or) no. of request again re-checks once, still same continue to FallBackMethod else execute Microservice.



Hystrix: It is a API (set of classes and interfaces) given by Netflix to handle Proper Execution and Avoid repeated exception logic (Fault Tolerance API) in Microservice Programming.

➔It is mainly used in production Environment not in Dev Environment.

➔Hystrix supports FallBack and CircuitBreaker process.

➔It provides Dashboard for UI. (View problems and other details in Services).

=-=-=Working with Hystrix=-=-=

Step#1:-- In pom.xml add Netflix Hystrix dependency

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

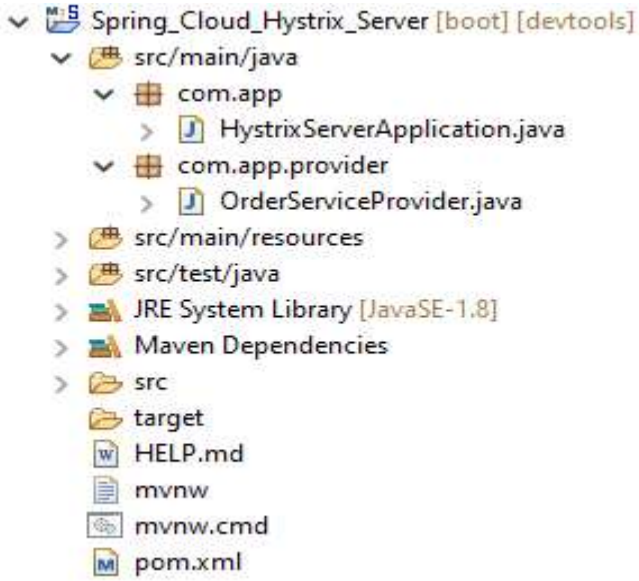
Step#2:-- At starter class level apply annotation @EnableCircuitBreaker (or) @EnableHystrix.

@EnableCIrcuitBreaker will find concept at runtime using pom.xml dependency ex: Hystrix, Turbine etc…
where as @EnableHystrix will execute only Hystrix CIrcuitBreaker.

Step#3:-- Define one Service method and apply Annotation : **@HystrixCommand** with Details like fallBackMethod, commandKey…

Example:

Folder Structure :



Step#1:-- Create Spring Starter Project with Dependencies : web, eureka discovery, Hystrix.

Hystrix Dependency:--

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

GroupId : org.sathyatech
ArtifactId : Spring_Cloud_Hystrix_Server
Version : 1.0
=>Finish

Step#2:-- Apply below annotations at Starter class (both)

@EnableDiscoveryClient
@EnableHystrix

HystrixServerApplication.java

```
package com.app;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.client.discovery.EnableDiscoveryClient;
```

```
import org.springframework.cloud.netflix.hystrix.EnableHystrix;
@SpringBootApplication
@EnableDiscoveryClient
@EnableHystrix
public class HystrixServerApplication {
	public static void main(String[] args) {
		SpringApplication.run(HystrixServerApp.class, args);
	}
}
```

Step#3:-- application.properties file:--

```
server.port=9800
spring.application.name=ORDER-PROVIDER
eureka.client.serviceUrl.defaultZone=http://localhost:8761/eureka
```

Step#4:-- Define RestController with FallbackMethod (**OrderServiceProvider.java**).

```
package com.app.provider;
import java.util.Random;
import org.springframework.web.bind.annotation.GetMapping;
import org.springframework.web.bind.annotation.RestController;
import com.netflix.hystrix.contrib.javanica.annotation.HystrixCommand;

@RestController
public class OrderServiceProvider {

	@GetMapping("/show")
	@HystrixCommand(fallbackMethod="showFallBack")
	//parameter must be same as fallBackMethod name
	public String showMsg() {
	 System.out.println("From service");
	if (new Random().nextInt(10)<=10)
	{
	   throw new RuntimeException("DUMMY");
	}
	return "Hello From Provider";
	}

	//fallBack method
	public String showFallBack() {
	System.out.println("From ballback");
	return "From FallBack method";
	}
```

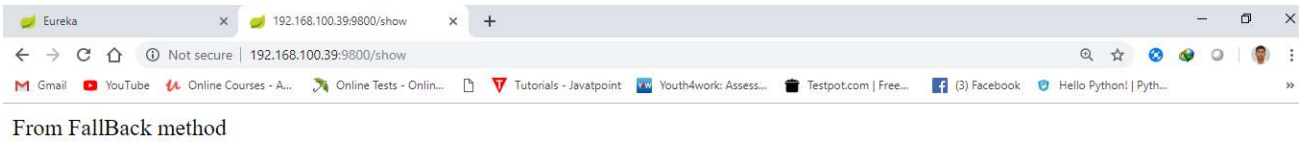
}

NOTE: Fallback method ReturnType must be same as service method return type.

Execution Process:--

Step#5:-- Run Eureka Server and Order Provider.

Step#6:-- Goto Eureka and Execute **ORDER PROVIDER** and enter URL path **:/show** (http://192.168.100.39:9800/show)

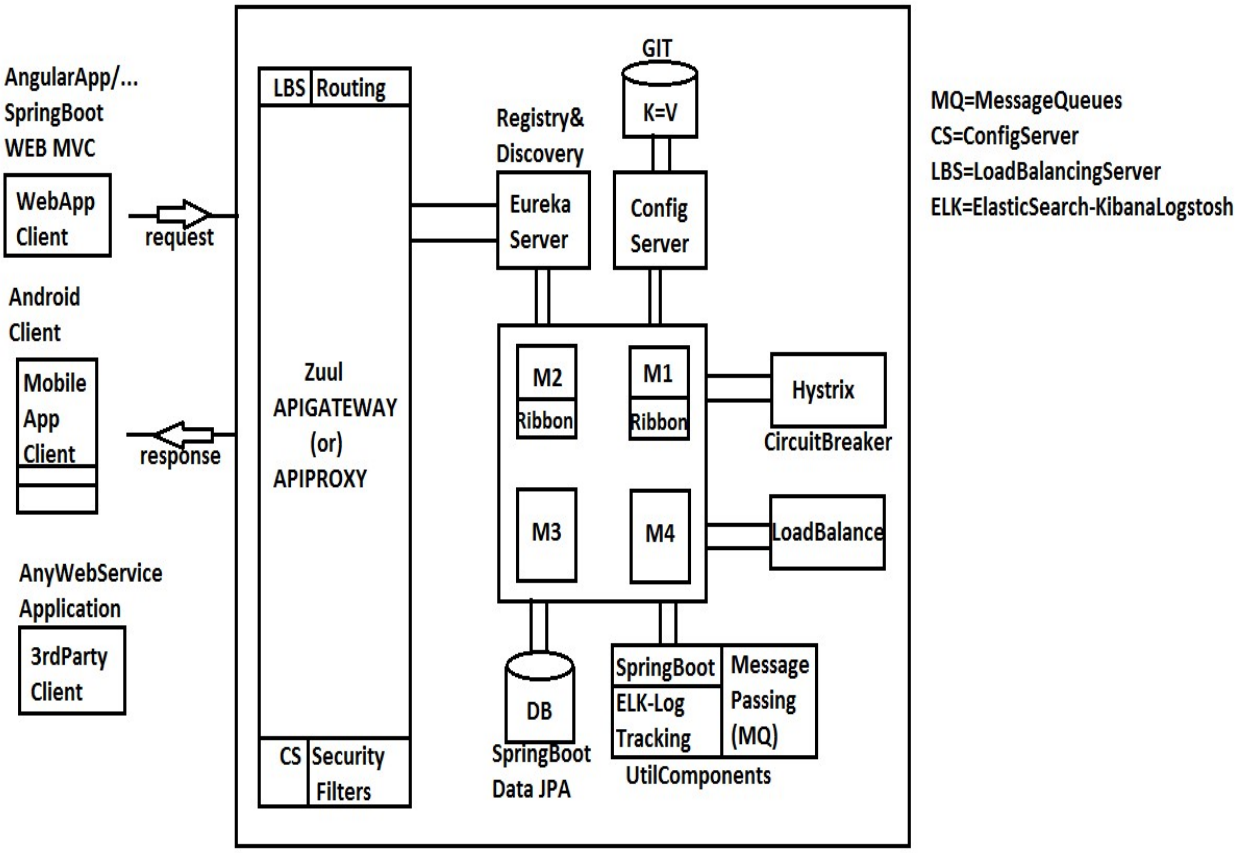


OUTPUT SCREEN OF "HYSTRIX-SERVICE-APP":--

```
2019-04-21 10:19:29.114  INFO 13632 --- [freshExecutor-0] com.netflix.discovery.DiscoveryClient    : Single vip registry refresh property : nu
2019-04-21 10:19:29.126  INFO 13632 --- [freshExecutor-0] com.netflix.discovery.DiscoveryClient    : Force full registry fetch : false
2019-04-21 10:19:29.130  INFO 13632 --- [freshExecutor-0] com.netflix.discovery.DiscoveryClient    : Application is null : false
2019-04-21 10:19:29.130  INFO 13632 --- [freshExecutor-0] com.netflix.discovery.DiscoveryClient    : Registered Applications size is zero : tr
2019-04-21 10:19:29.130  INFO 13632 --- [freshExecutor-0] com.netflix.discovery.DiscoveryClient    : Application version is -1: false
2019-04-21 10:19:29.134  INFO 13632 --- [freshExecutor-0] com.netflix.discovery.DiscoveryClient    : Getting all instance registry info from t
2019-04-21 10:19:29.559  INFO 13632 --- [freshExecutor-0] com.netflix.discovery.DiscoveryClient    : The response status is 200
2019-04-21 10:19:59.597  INFO 13632 --- [freshExecutor-0] com.netflix.discovery.DiscoveryClient    : Disable delta property : false
2019-04-21 10:19:59.597  INFO 13632 --- [freshExecutor-0] com.netflix.discovery.DiscoveryClient    : Single vip registry refresh property : nu
2019-04-21 10:19:59.597  INFO 13632 --- [freshExecutor-0] com.netflix.discovery.DiscoveryClient    : Force full registry fetch : false
2019-04-21 10:19:59.597  INFO 13632 --- [freshExecutor-0] com.netflix.discovery.DiscoveryClient    : Application is null : false
2019-04-21 10:19:59.597  INFO 13632 --- [freshExecutor-0] com.netflix.discovery.DiscoveryClient    : Registered Applications size is zero : tr
2019-04-21 10:19:59.597  INFO 13632 --- [freshExecutor-0] com.netflix.discovery.DiscoveryClient    : Application version is -1: false
2019-04-21 10:19:59.597  INFO 13632 --- [freshExecutor-0] com.netflix.discovery.DiscoveryClient    : Getting all instance registry info from t
2019-04-21 10:20:00.074  INFO 13632 --- [freshExecutor-0] com.netflix.discovery.DiscoveryClient    : The response status is 200
2019-04-21 10:20:42.409  INFO 13632 --- [nio-9800-exec-1] o.a.c.c.C.[Tomcat].[localhost].[/]       : Initializing Spring DispatcherServlet 'd
2019-04-21 10:20:42.409  INFO 13632 --- [nio-9800-exec-1] o.s.web.servlet.DispatcherServlet        : Initializing Servlet 'dispatcherServlet'
2019-04-21 10:20:42.529  INFO 13632 --- [nio-9800-exec-1] o.s.web.servlet.DispatcherServlet        : Completed initialization in 120 ms
From service
From ballback
From service
From ballback
From service
From ballback
From service
From ballback
From service
From ballback
```

Activate Windows

SpringCloud Netflix MicroService Design



API PROXY /API GATEWAY

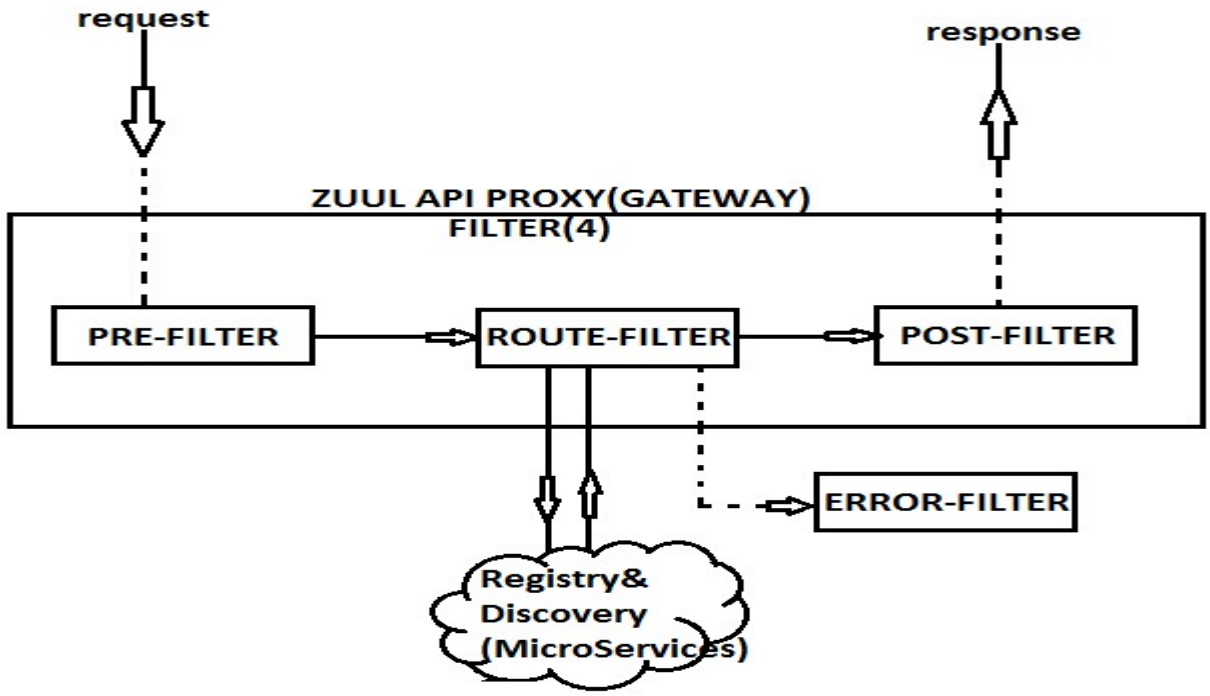
➔In one application there will be Multiple MicroServices running in different servers and ports.

➔Accessing these by client will be complicated.so, all are accessed through one entrypoint which makes

- ➔Single Entry and Exit
- ➔One Time Authentication(SSO=SingleSignOn)
- ➔Executing of Routing(Find Execution Path b/n multiple microservices)
- ➔Avoid Direct URL to Client (Avoid CROS origin req/res format)
- ➔Supports Filtering

*Spring Cloud Netflix ZUUL behaves as API PROXY for Microservices Application which supports “Integration with any type of client component”(web,mobile,3rd party webservices..etc)

ZUUL (APIPROXY) Working flow:



ZUUL API (PROXY-SERVER) GATEWAY:

Zuul Server is a netflix Component used to Configure **"Routing for MicroServices"**

Using keys like:

zuul.routes.<modules>.path= . . . . . .
zuul.routes.<modules>.serviceId= . . . . . .

#Before Creating ZuulServer,we should have already created:

a) Eurekaserver project
b) MicroServices (Ex:PRODUCT-SERVICE,CUSTOMER-SERVICE,STUDENT-SERVICE…) (with load balance implemented)

Step#1 Create Spring Starter Project as: **ZUUL-SERVER**
with dependencies: web,zuul,eureka discovery.

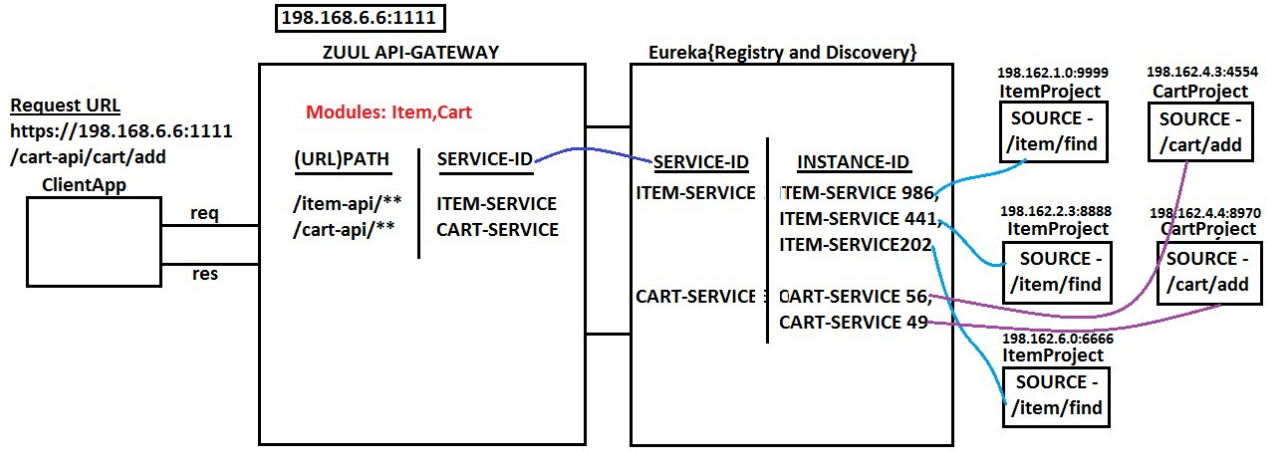
Step#2 application.properties should have below details like:

server.port=8558
eureka.client.service-url.default-zone=http://localhost:8761/eureka
spring.application.name=ZUUL-PROXY
zuul.routes.<module>.path=/<module>-api/**
zuul.routes.<module>.service-id=[SERVICE-ID]

Step#3 In ZuulServer project, at starter class level add annotation:**@EnableZuulProxy**

Step#4 Implement Filters like **: PRE,ROUTE,POST,ERROR**
Using one abstract class : **ZuulFilter(AC)** and use **FilterConstants(C)**.

ZUUL ExampleService:



➔Here, ZuulServer behaves as Entry and Exit Point.
➔It hides all details like Eureka Server and Service-Instances from Client.
➔Zuul Provides and only ZUUL-URL and Paths of Services only.
➔Zuul takes care of Client (Request) Loadbalancing even.
➔Provides Routing based on API (PATH/URL)
➔Zuul must be registered with EurekaServer.
➔In Zuul Server Project,we should provide module details like Path, Service-Id using application.properties (or) .yml
➔Example application.properties

```
zuul.routes.item.path=/item-api/**
zuul.routes.item.service-id=ITEM-SERVICE
zuul.routes.cart.path=/ cart -api/**
zuul.routes. cart.service-id=CART-SERVICE
```

➔If two modules are provided in Zuul then, only module name gets changed in keys.
Consider below example:

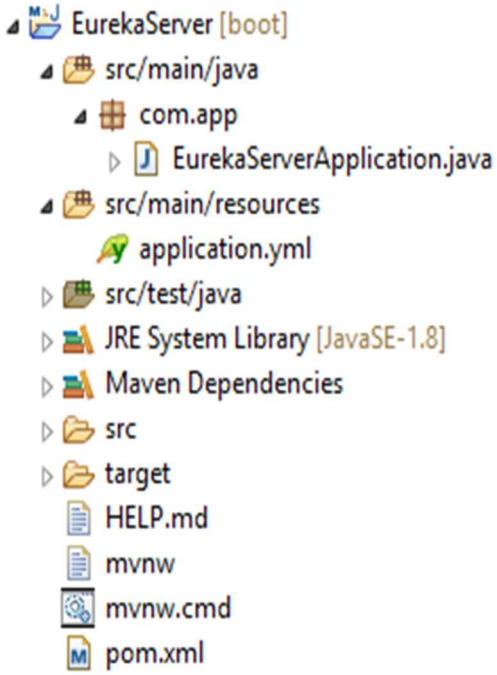
MODULE	PATH	SERVICE-ID
Product	/prod-api/**	PROD-SERVICE
Student	/std-api/**	STD-SERVICE

application.properties:

```
zuul.routes.product.path=/prod-api/**
zuul.routes.product.service-id=PROD-SERVICE
zuul.routes.student.path=/ std-api/**
zuul.routes.student.service-id=STD-SERVICE
```

EUREKA SERVER:

FolderStructure:



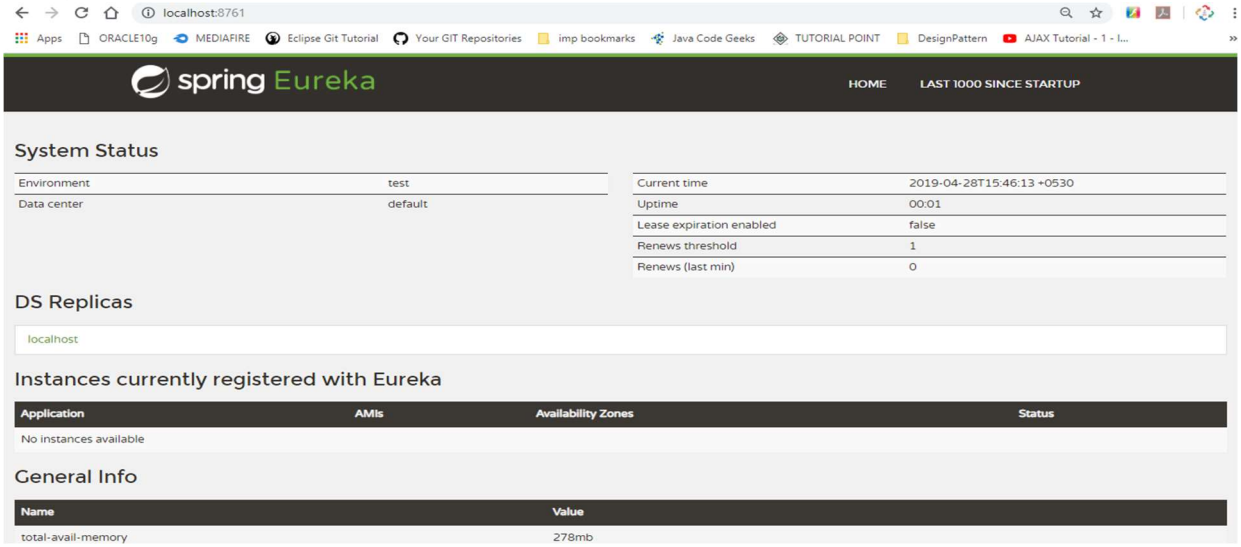
EurekaServerApplication.java:

```
package com.app;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.netflix.eureka.server.EnableEurekaServer;

@SpringBootApplication
@EnableEurekaServer
public class EurekaServerApplication {

	public static void main(String[] args) {
		SpringApplication.run(EurekaServerApplication.class, args);
	}
}
```

application.yml:

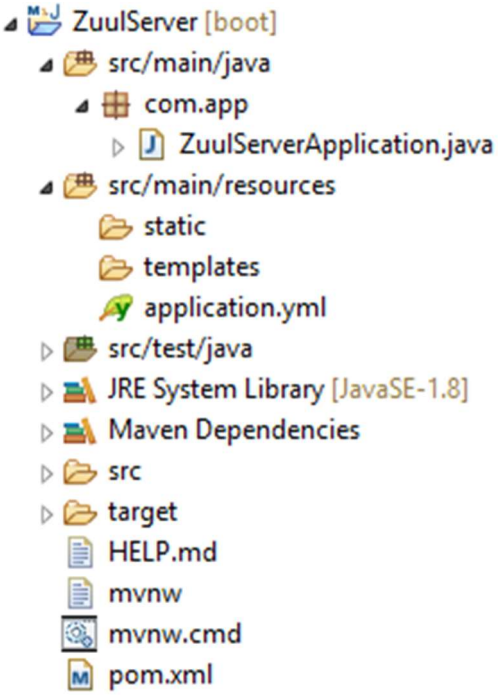
```
server:
  port: 8761

eureka:
  client:
    register-with-eureka: false
    fetch-registry: false
```

Output:



ZUULSERVER:

FolderStructure:



ZuulServerApplication.java:

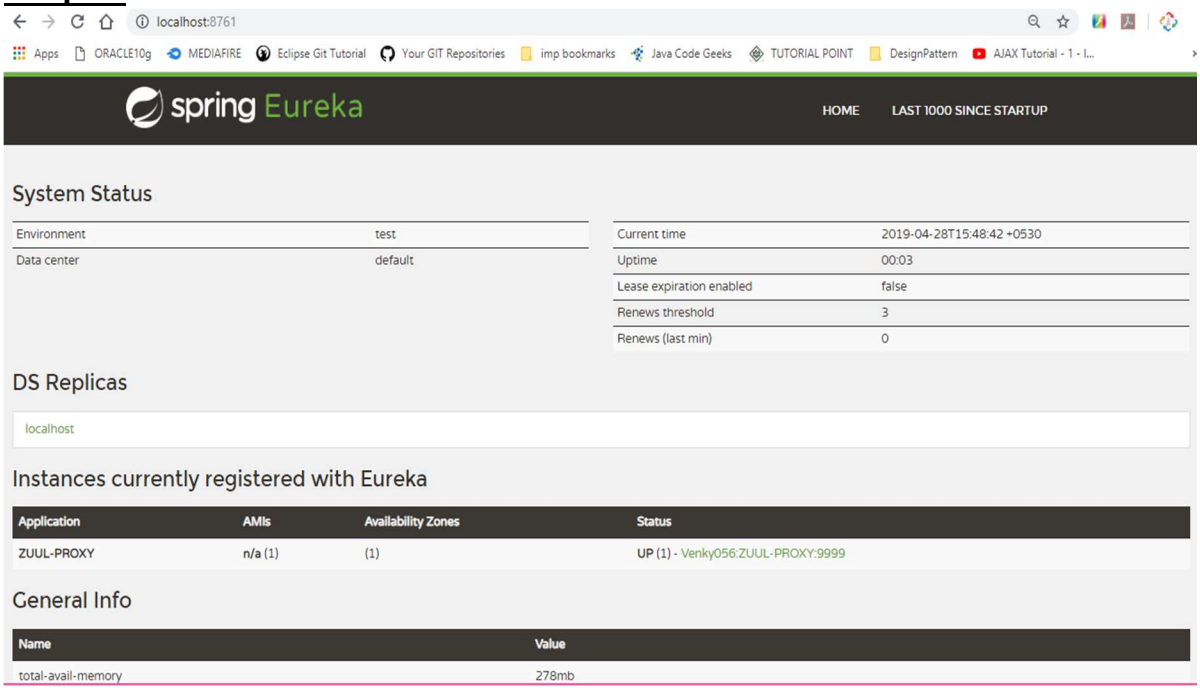
```
package com.app;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.client.discovery.EnableDiscoveryClient;
import org.springframework.cloud.netflix.zuul.EnableZuulProxy;

@SpringBootApplication
@EnableDiscoveryClient
@EnableZuulProxy
public class ZuulServerApplication {
	public static void main(String[] args) {
```

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

application.yml:

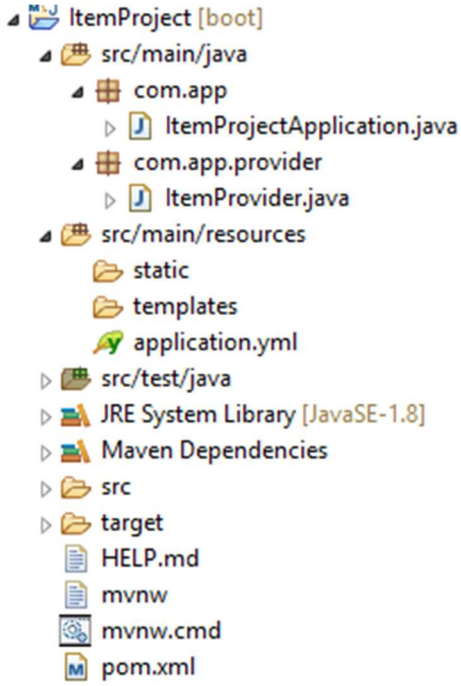
```
server:
  port: 9999

spring:
  application:
    name: ZUUL-PROXY

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

zuul:
  routes:
    item:
      path: /item-api/**
      service-id: ITEM-SERVICE
```

Output:



ITEMPROJECT:

FolderStructure:



ItemProjectApplication.java:

```
package com.app;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.client.discovery.EnableDiscoveryClient;
@SpringBootApplication
@EnableDiscoveryClient
public class ItemProjectApplication {
	public static void main(String[] args) {
		SpringApplication.run(ItemProjectApplication.class, args);
	}
}
```

ItemProvider.java:

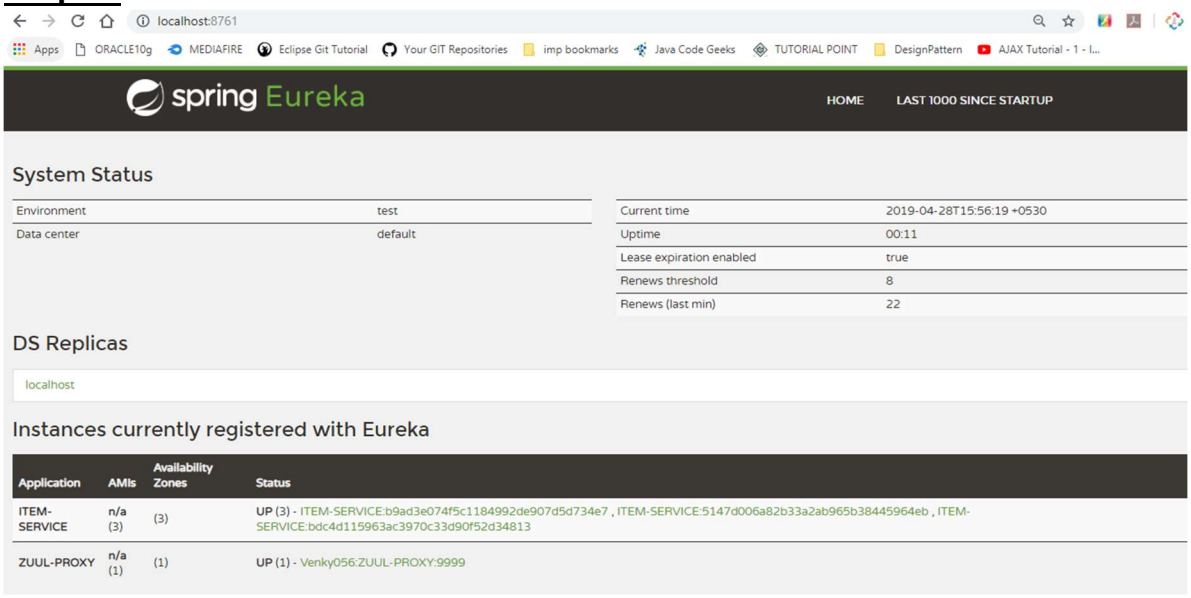
```
package com.app.provider;
import org.springframework.beans.factory.annotation.Value;
import org.springframework.web.bind.annotation.GetMapping;
import org.springframework.web.bind.annotation.RequestMapping;
import org.springframework.web.bind.annotation.RestController;

@RestController
@RequestMapping("/item")
public class ItemProvider {
	@Value("${server.port}")
	private String port;
	@GetMapping("/find")
```

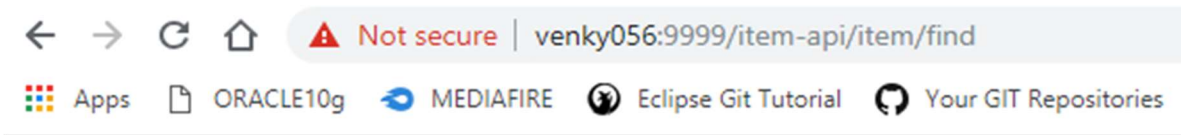
```
        public String findItem() {
                return "ITEM FOUND:"+port;
        }
}
```

application.yml:

```
server:
  port: 9966

spring:
  application:
    name: ITEM-SERVICE

eureka:
  client:
    service-url:
      default-zone: http://localhost:8761/eureka
  instance:
    instance-id: ${spring.application.name}:${random.value}
```

output:





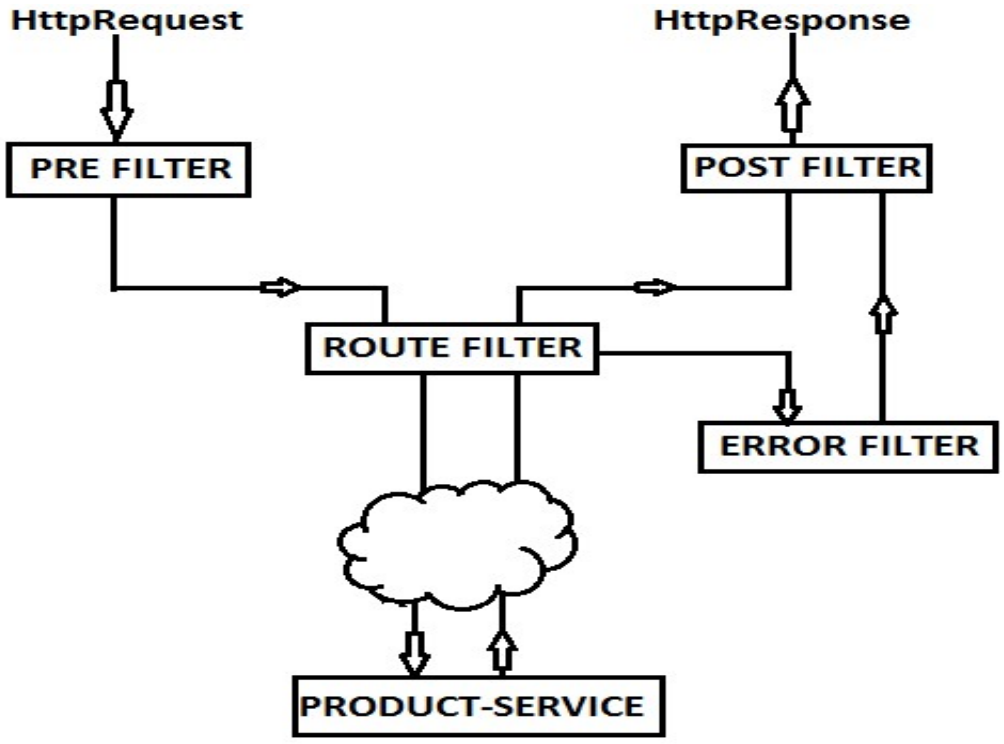
ITEM FOUND:9965

Working with ZUUL Filter:

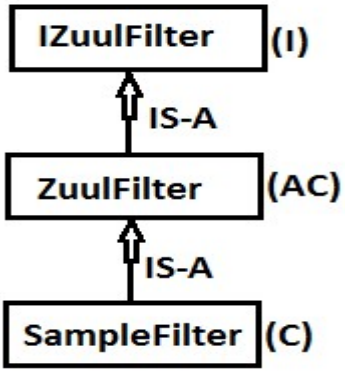
Filters are used to validate request construct valid response. In simple , we also call it as “PRE-POST” processing logic.

ZUUL Filter provides even extra types like ROUTE FILTERS and ERROR FILTERS.

- When client made request to ZUUL then Pre Filter gets called automatically.
- After validating, request is dispatched to Route Filter.
- Route Filter is like 2nd level validation at required SERVICE level.
- Route Filter will dispatch request to one Microservice based on Service-Id
- If microservice is not executed properly (i.e. throwing exception) then Error filter is called.
- Finally Post Filter works on Http Response (adds Headers, Encode data, Provide info to client..etc.) in case of either success or failure.



- Here, filter is a class must extends one abstract class **“ZuulFilter”** provided by Netflix API.
- We can define multiple filters in one application. Writing Filters are optional.
- While creating filter class we must provide Filter Order (0, 1, 2,3…) and Filter type (“pre”, “route”, “error”, “post”)
- Two filters of same type can have same order which indicates any execution order is valid.
- We can enable and disable filters using its flags (True/False).



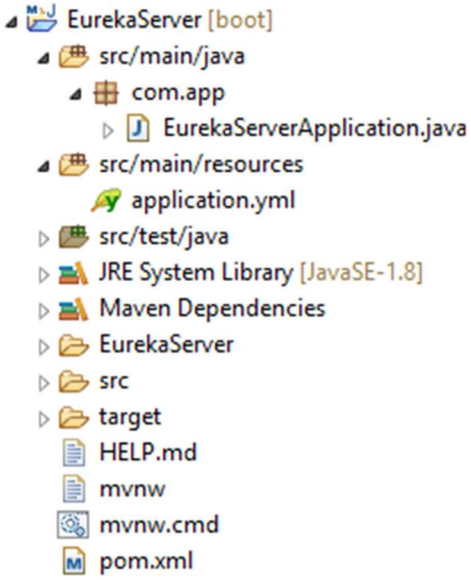
- To indicate Filter types, we use its equal constants (public static final string variables), provides as

Type	Constant
pre	PRE_TYPE
route	ROUTE_TYPE
error	ERROR_TYPE
post	POST_TYPE

- All above constants are defined in FilterConstants (C) as global variables (public static final string)
- Write one class in ZUUL server and extend ZuulFilter Abstract class, override below 4 methods in your filter.
- shouldFilter() – Must be set to **'true'**. If value is set to false then filter will not be executed.
- run() – contains Filter logic. Executed once when filter is called.
- filterType() – Provides Filter Constant. Must be one Type(pre, post, route, error)
- filterOrder() – Provides order for Filter. Any int type number like: 0, 56, 98.

EurekaServer:

FolderStructure:



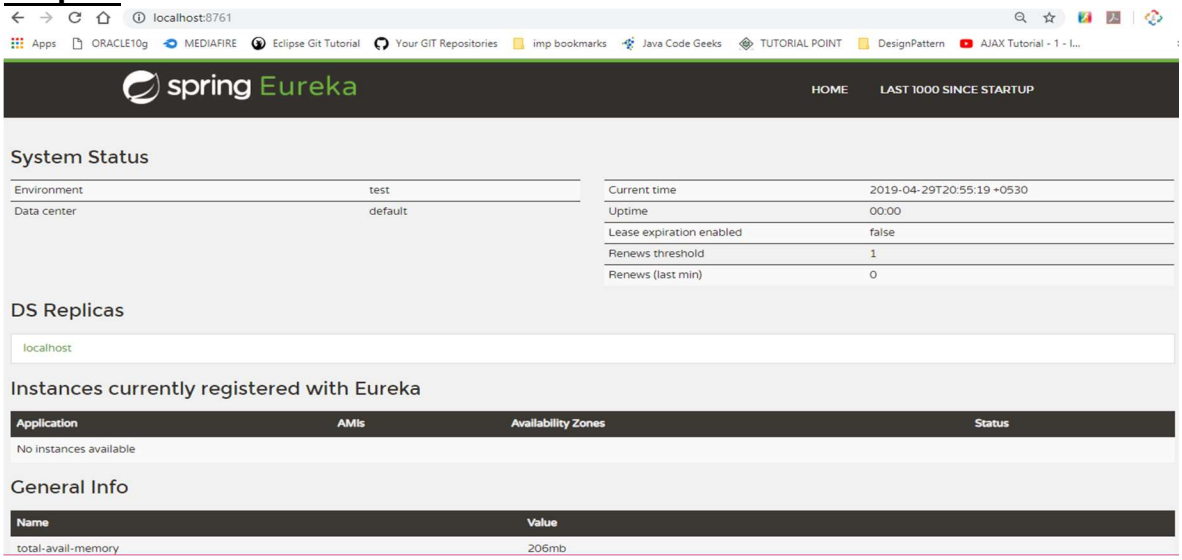
EurekaServerApplication.java:

```
package com.app;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.netflix.eureka.server.EnableEurekaServer;
@SpringBootApplication
@EnableEurekaServer
public class EurekaServerApplication {
	public static void main(String[] args) {
		SpringApplication.run(EurekaServerApplication.class, args);
	}
}
```

application.yml:

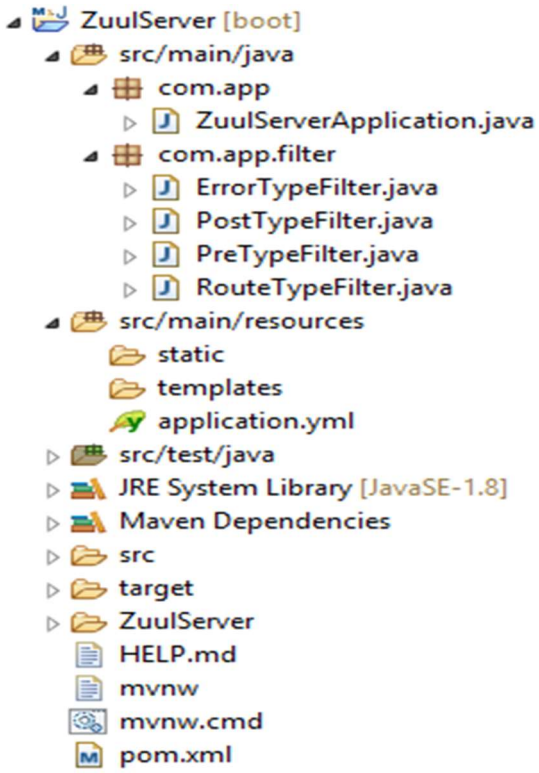
```
server:
  port: 8761

eureka:
  client:
    register-with-eureka: false
    fetch-registry: false
```

output:



ZUUL SERVER:

FolderStructure:



ZuulServerApplication.java:

```
package com.app;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.client.discovery.EnableDiscoveryClient;
import org.springframework.cloud.netflix.zuul.EnableZuulProxy;
@SpringBootApplication
@EnableDiscoveryClient
@EnableZuulProxy
public class ZuulServerApplication {
	public static void main(String[] args) {
		SpringApplication.run(ZuulServerApplication.class, args);
	}
}
```

ErrorTypeFilter.java:

```
package com.app.filter;
import org.springframework.cloud.netflix.zuul.filters.support.FilterConstants;
import org.springframework.stereotype.Component;
import com.netflix.zuul.ZuulFilter;
import com.netflix.zuul.exception.ZuulException;
@Component
public class ErrorTypeFilter extends ZuulFilter{
	/**Enable(true) or Disable Filter(false)**/
	public boolean shouldFilter() {
		return true;
```

```
	}
	/**Define Filter Logic Here**/
	public Object run() throws ZuulException {
		System.out.println("FROM ERROR FILTER");
		return null;
	}
	/**Specify Filter Type**/
	public String filterType() {
		return FilterConstants.ERROR_TYPE;
	}
	/**Provider Filter Order for Execution**/
	public int filterOrder() {
		return 0;
	}
}
```

PostTypeFilter.java:

```
package com.app.filter;

import org.springframework.cloud.netflix.zuul.filters.support.FilterConstants;
import org.springframework.stereotype.Component;
import com.netflix.zuul.ZuulFilter;
import com.netflix.zuul.exception.ZuulException;
@Component
public class PostTypeFilter extends ZuulFilter{
	/**Enable(true) or Disable Filter(false)**/
	public boolean shouldFilter() {
		return true;
	}
	/**Define Filter Logic Here**/
	public Object run() throws ZuulException {
		System.out.println("FROM POST FILTER");
		return null;
	}
	/**Specify Filter Type**/
	public String filterType() {
		return FilterConstants.POST_TYPE;
	}
	/**Provider Filter Order for Execution**/
	public int filterOrder() {
		return 0;
	}
}
```

PreTypeFilter.java:

```
package com.app.filter;
import org.springframework.cloud.netflix.zuul.filters.support.FilterConstants;
import org.springframework.stereotype.Component;
import com.netflix.zuul.ZuulFilter;
import com.netflix.zuul.exception.ZuulException;
@Component
public class PreTypeFilter extends ZuulFilter{
	/**Enable(true) or Disable Filter(false)**/
	public boolean shouldFilter() {
		return true;
	}
	/**Define Filter Logic Here**/
	public Object run() throws ZuulException {
		System.out.println("FROM PRE FILTER");
		return null;
	}
	/**Specify Filter Type**/
	public String filterType() {
		return FilterConstants.PRE_TYPE;
	}
	/**Provider Filter Order for Execution**/
	public int filterOrder() {
		return 0;
	}
}
```

RouteTypeFilter.java:

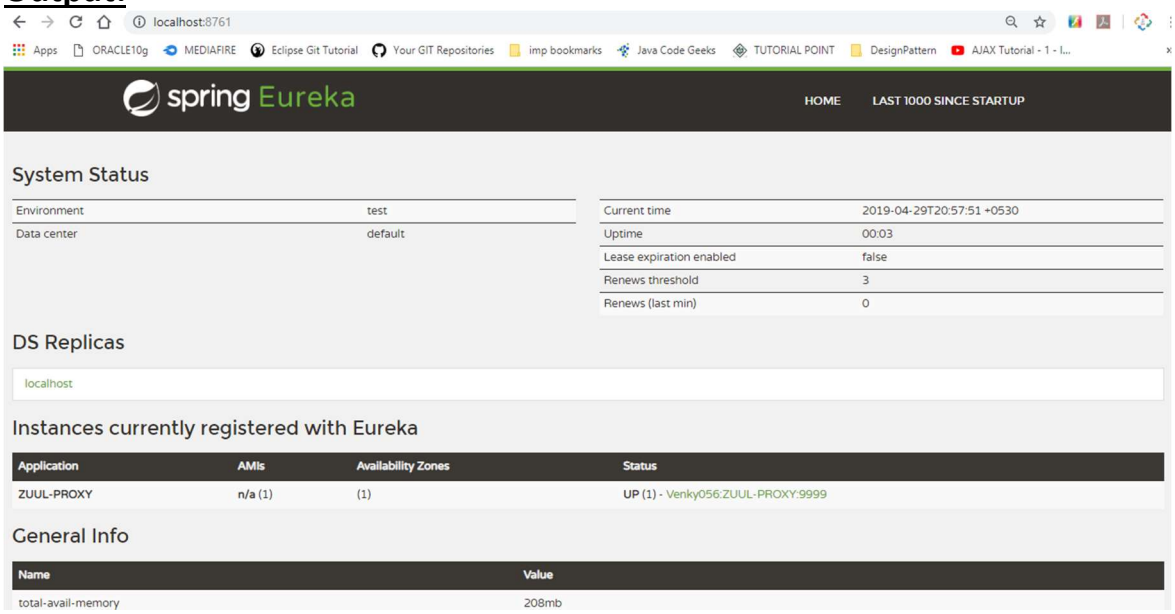
```
package com.app.filter;
import org.springframework.cloud.netflix.zuul.filters.support.FilterConstants;
import org.springframework.stereotype.Component;
import com.netflix.zuul.ZuulFilter;
import com.netflix.zuul.exception.ZuulException;
@Component
public class RouteTypeFilter extends ZuulFilter{
	/**Enable(true) or Disable Filter(false)**/
	public boolean shouldFilter() {
		return true;
	}
	/**Define Filter Logic Here**/
	public Object run() throws ZuulException {
		System.out.println("FROM ROUTE FILTER");
		return null;
```

```
        }
        /**Specify Filter Type**/
        public String filterType() {
                return FilterConstants.ROUTE_TYPE;
        }
        /**Provider Filter Order for Execution**/
        public int filterOrder() {
                return 0;
        }
}
```

application.yml:

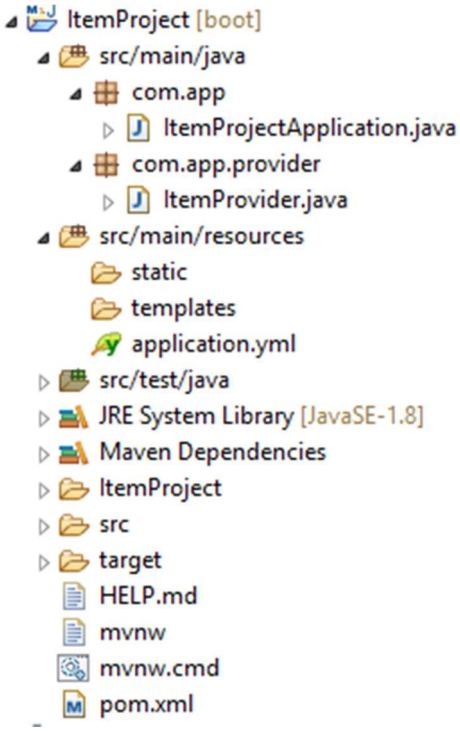
```
server:
  port: 9999

spring:
  application:
    name: ZUUL-PROXY

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

zuul:
  routes:
    item:
      path: /item-api/**
      service-id: ITEM-SERVICE
```

Output:



ItemProject:

FolderStructure:



ItemProjectApplication.java:

```
package com.app;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.client.discovery.EnableDiscoveryClient;
@SpringBootApplication
@EnableDiscoveryClient
public class ItemProjectApplication {
	public static void main(String[] args) {
		SpringApplication.run(ItemProjectApplication.class, args);
	}
}
```

ItemProvider.java:

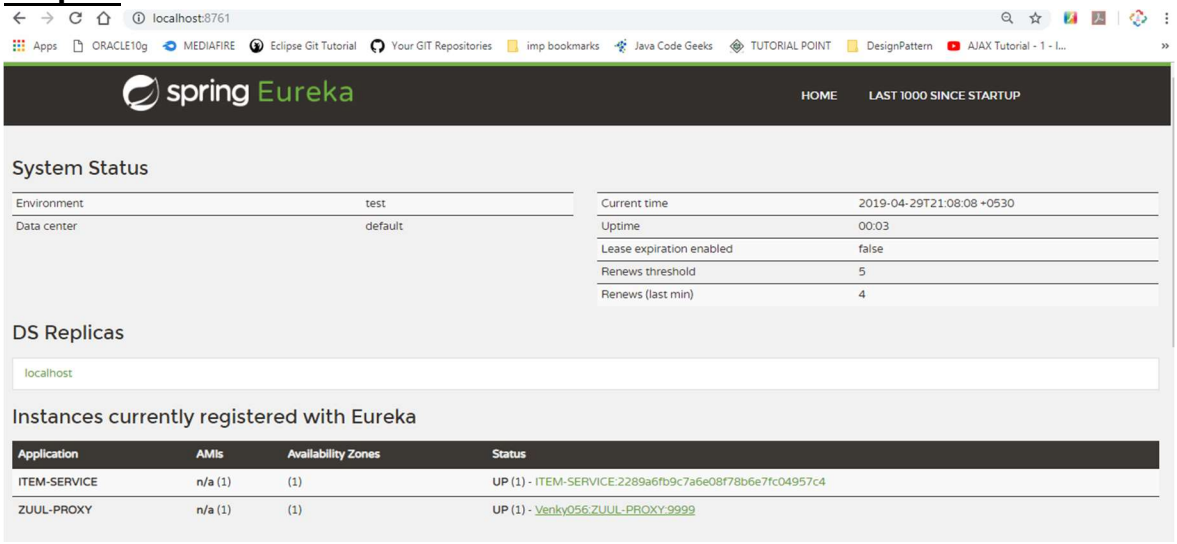
```
package com.app.provider;
import org.springframework.beans.factory.annotation.Value;
import org.springframework.web.bind.annotation.GetMapping;
import org.springframework.web.bind.annotation.RequestMapping;
import org.springframework.web.bind.annotation.RestController;
@RestController
@RequestMapping("/item")
public class ItemProvider {
	@Value("${server.port}")
	private String port;
	@GetMapping("/find")
```

```
        public String findItem() {
                return "ITEM FOUND:"+port;
        }
}
```

application.yml:

```
server:
  port: 9900

spring:
  application:
    name: ITEM-SERVICE

eureka:
  client:
    service-url:
      default-zone: http://localhost:8761/eureka
  instance:
    instance-id: ${spring.application.name}:${random.value}
```

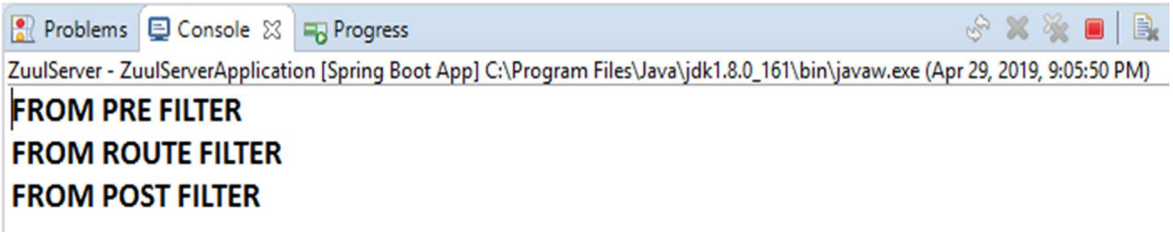
output:



BrowserOutput:

ITEM FOUND:9900

ConsoleOutput:



PROJECT LOMBOK

This is open source JAVA API is used to avoid writing (or generating) common code for Bean/Model/Entity classes.

That is like:

1. Setters and Getters
2. toString() method
3. Default and Parameterized constructor
4. hashCode() and equals() methods.

- Programmer can write these methods manually or generate using IDE. But if any modification(s) are done in those classes then again generate set/get methods also delete and write code for new : toString, hashCode, equals and Param const (it is like repeated task)
- By using Lombok API which reduces writing code or generating task for Beans. Just apply annotations, it is done.
- To use lombok, while creating Spring Boot Project choose dependency: Lombok (or) Add below dependency in pom.xml
  (For spring boot project: do not provide version. it is provided by spring boot parent only.)

```
<dependency>
    <groupId>org.projectlombok</groupId>
    <artifactId>lombok</artifactId>
    <scope>provided</scope>
</dependency>
```

For non-spring boot projects

```
<dependency>
    <groupId>org.projectlombok</groupId>
    <artifactId>lombok</artifactId>
    <version>1.18.6</version>
</dependency>
```

Installation of Lombok in IDE:

1) Open STS/Eclipse (any workspace)

2) Create spring boot project with Lombok Dependency (or) maven project with above Lombok Dependency.

3) Update Maven Project

4) Close STS.

5) Go to lombok jar location

For e.g.:

C:\Users\<username>\.m2\repository\org\projectlombok\lombok\1.18.6

6) open command Prompt here

➔ Shift + Mouse Right click

➔Choose "Open Command Window Here"

➔Type cmd given below

Java -jar lombok-1.18.6.jar

➔Wait for few minutes (IDEs are detected)

➔ Click on Install/Update

➔ Finish

7) Open STS/Eclipse and start coding

=-=-=-=-Example application=-=-=-=-=

#1 create spring Boot starter project

- File >➔new ➔ spring starter project ➔ enter details:
  GroupId : com.app
  ArtifactId : SpringBootLombok
  Version: 1.0
- Choose dependency : lombok (only)

#2 Create Model class with below annotations

@Getter //Generates get methods
@Setter //Generates set methods
@ToString //override toString method
@NoArgsConstructor //generate default constructor
@RequiredArgsConstructor //override hashcode , equals method

**) To use @RequiredArgsConstructor which generates constructor using variable annnoated with @NonNull. If no variable found having @NonNull, then it is equal to generating "Default constructor" only

Note:

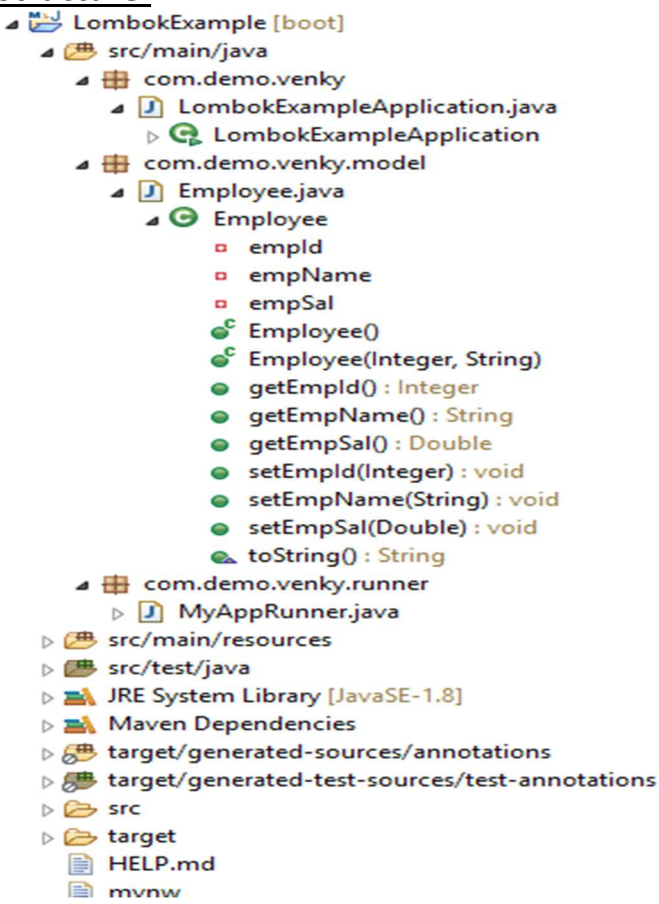
***#*:** Apply @Data (package : lombok.Data) over Bean/Model which generates Set, get, toString, equals, hashCode and RequiredArgs Constructor.

E.g.:

@Data

public class Employee {…….}

FolderStructure:



LombokExampleApplication.java:

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

Employee.java:

```
package com.demo.venky.model;
```

```
import lombok.Getter;
import lombok.NoArgsConstructor;
import lombok.NonNull;
import lombok.RequiredArgsConstructor;
import lombok.Setter;
import lombok.ToString;
//@Data                          //Generates all (get,set,constructors tostring )methods
@Getter                         //Generates get methods
@Setter                         //Generates set methods
@ToString                       //override toString method
@NoArgsConstructor      //generate default constructor
@RequiredArgsConstructor //override hashcode , equals method
public class Employee {
        @NonNull
        private  Integer  empId;
        @NonNull
        private  String empName;
        private  Double empSal;
}
```

MyAppRunner.java:

```
package com.demo.venky.runner;
import org.springframework.boot.CommandLineRunner;
import org.springframework.stereotype.Component;
import com.demo.venky.model.Employee;

@Component
public class MyAppRunner implements CommandLineRunner {
        public void run(String... args) throws Exception {
                Employee e1=new Employee();
                e1.setEmpId(10);
                e1.setEmpName("AA");
                e1.setEmpSal(6.66);
                Employee e2=new Employee();
                e2.setEmpId(20);
                e2.setEmpName("BB");
                e2.setEmpSal(7.77);
                Employee e3=new Employee();
                e3.setEmpId(30);
                e3.setEmpName("CC");
                e3.setEmpSal(9.99);
        }
}
```

Output:

```
Problems  Console  Progress  Servers
<terminated> Lombok - LombokApplication [Spring Boot App] C:\Program Files\Java\jdk1.8.0_161\bin\javaw.exe (May 11, 2019, 9:34:17 AM)

  .   ____          _            __ _ _
 /\\ / ___'_ __ _ _(_)_ __  __ _ \ \ \ \
( ( )\___ | '_ | '_| | '_ \/ _` | \ \ \ \
 \\/  ___)| |_)| | | | | || (_| |  ) ) ) )
  '  |____| .__|_| |_|_| |_\__, | / / / /
 =========|_|==============|___/=/_/_/_/
 :: Spring Boot ::        (v2.1.4.RELEASE)

2019-05-11 09:34:33.316  INFO 1088 --- [           main] com.venky.demo.LombokApplication         : Starting LombokApplication on Venky056 with PID 1088 (started b
2019-05-11 09:34:33.322  INFO 1088 --- [           main] com.venky.demo.LombokApplication         : No active profile set, falling back to default profiles: default
2019-05-11 09:34:37.863  INFO 1088 --- [           main] com.venky.demo.LombokApplication         : Started LombokApplication in 7.675 seconds (JVM running for 19.
false
```

Spring Boot Message Queues (MQ)

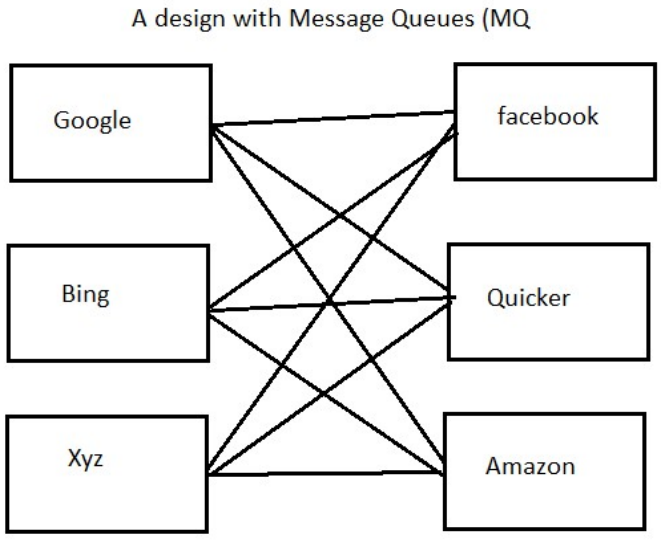
➔In case of real time application large data needs to be transferred and processed. Like google server to amazon, facebook, … etc.

➔Data (Message) transfer can be done using Message Queues.

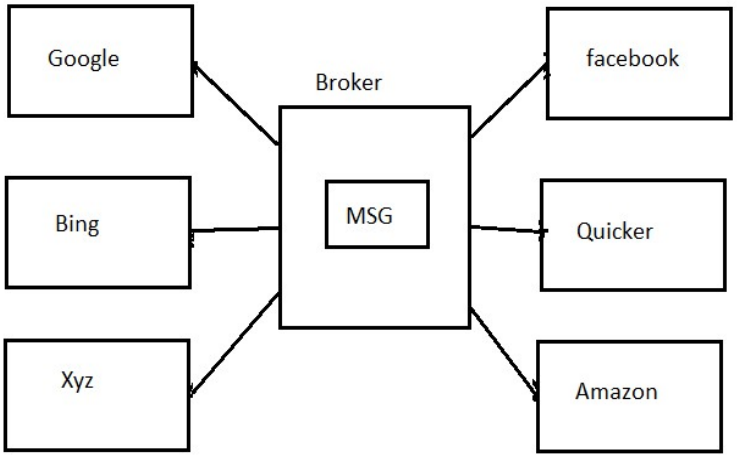
➔Message Queues are used for

a. Log aggregation (Read Large Log files from server and sent to another place)
b. Web Activities (Know what users are searching and provide related links and Advertisement in client websites)
c. Command Instruction (send message to Printer/Email one invoice on receive)
d. Data Streaming (Read large data from files, Networks, Databases continuously) etc..

➔In case of multiple clients sharing data without MQ, may look like this:



A design with Message Queues (MQ



➔MQ can be implemented using Language based technologies (or API)
Ex: JMS (Java Message Service)

➔Global MQ (between any type of client) Advanced Message Queuing protocol (AMQP)

➔Apache ActiveMQ, Rabbit MQ, Apache Atrims are different Service providers (Broker software's) for JMS

➔Apache Kafka is a service Provider (Broker software) for AMQP.

Spring Boot with Apache ActiveMQ

JAVA JMS is simplified using Spring Boot which reduces writing basic configuration for ConnectionFactory, Connection, Session, Destination Creation, Send/Receive message etc....

JMS supports 2 types of clients. Those are

a. Producer (Client): Sends message
b. Consumer (Client): Read Message

Messages are exchanged using **MessageBroker** called as **MOM** (Message Oriented Middleware)

Types of Communications in MQ's:

1. P2P (Peer-To-Peer): sending 1 message to one consumer.
2. Pub/Sub (Publish and Subscribe multiple consumers

*** JMS supports two types of communications

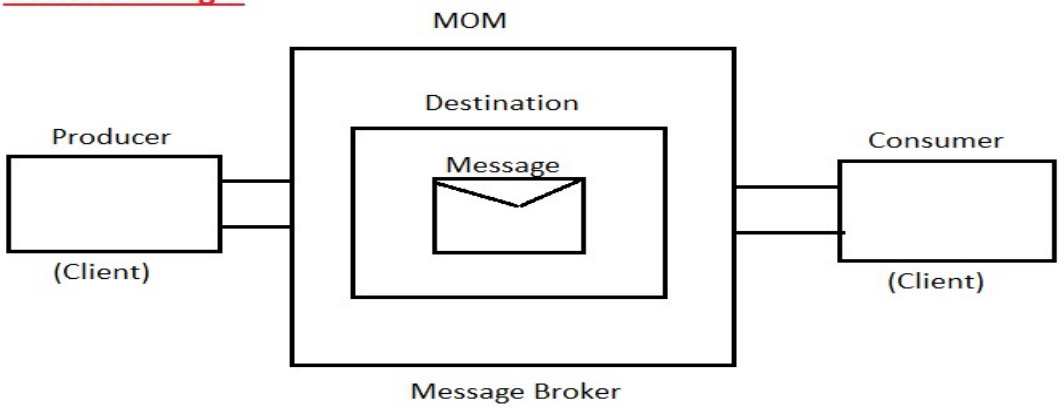
Note:

a. Destination is Special memory created in MOM which holds messages.
b. Here Queue Destination is used for P2P.

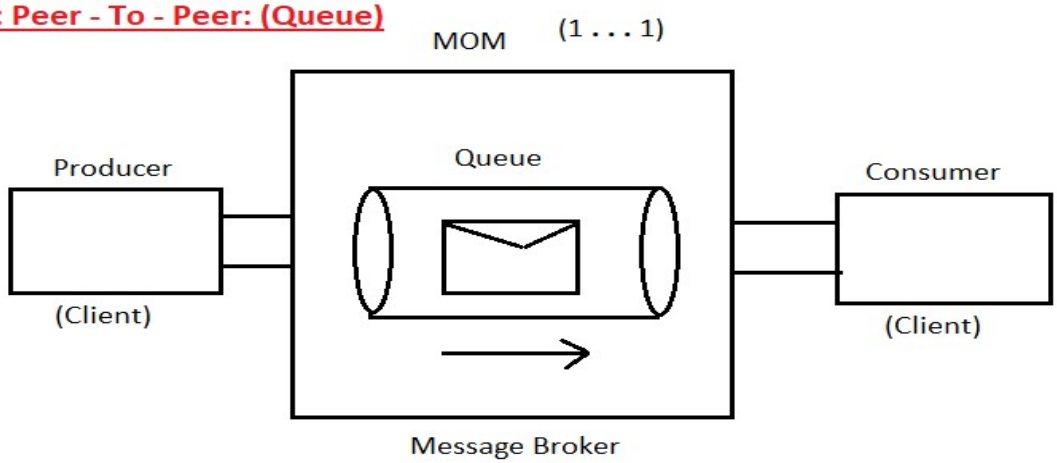
Limitations of JMS:

a. Used between Java Applications.
b. Message (Data) size should be smaller
c. Only one MOM (one instance) runs at a time.
d. Large data takes lot of time to process.
e. If Pub/Sub model is implemented with more consumers then process will be very slow
f. Day may not be delivered (data lose) in case of MOM stops Restart.

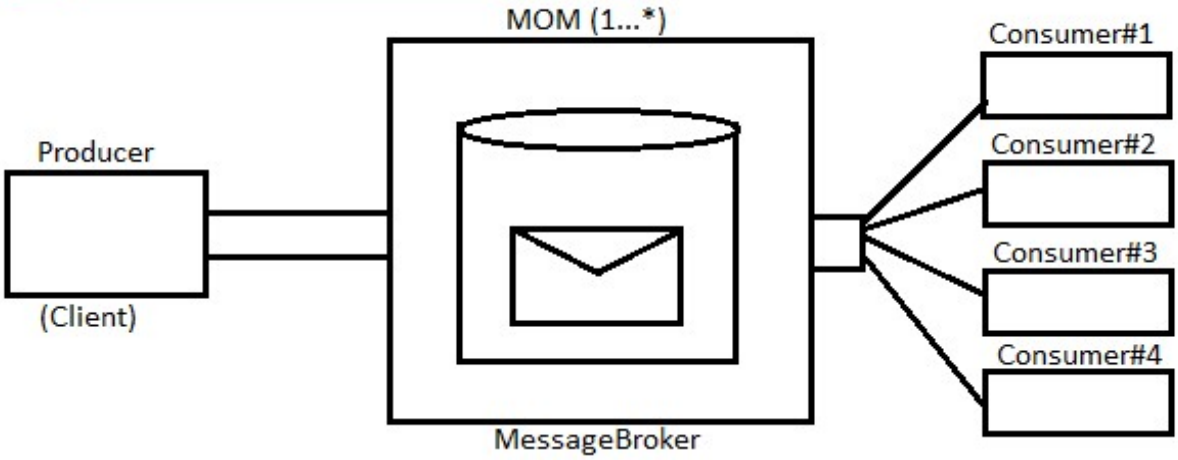
Generic Design:



(P2P: Peer - To - Peer: (Queue)



Pub/Sub:Publish and Subscribe(Topic)



Steps to Implements ActiveMQ:

Step#1 Create one Spring boot starter application using dependencies:
(or add below dependency in pom.xml)

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

Step#2 In application.properties file provide common keys like MQ brokerUrl, user, password.

➔If we do not specify any type then it behaves as **P2P (Queue).** To make it as Pub/Sub (Topic).

application.properties:

```
spring.activemq.broker-url=tcp://localhost:61616
spring.activemq.user=admin
spring.activemq.password=admin
spring.jms.pub-sub-domain=false
```

Step#3 If application is Producer type then use JmsTemplate object and call send() which will send message to MOM.

Step#4 If Application is Consumer type then define one Listener class using destination.

Use Code: @JmsListener(destination=" _____")

➔It must be Enabled using code: **@EnableJms**

➔In case of JmsTemplate (C) @EnableJms is not required.

Download and setup for ActiveMQ:

Download Link:

➔Go to below location

https://activemq.apache.org/components/classic /download/

➔Click on: apache-activemq-5.15.9-bin.zip

➔Extract to one folder

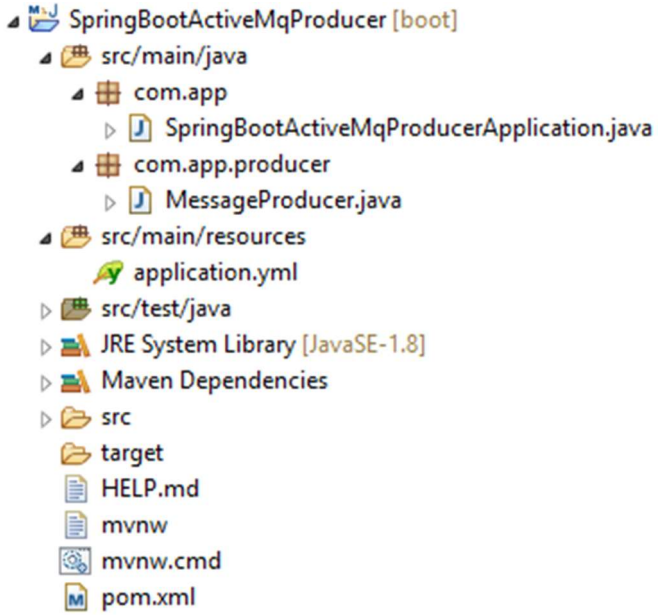
➔Go to ..\apache-activemq-5.15.9\bin\win64

➔Double click on activemq.bat file

➔Go to browser and type URL:http://localhost:8161/admin

➔Create multiple consumer applications in same or different workspaces and set **spring.jms.pub-sub-domain=true** In application.properties file (or yml).

Producer FolderStructure:



SpringBootActiveMqProducerApplication.java:

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

MessageProducer.java:

```
package com.app.producer;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.boot.CommandLineRunner;
import org.springframework.jms.core.JmsTemplate;
import org.springframework.stereotype.Component;
@Component
public class MessageProducer implements CommandLineRunner{
	@Autowired
	private JmsTemplate template;
	@Override
	public void run(String... args) throws Exception {
	template.send("my-tpca", (ses)->ses.createTextMessage("AAAAAAAAA"));
		System.out.println("sent from Producer");
	}
}
```

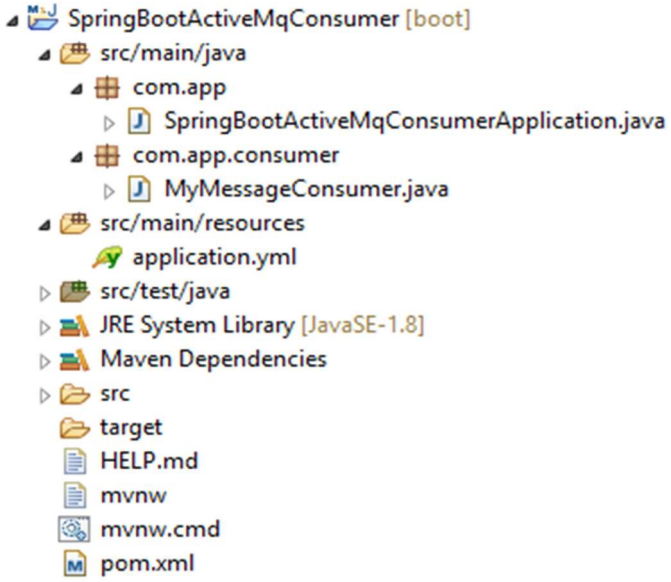
application.yml:

```
spring:
  activemq:
    broker-url: tcp://localhost:61616
    user: admin
    password: admin
  jms:
    pub-sub-domain: true
```

ConsoleOutput:

```
SpringBootActiveMqProducer - SpringBootActiveMqProducerApplication [Spring Boot App] C:\Program Files\Java\jdk1.8.0_161\bin\javaw.exe (May 11, 2019, 9:57:33 AM)

  .   ____          _            __ _ _
 /\\ / ___'_ __ _ _(_)_ __  __ _ \ \ \ \
( ( )\___ | '_ | '_| | '_ \/ _` | \ \ \ \
 \\/  ___)| |_)| | | | | || (_| |  ) ) ) )
  '  |____| .__|_| |_|_| |_\__, | / / / /
 =========|_|==============|___/=/_/_/_/
 :: Spring Boot ::        (v2.1.4.RELEASE)

2019-05-11 09:57:37.863  INFO 1764 --- [           main] .a.SpringBootActiveMqProducerApplication : Starting SpringBootActiveMqProducerApplication on Venky05
2019-05-11 09:57:37.874  INFO 1764 --- [           main] .a.SpringBootActiveMqProducerApplication : No active profile set, falling back to default profiles: default
2019-05-11 09:57:43.063  INFO 1764 --- [           main] .a.SpringBootActiveMqProducerApplication : Started SpringBootActiveMqProducerApplication in 6.982 sec
sent from Producer
```

Consumer FolderStructure:



SpringBootActiveMqConsumerApplication.java:

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

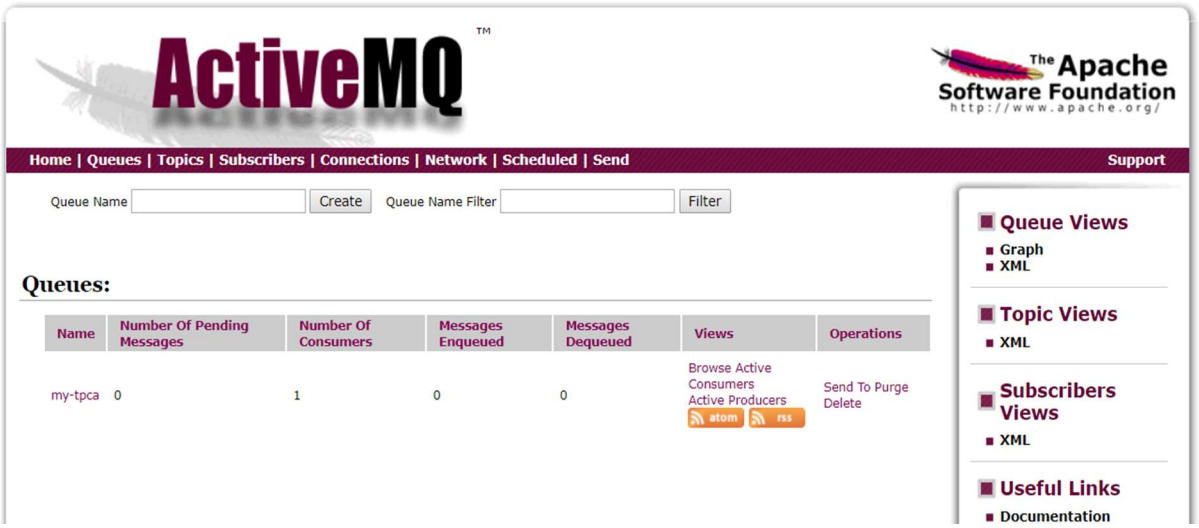
MyMessageConsumer.java:

```
package com.app.consumer;
import org.springframework.jms.annotation.EnableJms;
import org.springframework.jms.annotation.JmsListener;
import org.springframework.stereotype.Component;
@EnableJms
@Component
public class MyMessageConsumer {
	@JmsListener(destination = "my-tpca")
	public void readMessage(String msg) {
		System.out.println("from consumer");
		System.out.println("msg is:"+msg);
	}
}
```

application.yml:

```
spring:
  activemq:
    broker-url: tcp://localhost:61616
    user: admin
    password: admin
  jms:
    pub-sub-domain: true
```

BrowserOutput:



Spring Boot Apache Kafka Integration

Apache Kafka is used for

A. Distributed Messaging System, which works for multiple destinations of any type (any Language +Plugin required), to send or receive Messages.

B. Supports Realtime Data Streaming. It means read continuous and Large data from external source like Float Files, Database, networks, etc.…

C. Message Brokers will persist the message (save into their memory) to avoid data lose in case of consumer non-available or broker is down.

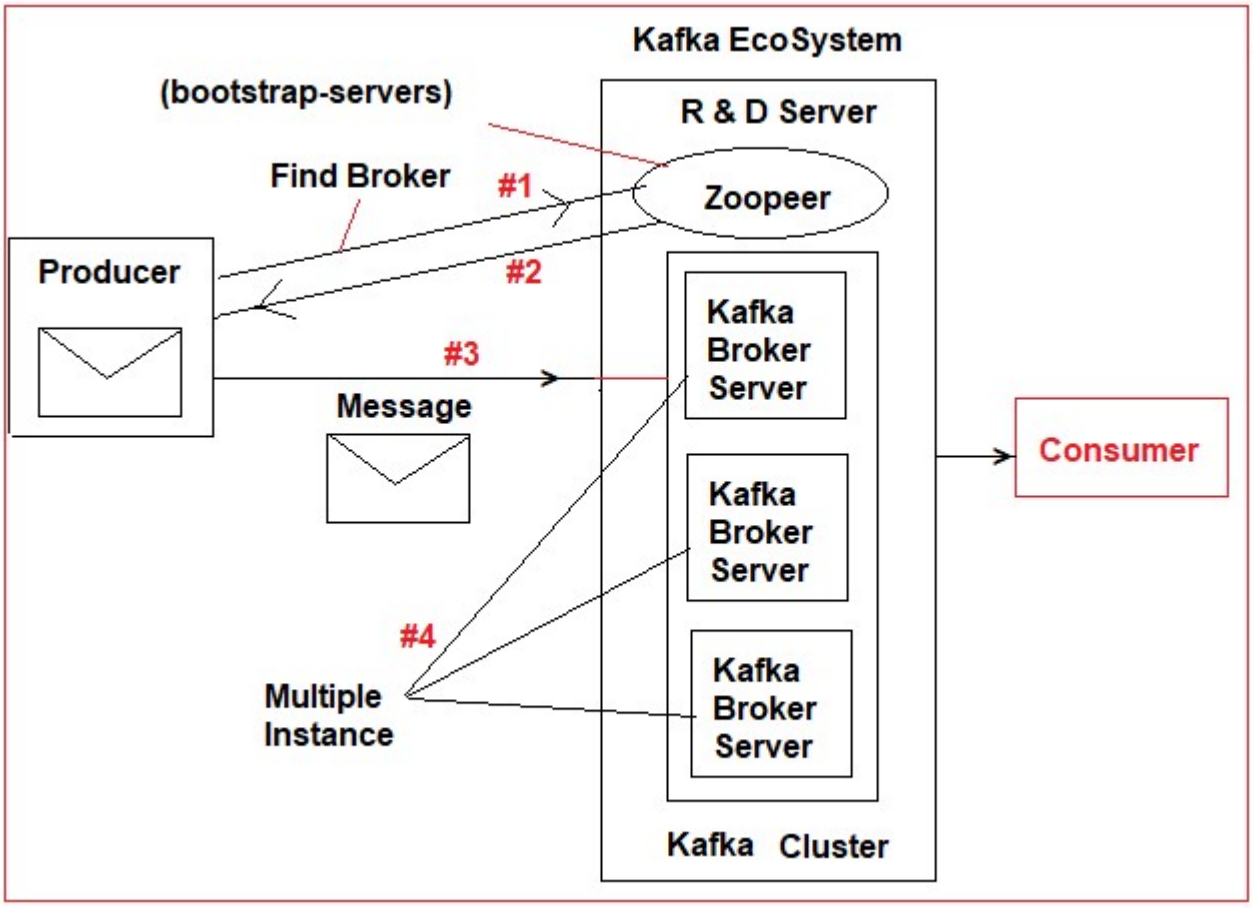
D. Kafka Default communication type is Pub/Sub (Topics).

E. Kafka Supports Load Balancing for Broker Softwire's to make execution faster. It is known as Kafka Cluster.

F. All these Broker instances must be Registered with Registry and Discovery (R&D) Server. Kafka comes with default **"Zookeeper R&D Server".**

G. This complete Kafka Software is called as Kafka **Ecosystem** (= Kafka Cluster + R&D Server)

H. Kafka works as Protocol independent i.e. works for TCP, FTP, SMTP, HTTP… etc.)



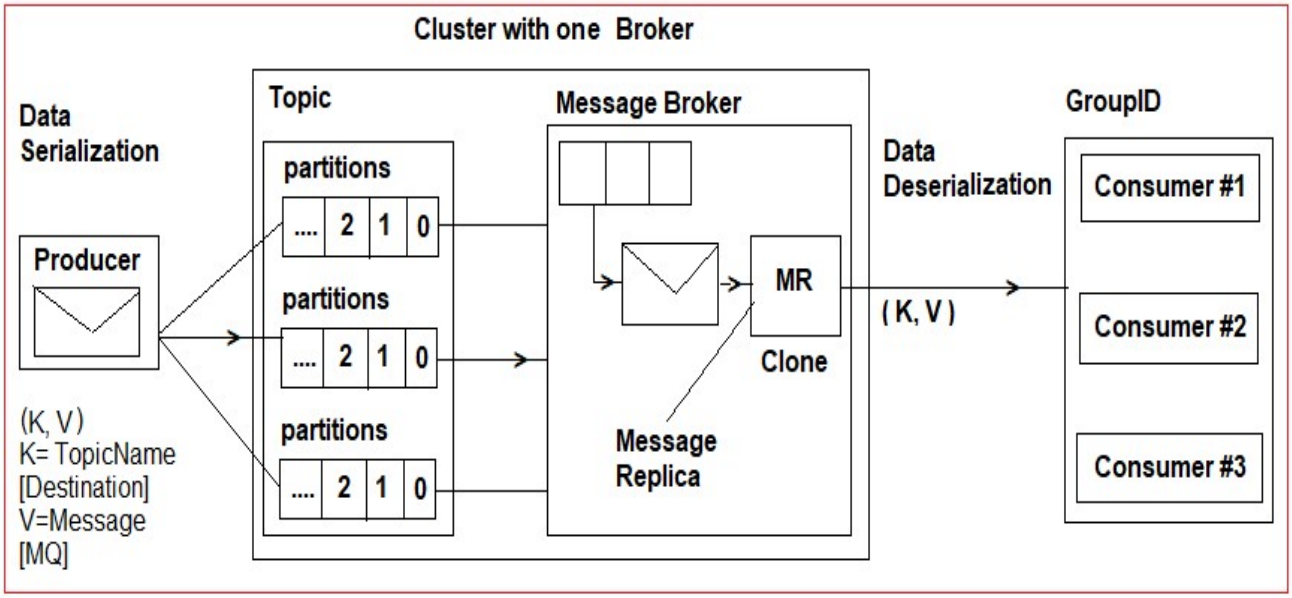
Execution Flow:

➔Producer Application should get Message Broker details from R & D Server (zookeeper) known as bootstrap-server).

➔Producer gets unique-id of Message Broker server and sends message to Broker.

➔MessageBroker will send this message to one or multiple consumers.

➔Producer sends data <k, V> format in Serialized (Converting to binary/Characters formats). Here K=Destination (Topic name) and V= Message.
➔Every Message will be partitioned into Multiple parts in Topic (Destination) to avoid large data sending, by making into small and equal parts (some time size may vary).
➔Broker reads all partitions data and creates its replica (Clone/Mirror obj) to send message to multiple consumers based on **Topic** and **Group-Id**.
➔At Consumer side Deserialization must be applied on K, V to read data. Consumer should also be linked with bootstrap-server to know its broker.



➔Partitions are used to breakdown large message into multiple parts and send same to multiple brokers to make data destination in parallel.
➔Message Replica: it creates multiple copies to one message to publish one message to multiple Consumers.

<u>Kafka Producer and Consumer Setup Details:</u>
➔For Producer Application we should details in application.properties (or). yml
➔Those are

bootstrap-servers=localhost:9092
key-serializer=StringSerializer
value-serializer=StringSerializer

➔By using this Spring Boot creates instance of **"KafkaTemplate<K, V>"** then we can call send(k, v) method which will send data to Consumer.
=>Here: K=Topic Name, V= Data/Message
➔For Consumer Application we should provide details in application.properties (or) .yml
➔Those are

bootstrap-servers=localhost:9092
key-deserializer=StringDeserializer
value-deserializer=StringDeserializer
group-id=MyGroupId

➔By using this Spring Boot configures the Consumer application, which must be implemented using: @KafkaListener(topics="_____", groupId="_____")

***** bat files in kafka to be created*****

1.Cluster.bat

➔Starts Zookeeper with Kafka Cluster design

.\bin\windows\zookeeper-server-start.bat .\config\zookeeper.properties

2Server.bat

➔Starts Kafka Server (Message Broker)

.\bin\windows\kafka-server-start.bat .\config\server.properties

Coding Steps:

Step#1 Create new Spring boot Starter project with dependencies: web, kafka

GroupId: com.app

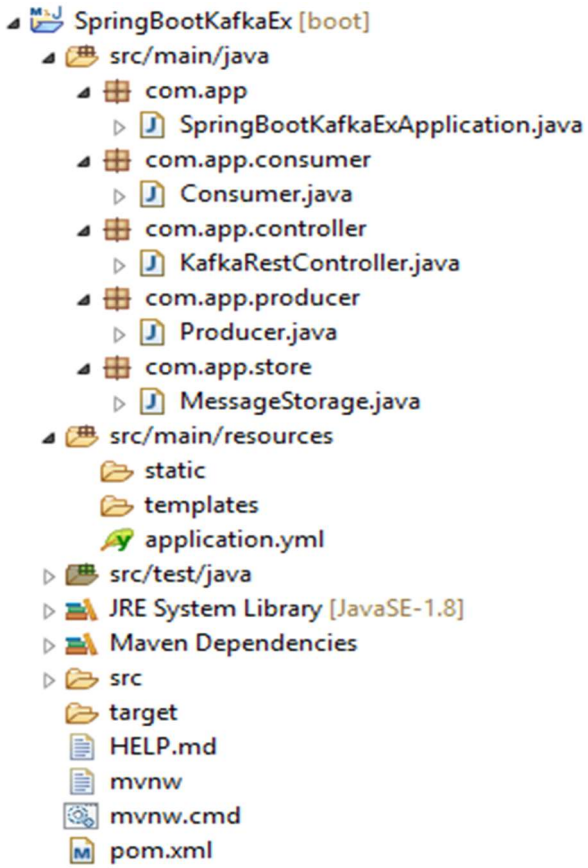
ArtifactId: SpringBootKafkaApp

version: 1.0

Kafka Dependency:

```
<dependency>
    <groupId>org.springframework.kafka</groupId>
    <artifactId>spring-kafka</artifactId>
</dependency>
```

FolderStructure:



Step#2 add key= value pairs in application (. properties/. yml) file.

```
server:
  port: 9988

spring:
  kafka:
    producer:
      bootstrap-servers: localhost:9092
      key-serializer: org.apache.kafka.common.serialization.StringSerializer
      value-serializer: org.apache.kafka.common.serialization.StringSerializer
    consumer:
      bootstrap-servers: localhost:9092
      key-deserializer: org.apache.kafka.common.serialization.StringDeserializer
      value-deserializer: org.apache.kafka.common.serialization.StringDeserializer
      group-id: groupId

my:
 app:
  topicname: sampletopic
```

Step#3 Define one starter class

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

Step#4 Define Producer code

```
package com.app.producer;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.beans.factory.annotation.Value;
import org.springframework.kafka.core.KafkaTemplate;
import org.springframework.stereotype.Component;
@Component
public class Producer {
	@Value("${my.app.topicname}")
	private String topic;
	@Autowired
	private KafkaTemplate<String, String> template;
```

```
	public void sendMessage(String message) {
		template.send(topic, message);
	}
}
```

Step#4 Define Message Storage class

```
package com.app.store;
import java.util.ArrayList;
import java.util.List;
import org.springframework.stereotype.Component;
@Component
public class MessageStorage {
	private List<String> list=new ArrayList<String>();
	public void put(String message) {
		list.add(message);
	}
	public String getAll() {
		return list.toString();
	}
}
```

Step#5: Define Consumer class

```
package com.app.consumer;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.kafka.annotation.KafkaListener;
import org.springframework.stereotype.Component;
import com.app.store.MessageStorage;
@Component
public class Consumer {
	@Autowired
	private MessageStorage storage;
	@KafkaListener(topics="${my.app.topicname}",groupId="groupId")
	public void consume(String message) {
		storage.put(message);
	}
}
```

Step#6: Define Kafka Controller class

```
package com.app.controller;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.web.bind.annotation.RequestMapping;
import org.springframework.web.bind.annotation.RequestParam;
import org.springframework.web.bind.annotation.RestController;
import com.app.producer.Producer;
import com.app.store.MessageStorage;
```

```
@RestController
public class KafkaRestController {
	@Autowired
	private Producer producer;
	@Autowired
	private MessageStorage storage;
	@RequestMapping("/send")
	public String readInMessage(@RequestParam String message) {
		producer.sendMessage(message);
		return "message sent!!";
	}
	@RequestMapping("/view")
	public String viewOutMessage() {
		return storage.getAll();
	}
}
```

***Run Starter class and enter URLs:**

http://localhost:9988/send?message=OK

http://localhost:9988/view

output:

Spring Boot with Apache Camel

Routing: It is a process of sending large data from Application (Source) to another Application (Destination). Here data can be File System (.xml, .txt, .csv, .xlsx, .json, etc..), Database (Oracle DB, MySQL Db) or Message Queues using JMS (Active MQ) etc..

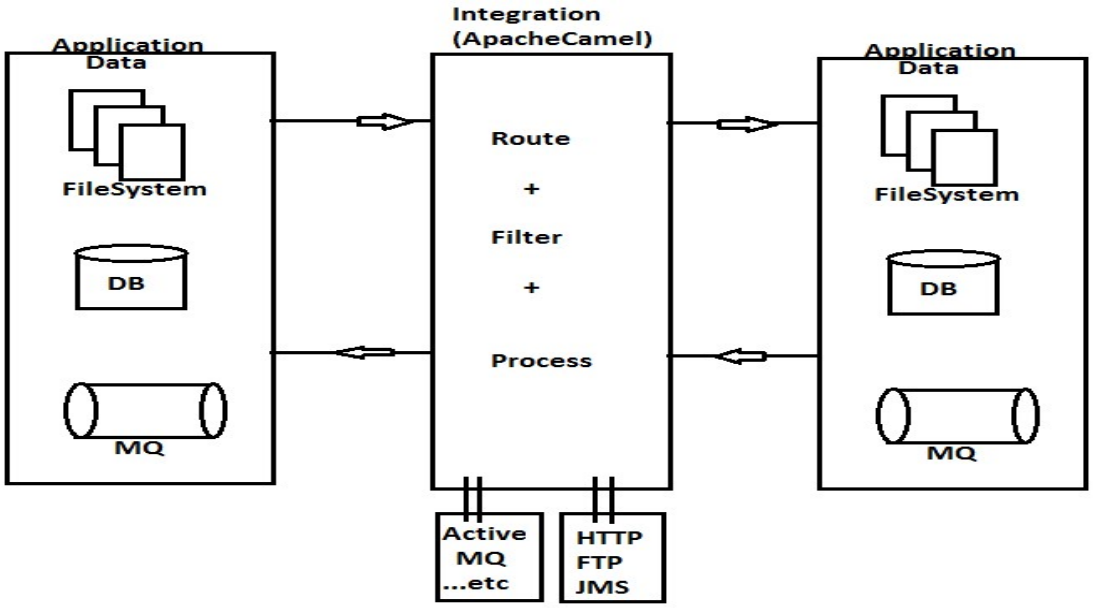
➔Apache Camel is OpenSource and Light weight "Conditional based Routing Engine" which supports filtering and processing.

➔Apache Camel also supports different language like PHP, Python, and JavaScript… etc.

➔Compared to Spring Batch Integration tool Apache camel is a light weight tool.

➔Camel supports reading data from different sources even like HTTP, FTP, JMS protocols based.

Daigram:



Implementing Camel Routing in Spring boot:

Step#1 in pom.xml, we must add below dependency which supports Spring boot integration.

```
<dependency>
   <groupId>org.apache.camel</groupId>
   <artifactId>camel-spring-boot-starter</artifactId>
   <version>2.23.2</version>
</dependency>
```

Step#2: Camel avoid main method (thread) execution control and run as independent while working with Spring boot, our starter class is main method. So, we should add key=value in properties file as

application.properties:

```
camel.springboot.main-run-controller=true
```

Step#3: Define one Route Builder class and configure details of routing, filtering and processing.

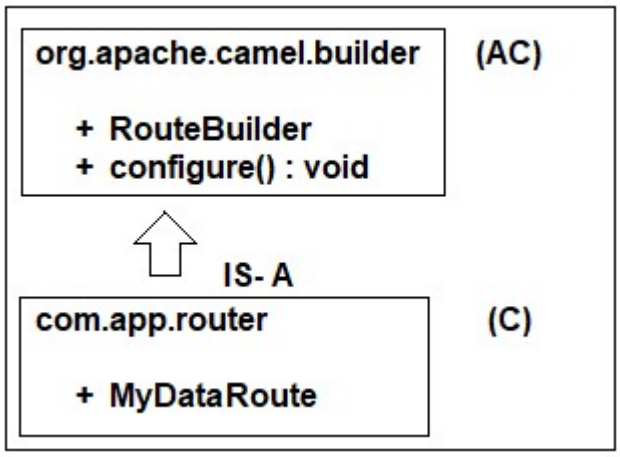
➔To implement this, we need to write one class using (Abstract class) RoutingBuilder provided by Apache camel having one abstract method: configure() which contains coding format like:

```
from (SourceLocation)
   . [filter] . [process].
   .to (DestinationLocation)
```

➔Here Location can be URL/Local File System DB, JMS (MessageQueues)… etc.

Coding Steps:

Step#1: Create Spring Boot starter application with dependencies: Apache Camel



GroupId: org.sathyatech
ArtifactId: SpringBootApacheCamel
Version: 1.0

Step#2: open application.properties (.yml) and add main method-control key as true.

application.properties:

```
camel.springboot.main-run-controller=true
```

(OR)

application.yml:

```
camel:
  springboot:
     main-run-controller=true
```

Step#3: Define Router Builder class with file transfer logic.

```
package com.app.router;
@Component
public class MyFilesRouter extends RouteBuilder {
 public void configure() throws Exception{
//with static location
```

```
    from ("file:D:\\source").to("file:D:\\destination");
 }
}
```

Step#4: Create two folders: source and Destination in "D: drive".

Step#5: Start Application and place files in "D:/source" which will be copied to "D:/destination".

EIP Patterns by Apache Camel: EIP stand for "Enterprise Integration Patterns" used to define short form code for

- Data routing
- Data Filtering
- Data Processing

#1 from ("file:source") .to("file:desti");

➔It will copy files from source to destination by taking files in backup folder in source with name **.camel**.

➔It supports even same file sending with new data (Operation to Override Program).

#2 from ("file:source?noop=true") .to("file:destination");

➔To avoid this, we should set as true.

#3 from ("{{source}}").to("{{destination}}")

➔Here {{location}} indicates dynamic location passing using Properties/Yml files, System args, command line inputs etc.

Example EIPs:

#1Dynamic Location:

Location (source/destination) can be passed at runtime using properties/yml files, config server, system arguments… etc.

➔To indicate Location (URL file System, DB, MQ…) comes at runtime use format: {{location}}

Code changes

a. applictaion.properties:

```
camel.springboot.main-run-controller=true
my.source=file:D/source?noop=true
my.destination=file:/desti
```

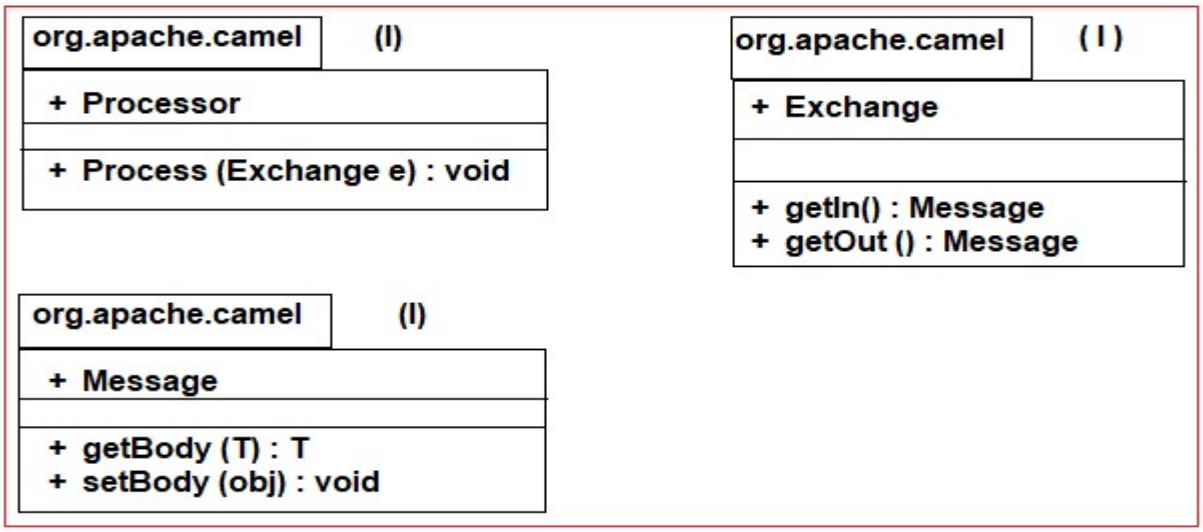
b. Router class code

```
from("{{my.source}}").to("{{my.destination}}");
```

#2 Processing Data:

In Realtime data will be converted or modified based on requirements. Like XML->JSON, JSON->Simple Text, XML->CSV, CSV->SQL Format etc. i.e. data converted from one format to another format which can be done using 3 supporting interfaces. Those are:

1.Processor
2.Exchange
3.Message



Code: Write inside Router (Impl) class:

```
from (“file:D:/source”)
  .process(new Processor() {
public void process (Exchange ex) throws Exception
{
//#1 Read Input Message
Message m = ex.getIn();
#2 Read Body from message
String body = m.getBody(String.class);
//#3 do processing
body =”modified ::”+body;
//#4 Writer data to out message
Message m2 = ex.getOut();
//#5 set body to out message
m2.setBody(body);
}
})
.to(“file:D:/destination?fileName=myFile.txt”);
```

***Note:** Here file name indicates new name for modified message. It can also be passed at run time.

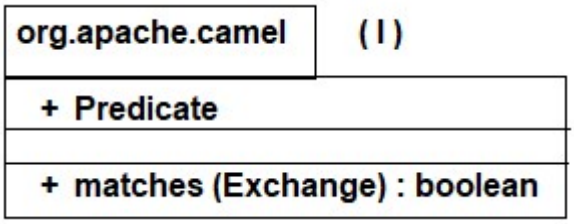
Using Lambda Expression## code:

```
from("file:D:/source")
.process(ex ➔{
String body=ex.getIn().getBody(String.class);
Body="New AA modified ::"+body;
ex.getOut().setBody(body);
})
.to("file:D:/destination?fileName=myFile.txt");
```

#3 Filters using Predicates:

Predicate is a type expression which returns either true or false based on condition checking.

=>If true next level steps are executed else false execution stopped here only.



=>ValueBuilder (C) is used to execute required Predicates, using method: contains(), startWith(), isNull(), …etc.

=>We can get ValueBuilder (C) object using methods body(), header().

=>Header() indicates checking on file name, extension, location … etc.

=>Body() indicates file data/ content check

Ex#1 File name having work sample

```
from("file:D:/source")
.filter(
header(Exchange.FILE_NAME).contains("sample")
.contains("sample")
)
.to("file:D:/destination");
```

Ex#2 File body starts with word java

```
from("file:D:/source")
.filter(body().startWith("java"))
.to("file:D:/destination");
```

Conditional based Routing [Choose –when-otherwise]

=>Filter are used to check predicates and if true executes the next level process but it does execute for false case.

=>To Handle switch-case concept for data routing use choose-when-other.

Format looks like:

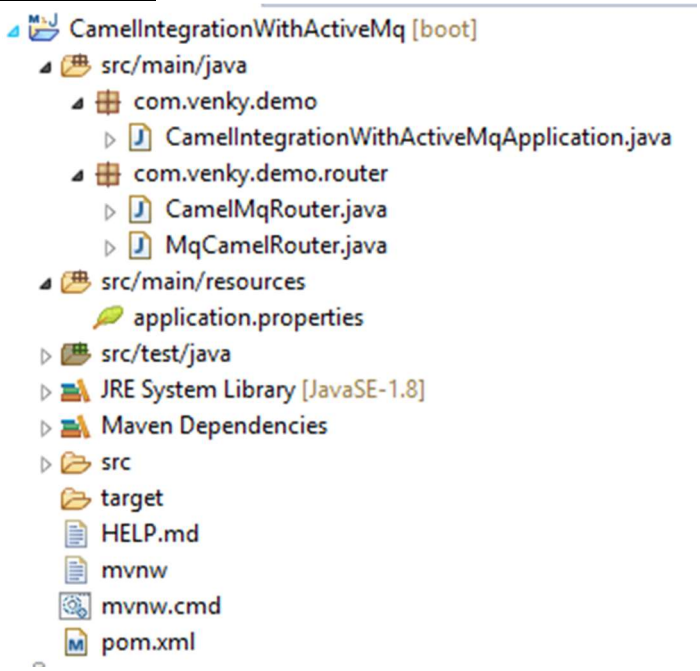
From(“source”)
. choice()
. when(condition#1).to(“destinatation#1”)
. when(“condition#2).to(“destinatation#2”)
….
otherwise().to(“destinatation#n”)

Example:
from(“file:D:/source”)
. choice()
.when(body().startWith(“java”))
.to(“file:D:/destinatation?fileName=a.txt”)

. when(body(). startWith(“xml”)).to(“file:D:/destinatation?fileName=b.txt”)
. when(body(). startWith(“xml”)).to(“file:D:/destinatation?fileName=b.txt”)
. otherwise().to(“file:D://destinatation?fileName=d.txt”);

Apache Camel Intergration with Active MQ(JMS)

➔Patterns used to communicate with MQ using camel is: jms<type>:<destination>
➔Here type can be queue or topic.
Example: jms:queue:info
jms:topic:news etc.
➔For this coding along with ActiveMQ and Camel Dependencies we should add ActiveMQ-pool and camel-jms integration dependencies.
Step#1 Create Spring boot starter project with dependencies: Apache Camel, ActiveMQ.
FolderStructure:



Step#2 add below dependencies in pom.xml file

```
<dependency>
	<groupId>org.apache.activemq</groupId>
	<artifactId>activemq-pool</artifactId>
</dependency>
<dependency>
	<groupId>org.apache.camel</groupId>
	<artifactId>camel-jms</artifactId>
	<version>2.23.2</version>
</dependency>
```

Step#3 Provide camel and ActiveMQ properties

---application.properties---

```
camel.springboot.main-run-controller=true
spring.activemq.broker-url=tcp://localhost:61616
spring.activemq.user=admin
spring.activemq.password=admin
```

Step#4 Define Routers

---a)Camel to MQ Router---

```
package com.venky.demo.router;
import org.apache.camel.builder.RouteBuilder;
import org.springframework.stereotype.Component;
@Component
public class CamelMqRouter  extends RouteBuilder{
	@Override
	public void configure() throws Exception {
		from("file:D:/MICROSERVICES PRACTICE-
		RAGHU/CAMEL/source").to("jms:queue:outdata");
	}
}
```

---b) MQ to camel Router---

```
package com.venky.demo.router;
import org.apache.camel.builder.RouteBuilder;
import org.springframework.stereotype.Component;
@Component
public class MqCamelRouter extends RouteBuilder{
	@Override
	public void configure() throws Exception {
		from("jms:queue:outdata").to("file:D:/MICROSERVICES PRACTICE-
RAGHU/CAMEL/desti");
	}	}
```

Step#5 Run starter class and start ActiveMQ using bat

Step#6 Login to MQ (http://localhost:8161/admin)

➔Click on menu Queue

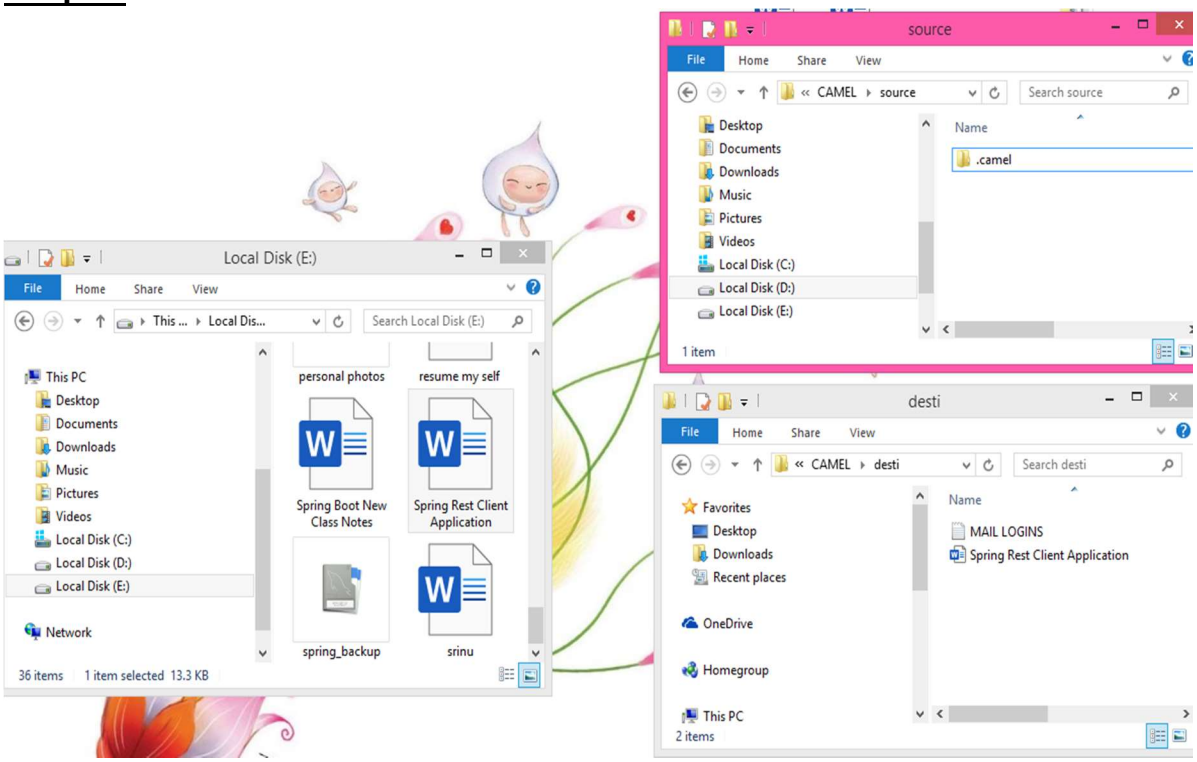
➔Enter Queue name and click create [2 queues: outdata, indata]

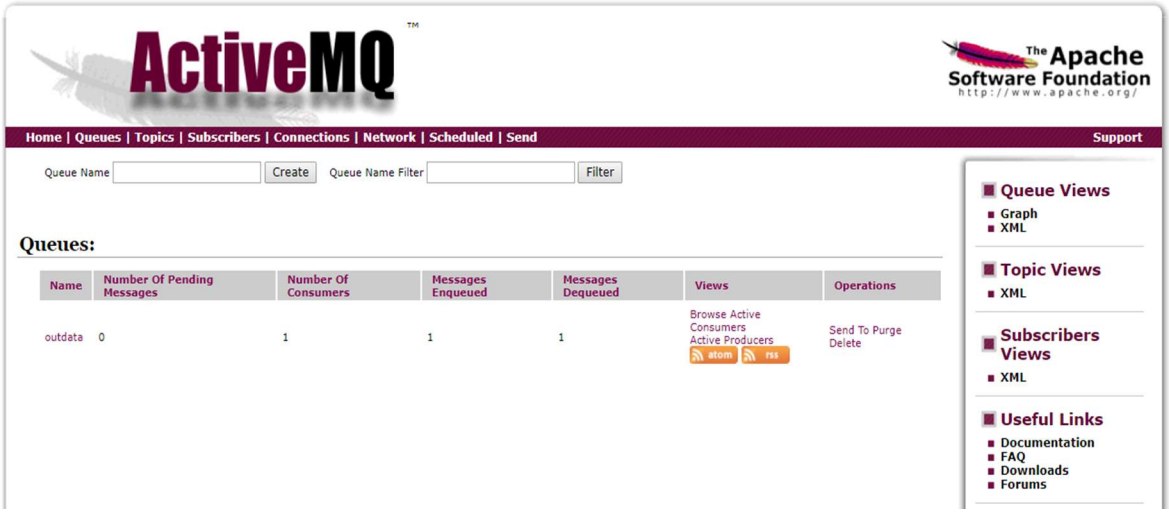
➔click on “sendTo” option on “indata” queue Enter message and press send. File will be copied to destination folder.

➔Go to D:/source folder and place text file having any message.MQ reads this from source.

=>Go to MQ =>click on queue name =>click messageId

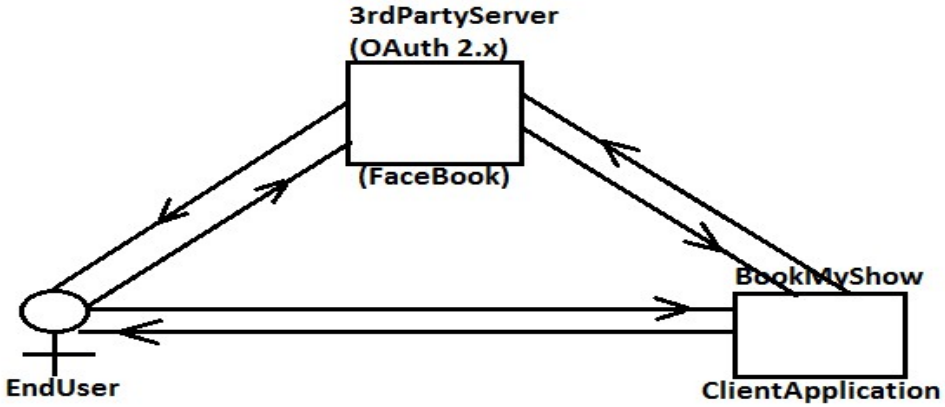
Output:





Open Authorization (OAuth 2.x)

OAuth 2.x is standard and framework which provides 3rd party security services to client application which are registered, on behalf of end user.



➔These 3rd party Applications are also called as "Authorization and Resource Servers".

➔OAuth 2.x standard is widely used in small/medium scale/daily used, business application.

➔OAuth2 Provide SSO (Single Sign on) for multiple applications acting as a one Service.

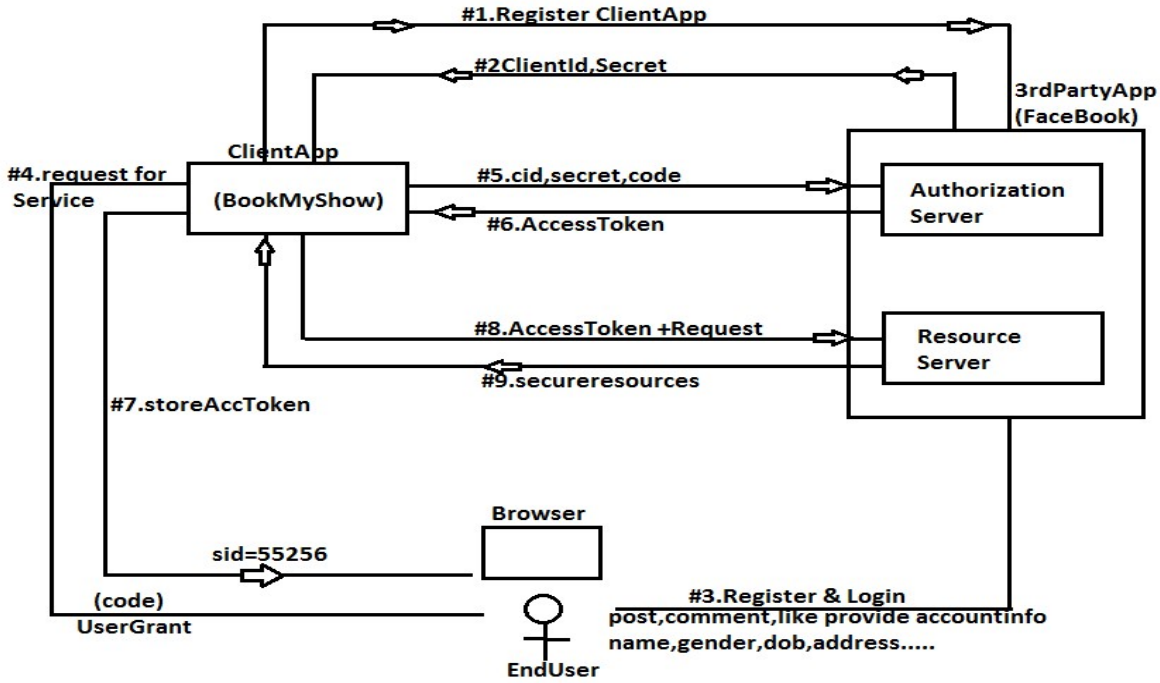
➔Example Client Application are: bookmyshow, yetra.com, quora, redbus, makemytrip, Netflix, mediafire, avast.com, carwale.com, zomato.com.

➔***OAuth2 may not be used for high level and Large scale applications (Ex:- Banking Creditcard, Stock Market… etc). These Spring Security ORM is used mostly.

➔Few Authorization and Resource Servers are : Google, facebook, Redit, Github, Twitter, Linkedin… etc.

Work flow of OAuth2:

Diagram:



OneTime setup for OAuth2:

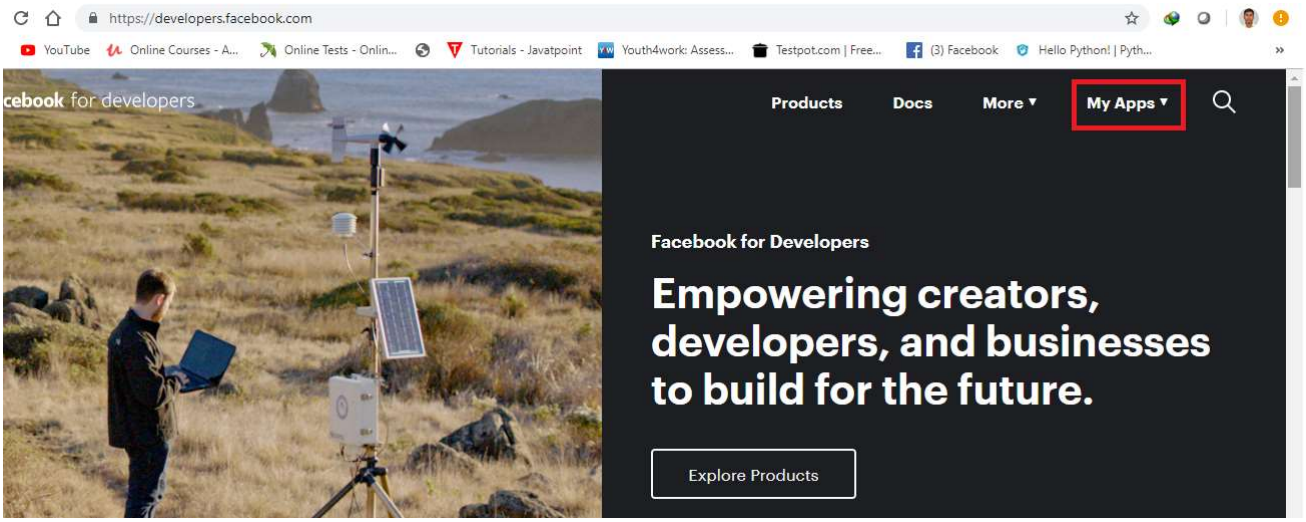
Step #1 Choose any one (or more) 3rd party "Authorization and Resource Server". Ex:-- facebook, Google cloud platform (GCP) Github, Linkedin, Twitter… etc.

Step #2 Here choosing Facebook as 3rd party server for open Authorization link is: https://developers.facebook.com/

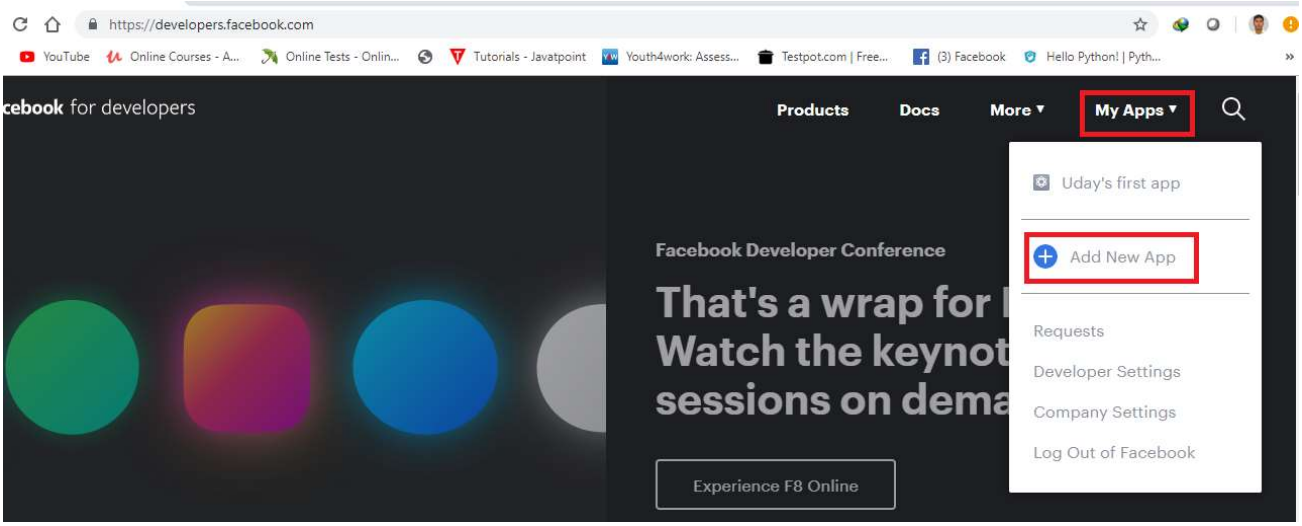
Step #3 Define one new (client) Application in FB Authorization server which generates ClientId (AppId) and secrete (App Secret)

➔Goto facebook developer page

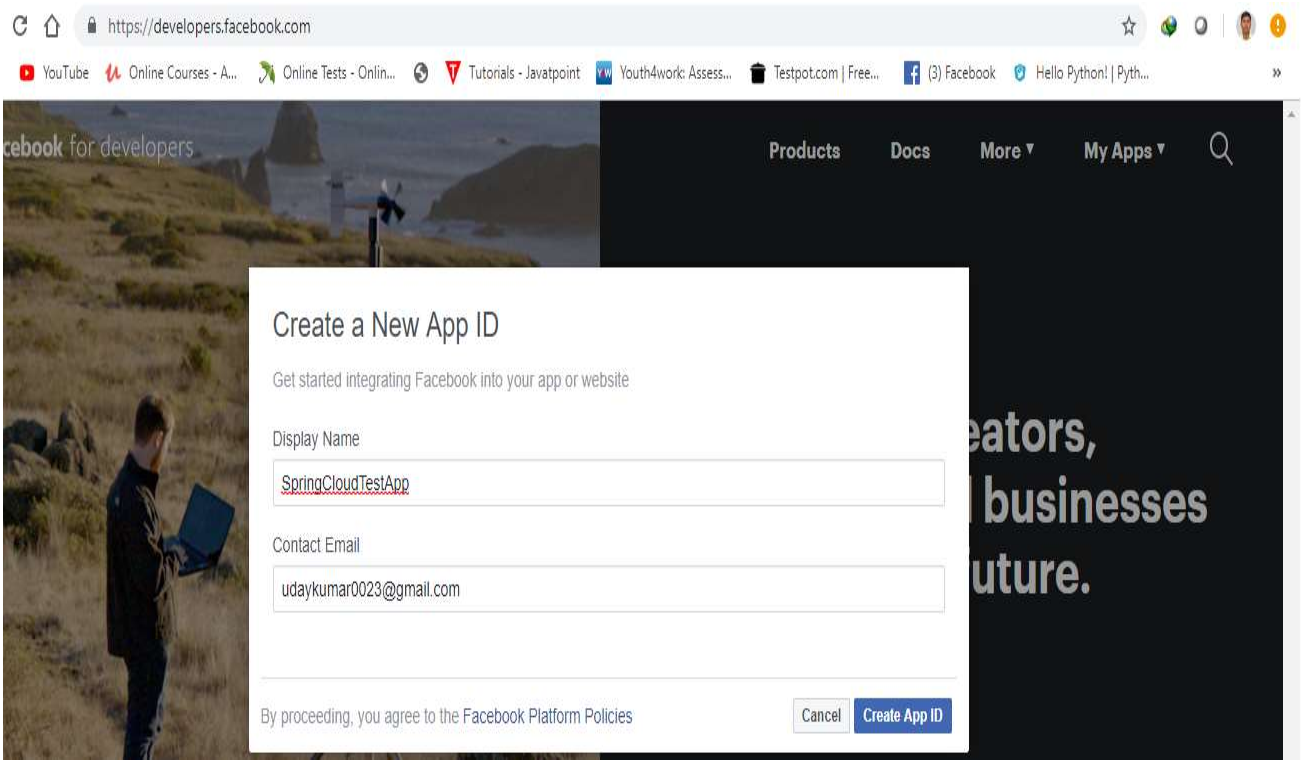
➔Click on top right corner "MyApps"



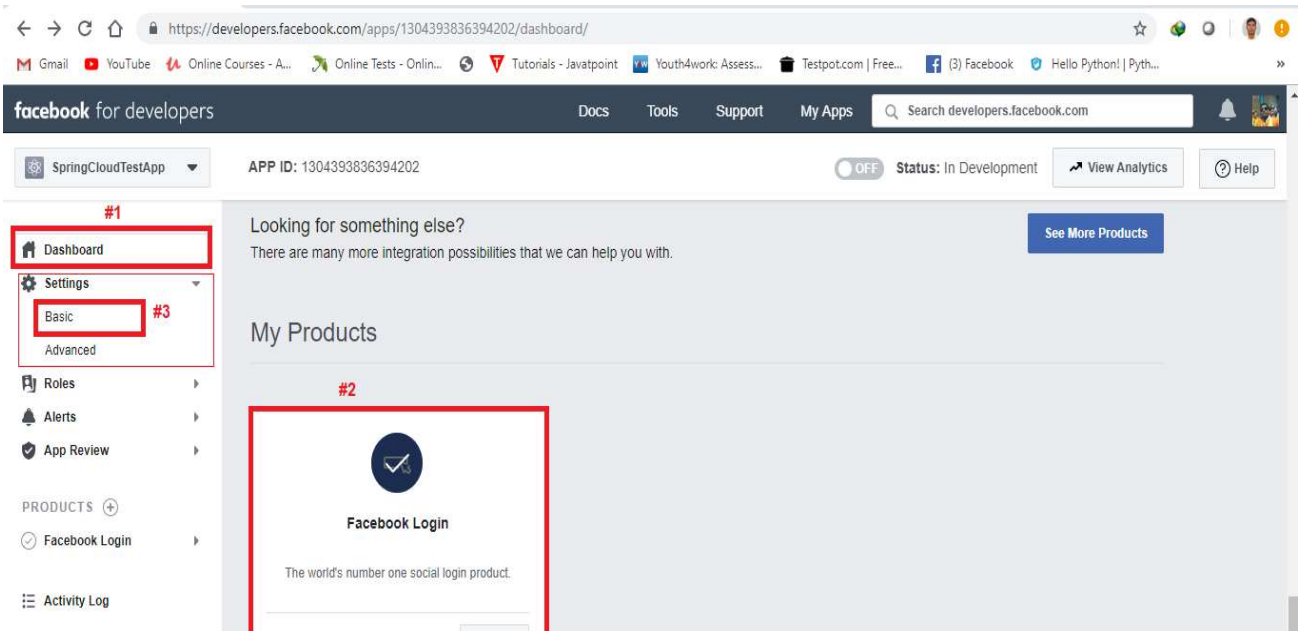
➔Choose "Add New App"



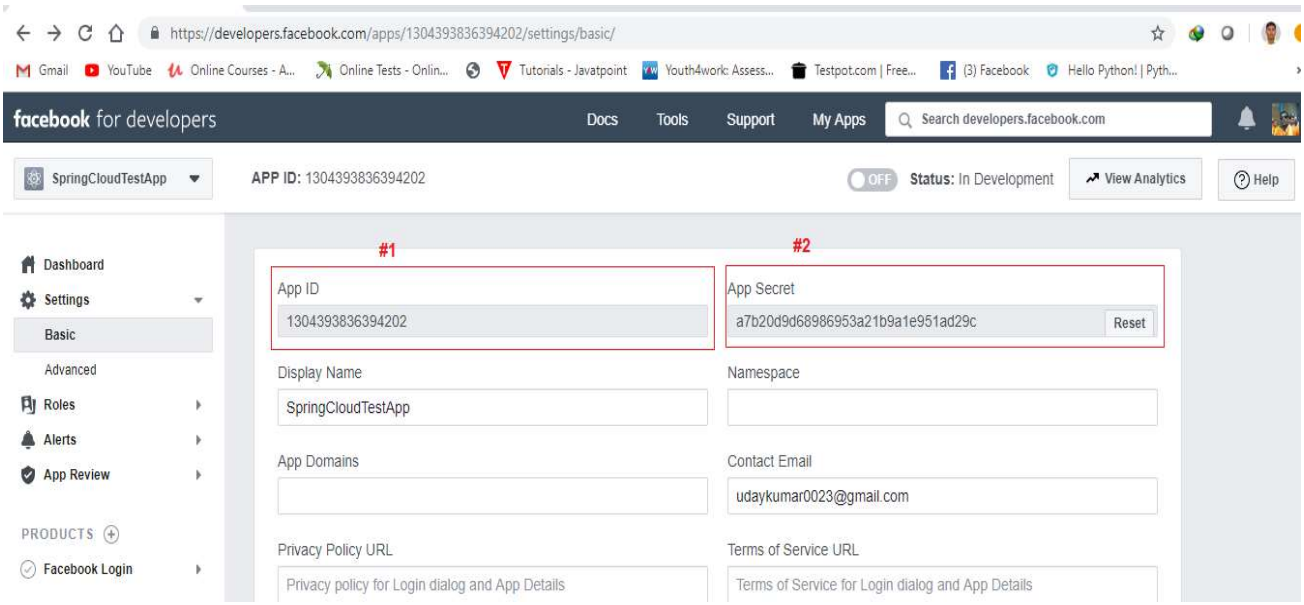
➔Provide Display name (ex: BootTest) and email id : udaykumar0023@gmail.com.



➔Click on “Create AppId”.
➔Complete Security verification
➔Click on “Dashboard”
➔Click on “facebook Login” setup button
➔Click on “Settings” >>”Basic



➔Basic AppId (ClientId) and App Secret (Client Secret)



Step #4 Create one SpringBoot Starter app with dependencies "Security" and "Cloud OAuth2".

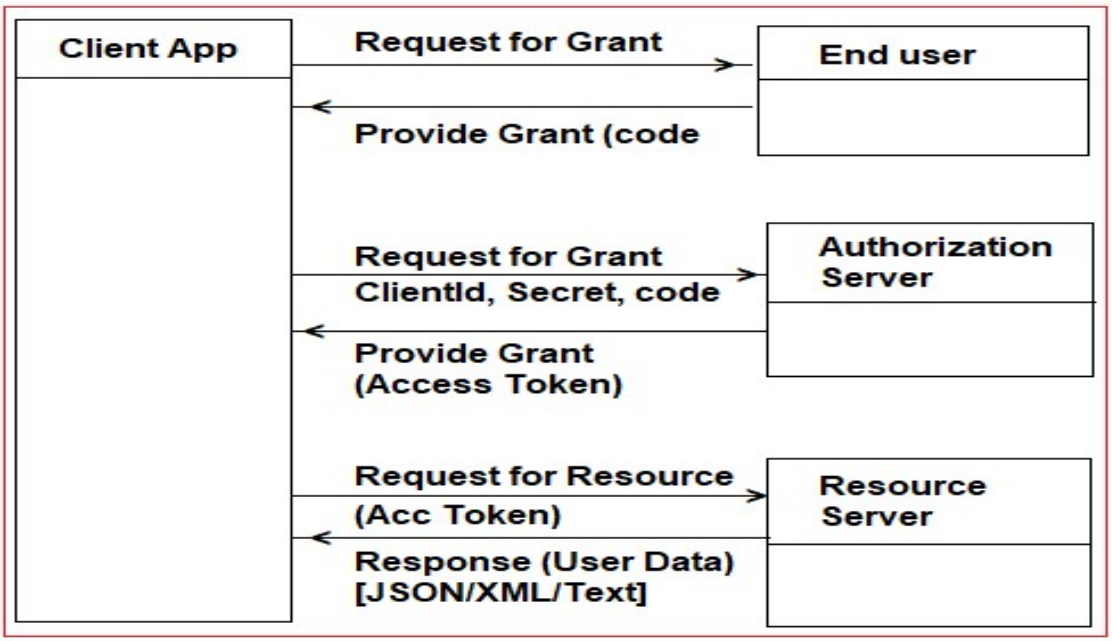
```
<dependency>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-security</artifactId>
</dependency>
<dependency>
        <groupId>org.springframework.cloud</groupId>
        <artifactId>spring-cloud-starter-oauth2</artifactId>
</dependency>
```

Step #5 Create application.yml file using below key value pairs.

application.yml:

```
server:
     9898
security:
  oauth2:
//Auth Server details
       client:
          clientId: <your clientId here>
          clientSecret: <Your secret here>
          accessTokenUri:
          userAuthorizationUri:
          tokenName:
          authenticationSchema:
          clientAuthenticationScheme:
#Resource Server details
      resource:
          userInfoUri:
```

Request Execution flow :



Components Involved: ClientApp, User(Browser), Auth Server (with Token Generator)and Resource Server (User data in XML/JSON).

Step#6 Define SecurityConfig class (SecurityInit is not required, Handled by spring Boot only).

➔Here Authentication Details not required to configure as we are using 3rd party security services.

➔In Authorization config specify which URLs needs type **"EveryOneAccess"** [PermitAll]

```
Package com.app.config;
@Configuration
@EnableOAuth2Sso
public class SecurityConfig extends WebSecurityConfigurerAdapter {
protected void configure(HttpSecurity http) throws Exception  {
  http.authorizeRquests().antMatchers("/","/login").permitAll()
.anyRequest().authenticated();
    }
 }
```

Step#7 Define RestController for User (or Any

```
package com.app.controller;
@RestController
pubic classs UserRestController {
@RequestMapping("/user")
public Principal showUser(Principal p) {
return p;
}
```

```
@RequestMapping("/home")
public String showData() {
return "Hello";
  }
}
```

Step#8 Define one UI Page ex: index.html under src/main/resource, in static folder

Index.html:

```
<html><body>
<h1>Welcome to Login Page/</h1>
<a href="user">Facebook</a>
        (or)
<hr/>
<form action="#" method="post">
User :  <input type="text">
Pwd : <input type="password">
<input type="submit">
</form>
</body></body></html>
```

Step#9 Run application and Enter URL http://localhost:9898

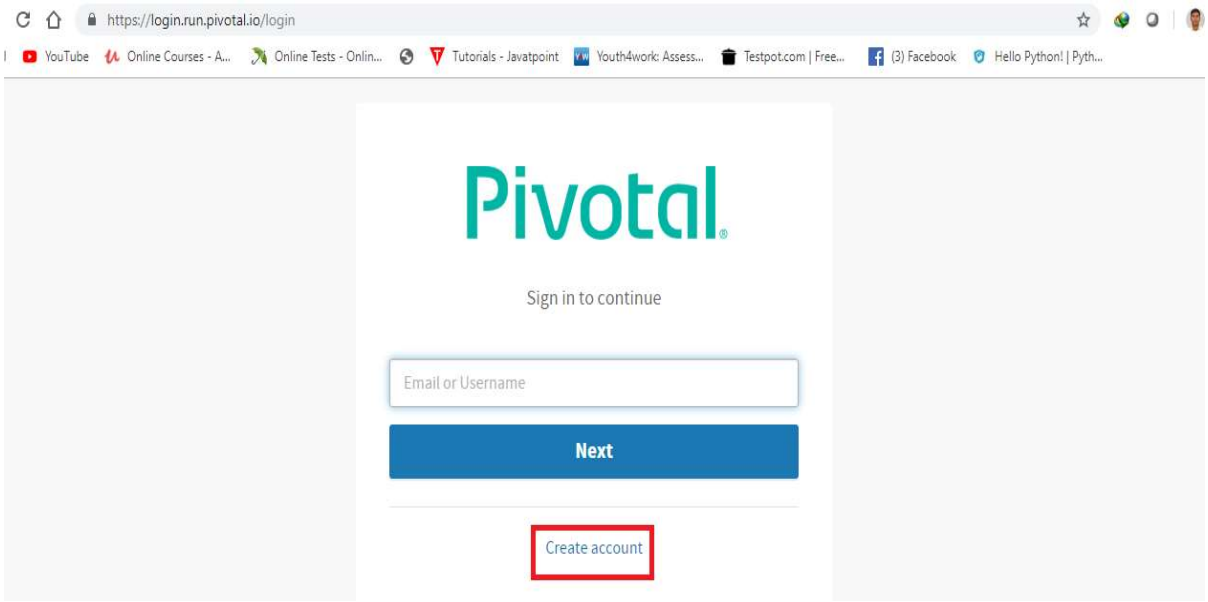
Step#10 Click on facebook Link and accept name (or) enter details.

Spring Boot PCF deployment
Pivotal Cloud Foundry (PCF)

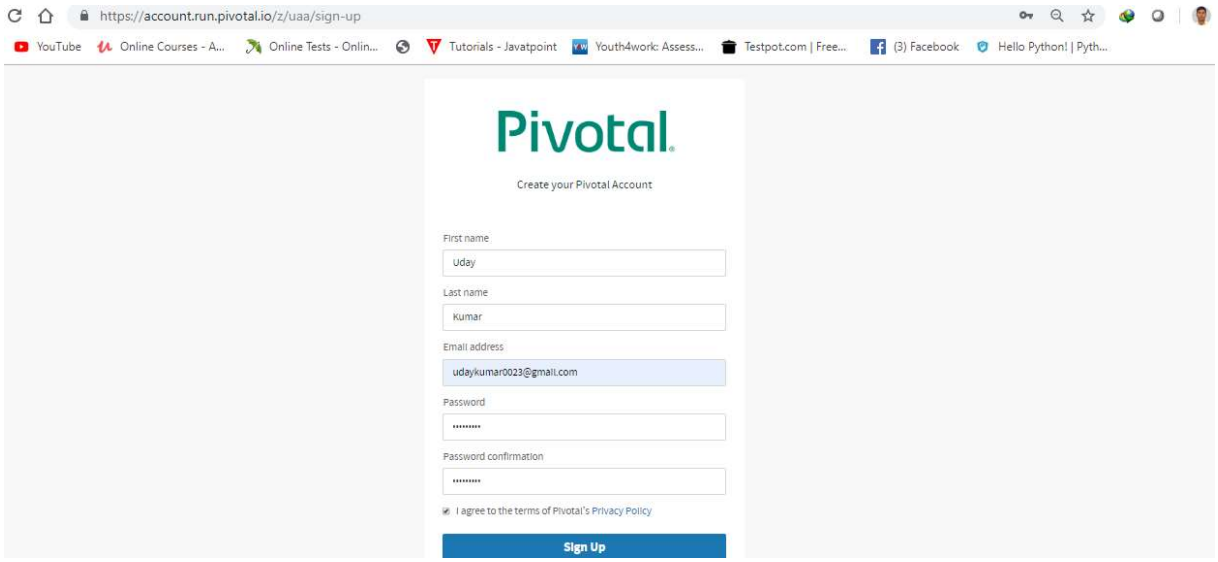
Pivotal Cloud Foundry is a Cloud Deployment Server provides service to Spring Boot and Microservices Applications mainly with all kinds of Environment setup like Databases, server, log tracers etc.

#PCF Account Setup#

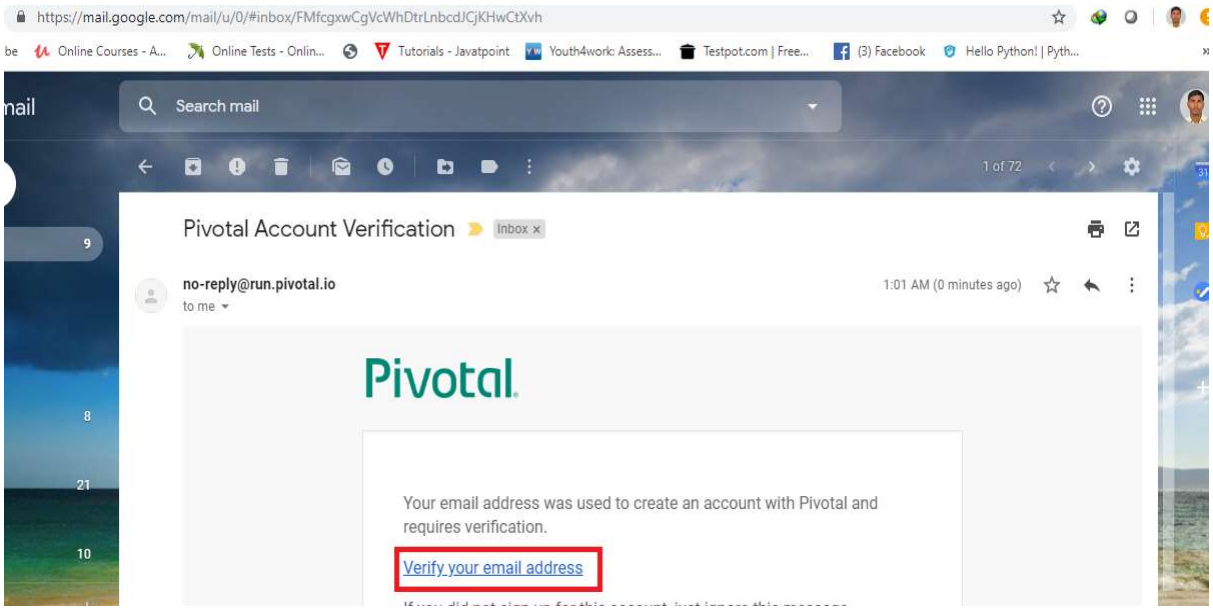
Step#1: Goto https://login.run.pivotal.io/login And click on Create new account



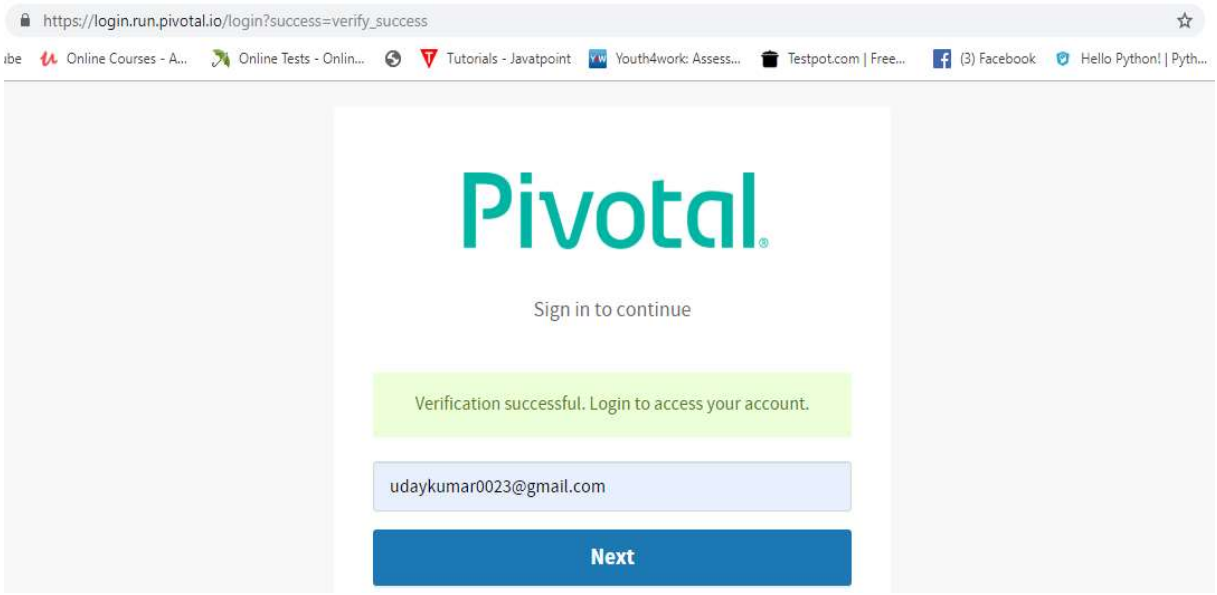
Step#2: Enter details name, email, password and conform password Register



Step#3: Goto Email Account and verify PCF link

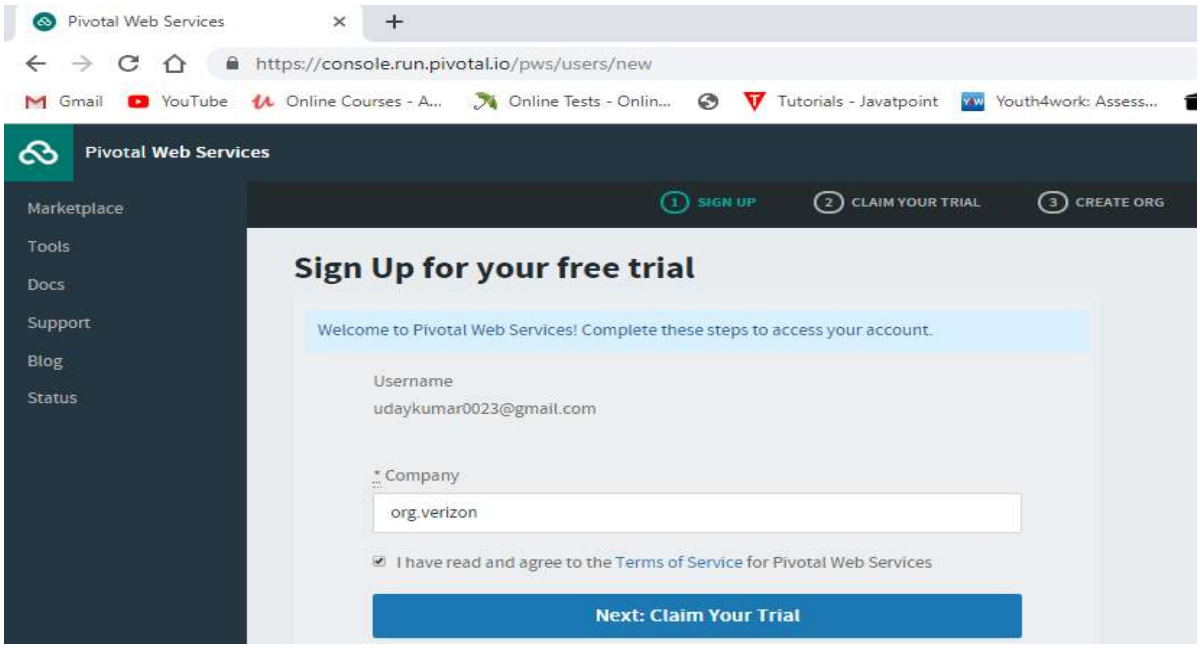


Step#4: Login to PCF account (Above URL)

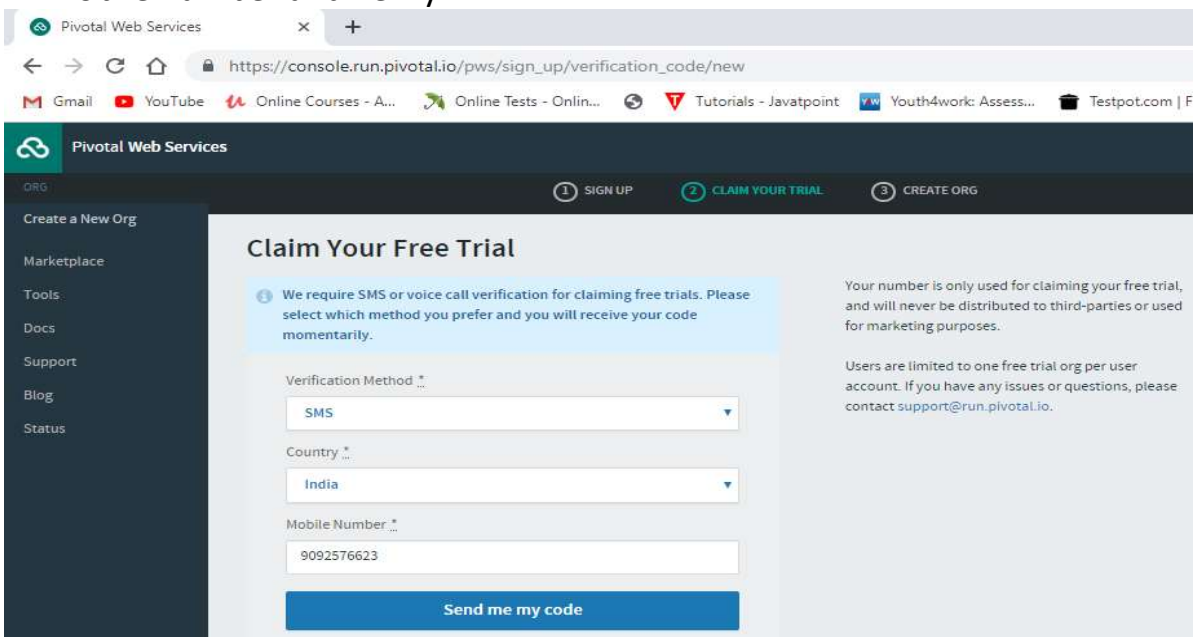


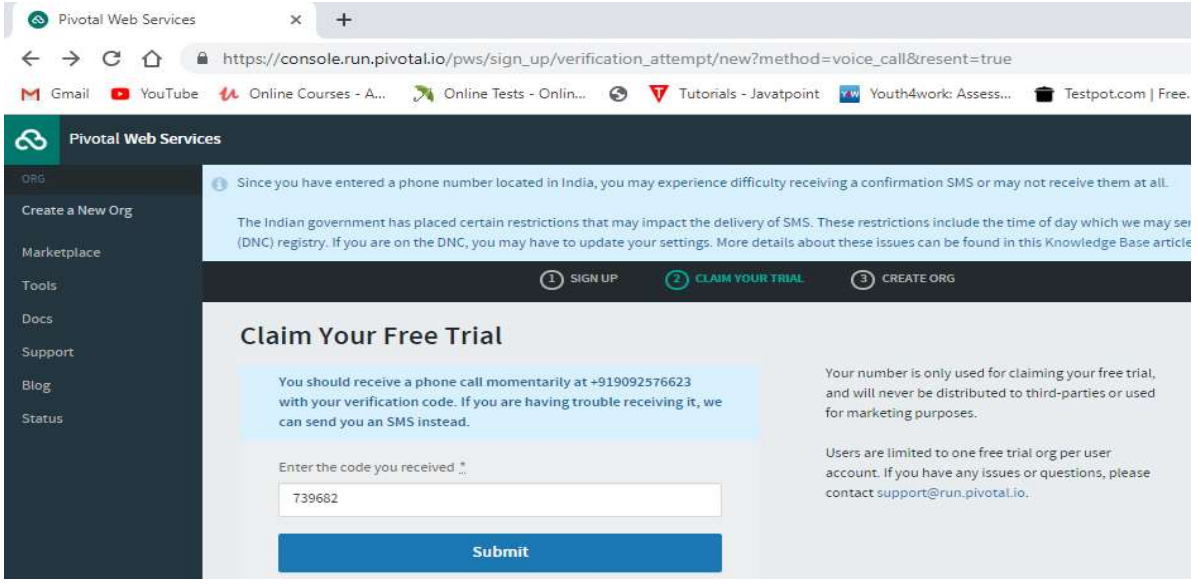
➔Click on pivotal web service

Step#5: Provide initial details like
➔Company name

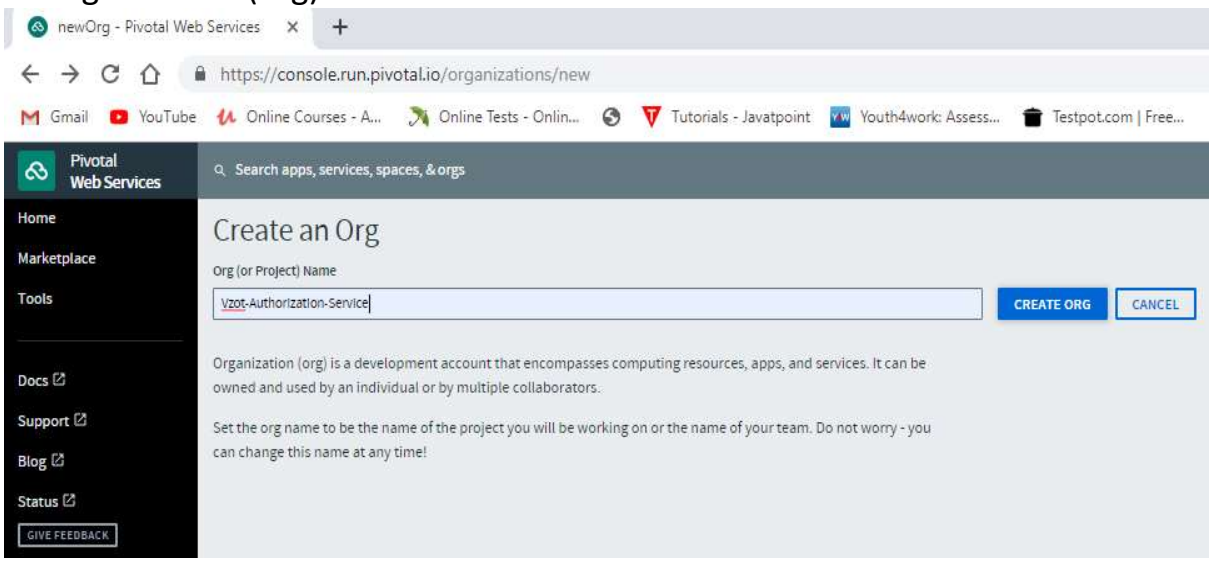


➔Mobile number and verify





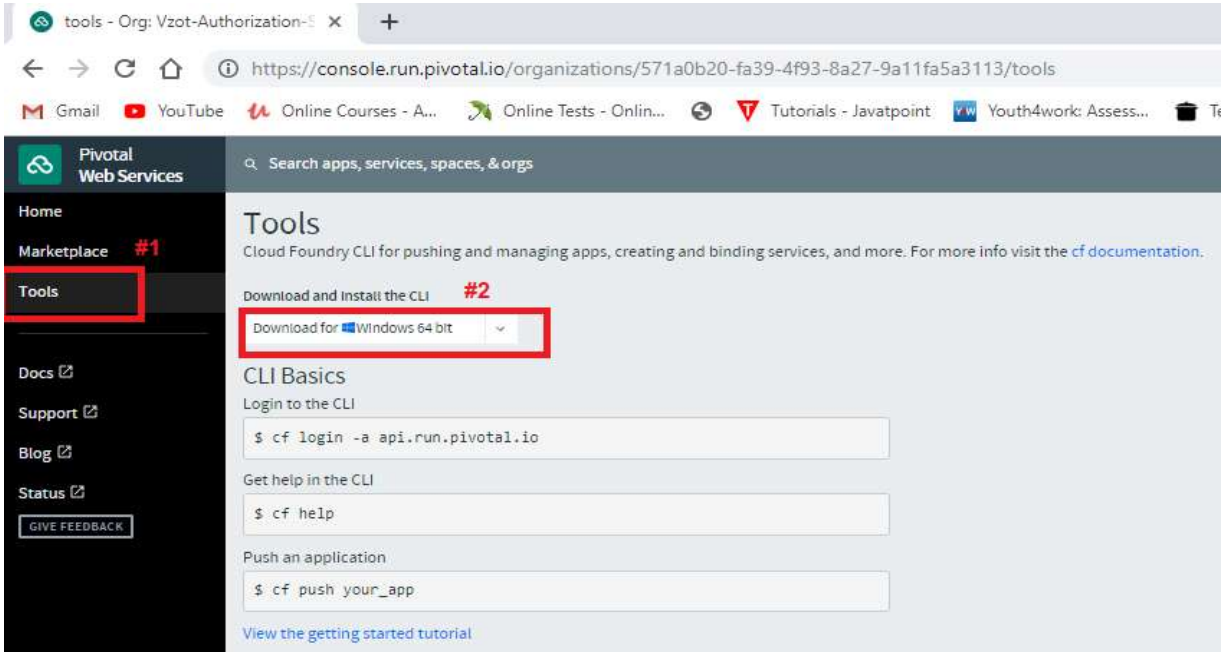
➔Organization (org) name > finish



Step#6: Download and setup PCF CLI

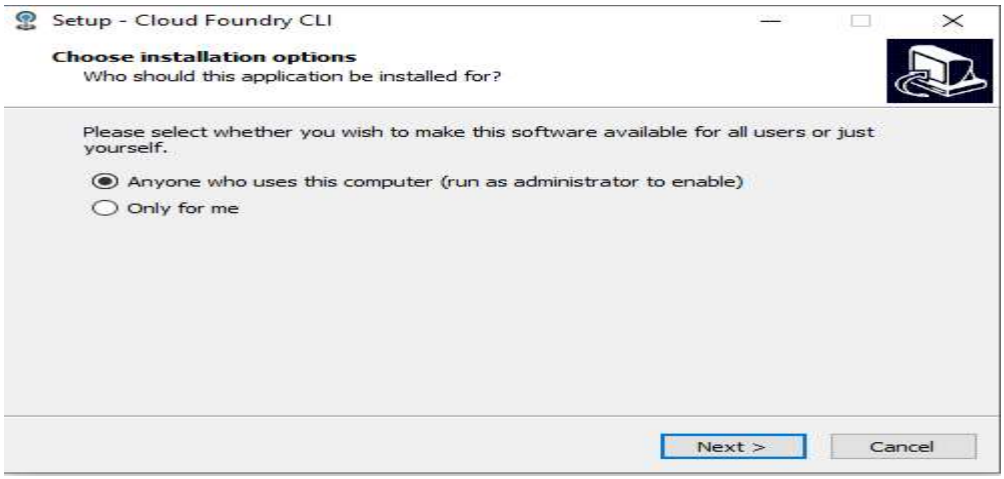
->Click on “Tools” option

->Choose OS and Bit and Download Software

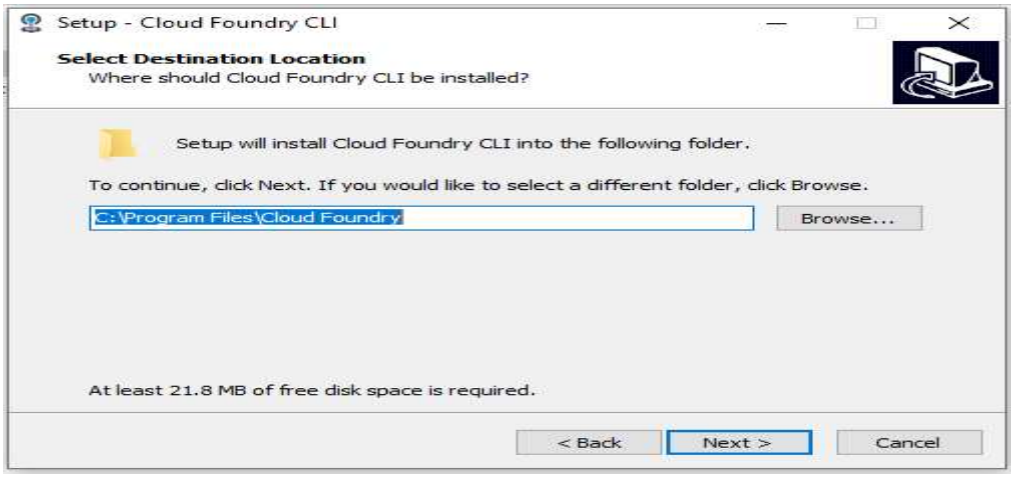


->Extract ZIP into Folder

->Click on “cf_installer.exe”.



➔next



➔next ➔next ➔Finish

Step#7: Login and Logout Commands

➔Goto cmd prompt

1.Login command is

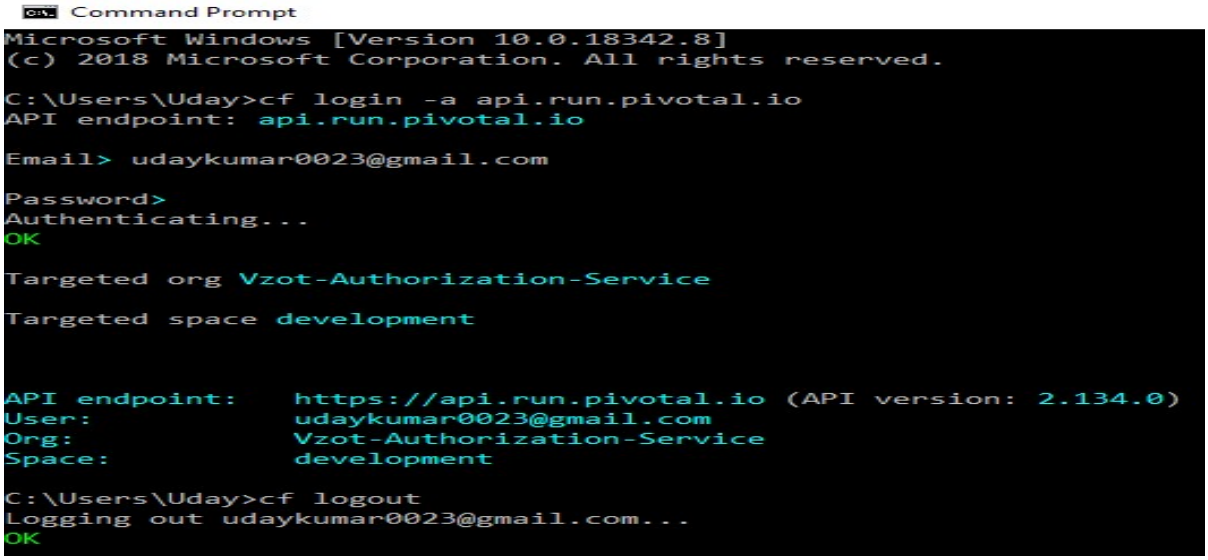
cf login –a api.run.pivotal.io

Email >

Password >

2.Logout command is

cf logout



TASK:
➔Spring Boot WEB MVC + Thymeleaf + Data JPA + H2 (Curd Operation) + Bootstrap

Step#8: Create Org and space in PCF
➔Login to PCF using browser
➔Click on home ➔ Click on create button
➔Enter org name **ex:** sample-org
➔finish

*** An org “sample-org” is created with default space (workspace) “development” is created.
=>A space (workspace) is a folder or location where project is stored and running.

Step#9: Create one Spring Boot Starter Project in STS.
➔File ➔ new ➔ Spring Starter Project
➔Enter Details ➔ choose Dependencies (Ex: web)
➔Finish

Step#10: Write Code for RestController, Services, Dao, and properties/yml files etc.

Step#11: Clean Application
➔Right click ➔ Run As ➔ Maven Clean
…Wait for status BUILD SUCCESS..
➔This step will clear all old folders and files which are in “project-name/target” folder.

Step#12: Do setup of JDK in workspace
>Windows > Preferences
>search with “Installed JRE”
>Click on “Add” > browse for location
Ex: “C:\Program Files\Java\jdk1.8.0_201”
>Choose new and delete old JRE
>Apply and close

Step#13: Update JRE to Project
=>Right click on Project > build path
=>Configure build path > Choose JRE System Lib.
=>Edit > select workspace JRE/JDK
=>Apply and close.

Step#14: Install Application (build project)
=>Right click > Run As > Maven install
..wait for few minutes, still BUILD SUCCESS..

**(If failed, then Update Maven Project, select force Update and finish.
Repeat step#11, 13 and then 14)

Step#14: Refresh Project to see updates in "target" folder.
=>Right click on Project > refresh (F5)
.. then ..
=>Right click on target folder
=>Properties (or Alt+Enter)
=>click on "Show In System Explorer"
=>Open target folder > find --.jar file
(Ex: SpringBootSampleApp-1.0.jar)

Step#16: Open command and login to PCF from here
=>shift + mouse right click
=>choose "open cmd window here"
=>Login to PCF
cmd/>cf login –a api.run.pivotal.io
Enter Email Id and password
=>Push Application to created org & space
cmd/>cf push [PROJECT-NAME] –p [JARNAME].jar
Ex:- cf push sathyatech –p SpringBootSampleApp-1.0.jar
.. wait for 5 minutes to upload project..

Step#17: Once success then go to PCF WebConsole (browser) and click on space "development"
To see total apps and running app.
=>Click on Route (URL) to execute app
=>Enter Paths to URL ex: /home/show …

Step#18: Logout PCF from cmd prompt
cmd/> cf logout

*** BUILD FAIL at CLEAN
Then Force Update maven Project
➔Project ➔ alt + F5 ➔ choose Force update
➔Apply and close [Finish]

*** BUILD FAIL at INSTALL
Then update JDK new version, in place of JRE

*** showing Cached Errors
=>Goto .m2 folder and delete that folder

=>come back to project > force update project

TASK:

=>Create Project with MySQL DB with CURD operations and upload to PCF
=>Go to Market place and chose mysql provider enter details
Instance name : myappsql
Choose or/space:
>choose plan > finish
=>Come to Home >Click on org > space > service
=>click on MySQl services > Bind App
=>select Our Project > bind > re-start app
=>Enter URL in browser and execute.