INTRODUCTION TO SPRING BOOT & CLOUD FOUNDRY

Home of All the Laws of Nature

Spring Boot

- Stand-alone, production-grade applications

  Ready to run.

- "Opinionated" view of the Spring platform & 3rd party libraries Minimizes manual Spring configuration.

- Don't need to concerned with every aspect of its lifecycle including deployment and management.

- Spring Boot Definition

Spring Boot

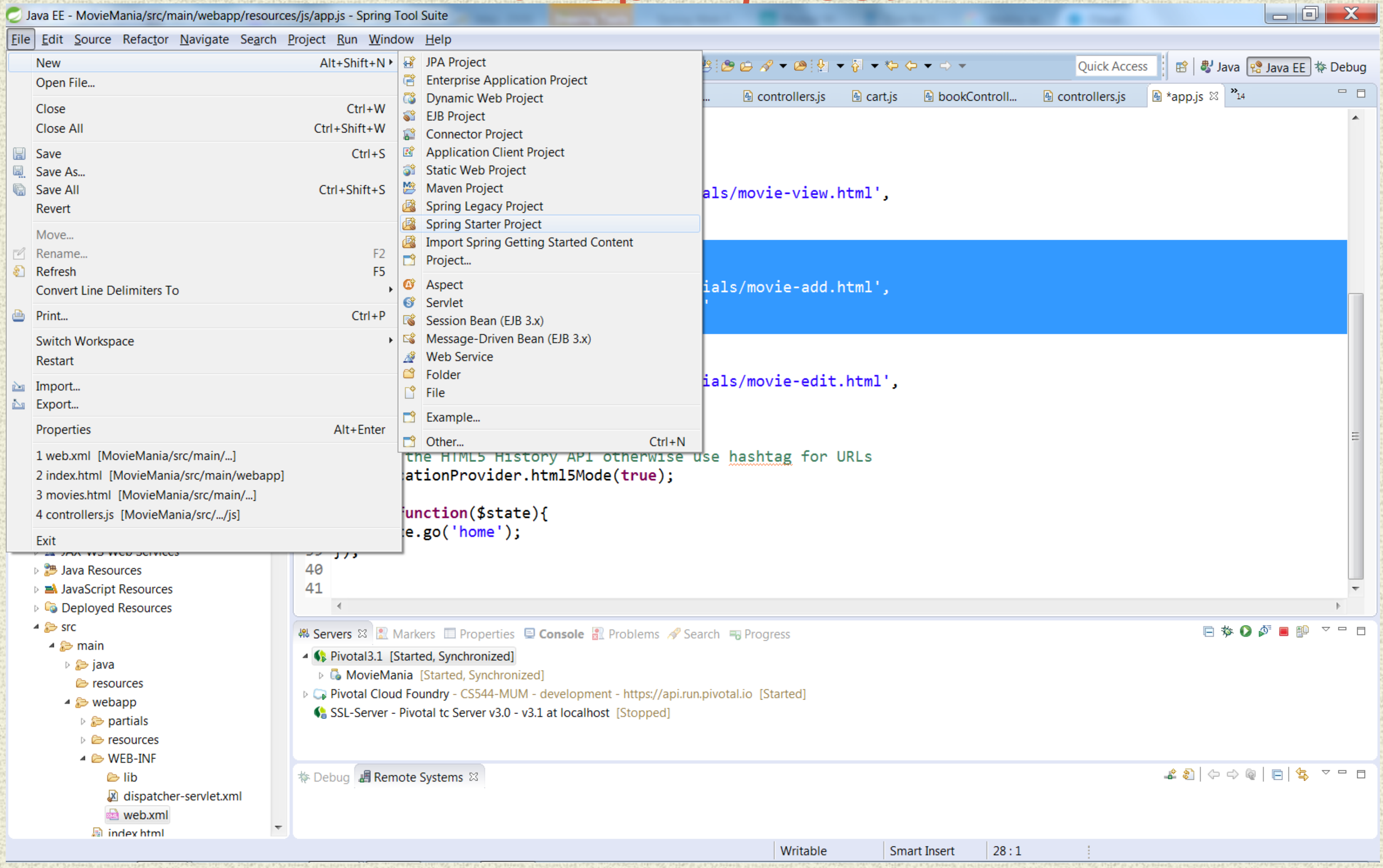
- "Menu-based" creation of stand-alone, production-grade Apps
- Spring Boot applications need very little Spring configuration.

- Pre-configured POM files to assist your initial project configuration.
- Essentially eliminates all other configuration work and has no requirements for XML
- Support for security, metrics, and health checks - production-ready apps
- Dev-Ops friendly - developers focus on business features not on infrastructure.

  - ***Assists in decomposing monolithic services into distributed microservices***
  - ***Designed to make microservices a resource-conscious, developer-focused process***.

- Spring Boot Reference
- Spring Boot Application Properties
- Spring Boot Developer Tools

HelloSpringThyme with Spring Boot



```
als/movie-view.html',

ials/movie-add.html',
'

ials/movie-edit.html',

the HTML5 History API otherwise use hashtag for URLs
ationProvider.html5Mode(true);

unction($state){
e.go('home');
});
```

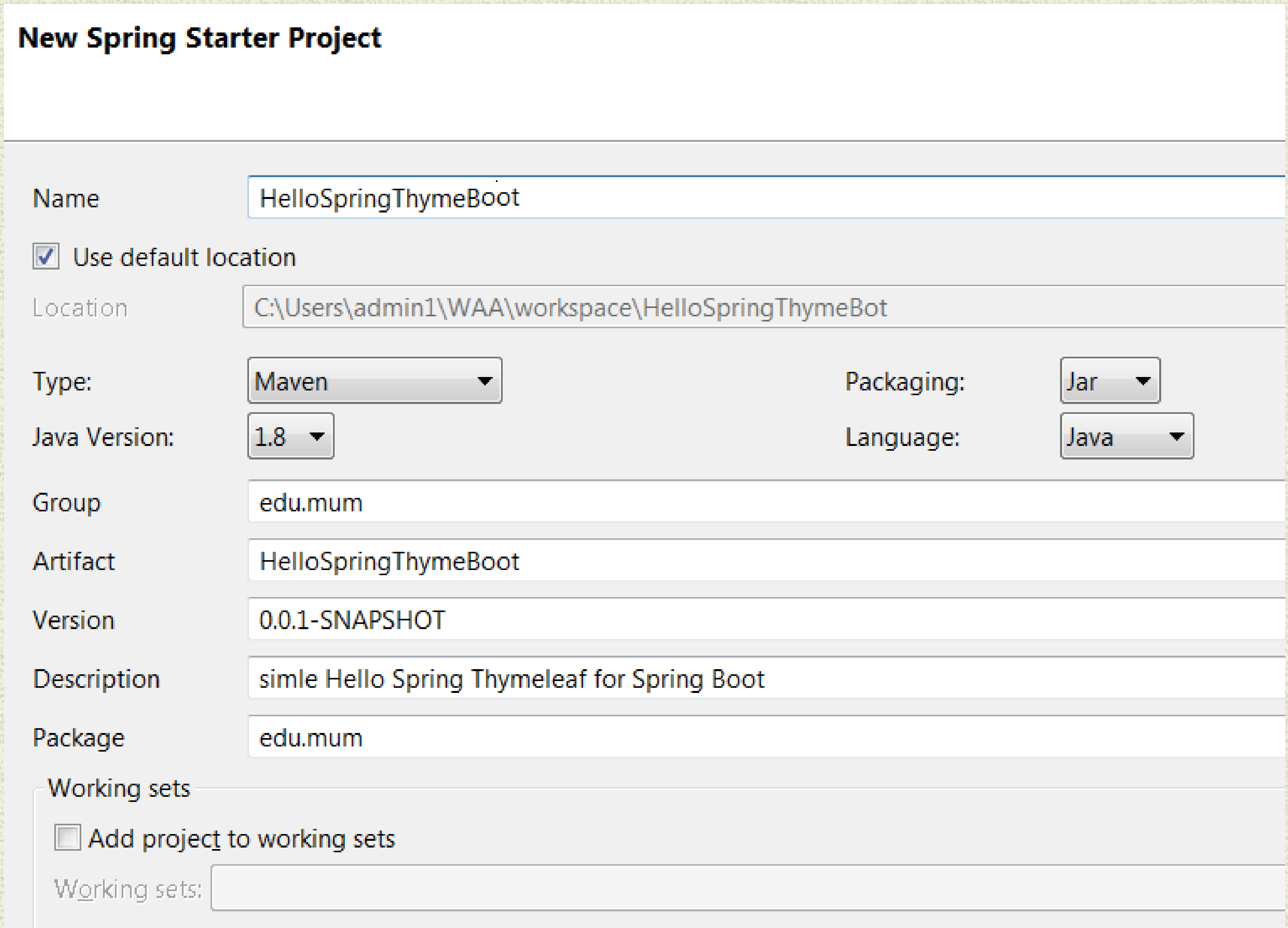
Pivotal3.1 [Started, Synchronized]

MovieMania [Started, Synchronized]

Pivotal Cloud Foundry - CS544-MUM - development - https://api.run.pivotal.io [Started]

SSL-Server - Pivotal tc Server v3.0 - v3.1 at localhost [Stopped]

Writable | Smart Insert | 28 : 1



New Spring Starter Project

Name: HelloSpringThymeBoot

☑ Use default location

Location: C:\Users\admin1\WAA\workspace\HelloSpringThymeBot

Type: Maven

Packaging: Jar

Java Version: 1.8

Language: Java

Group: edu.mum

Artifact: HelloSpringThymeBoot

Version: 0.0.1-SNAPSHOT

Description: simle Hello Spring Thymeleaf for Spring Boot

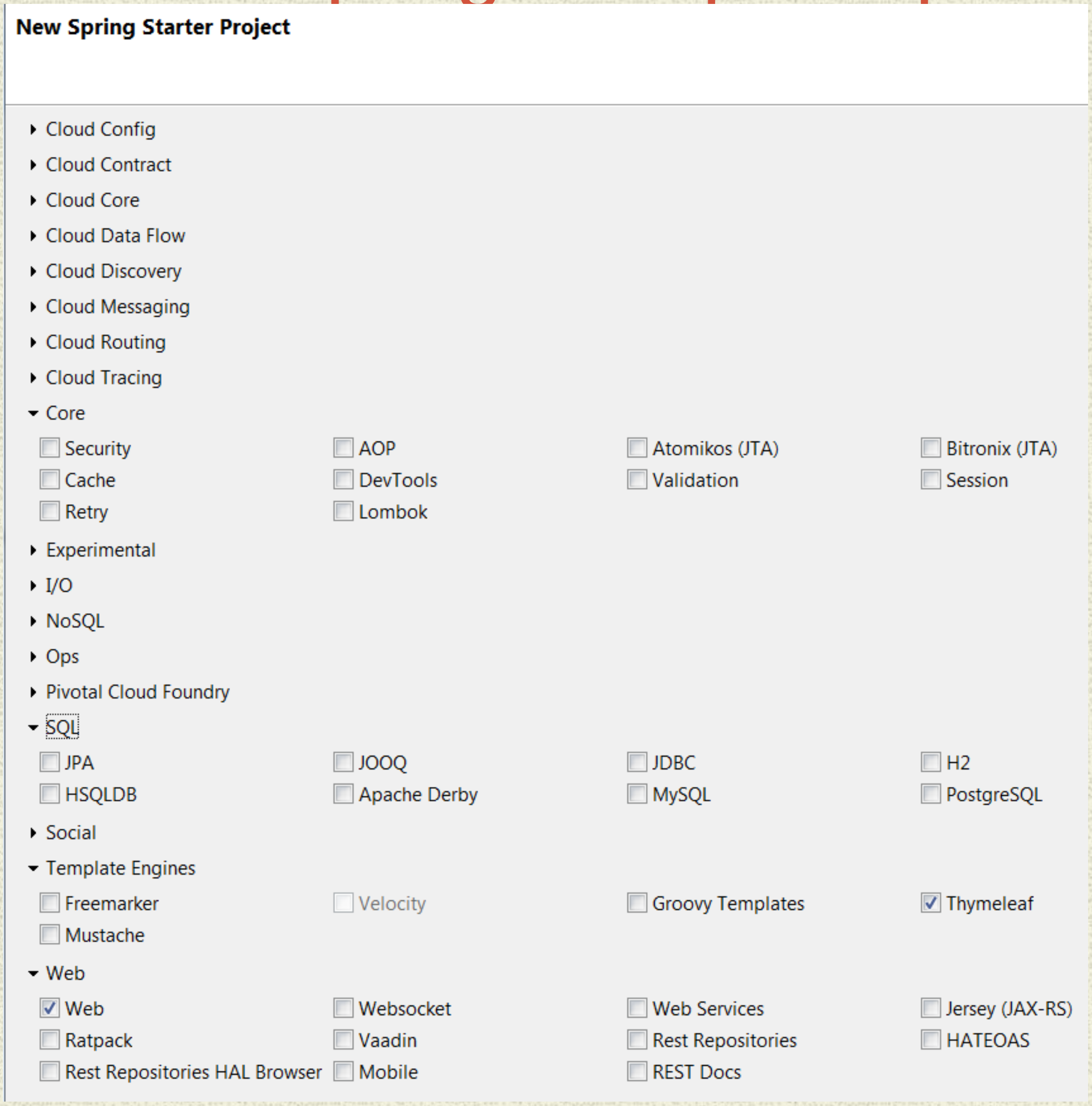
Package: edu.mum

Working sets

☐ Add project to working sets

Working sets:

HelloSpringThyme with Spring Boot [Cont.]



New Spring Starter Project

- ▸ Cloud Config
- ▸ Cloud Contract
- ▸ Cloud Core
- ▸ Cloud Data Flow
- ▸ Cloud Discovery
- ▸ Cloud Messaging
- ▸ Cloud Routing
- ▸ Cloud Tracing
- ▾ Core

□ Security　□ AOP　□ Atomikos (JTA)　□ Bitronix (JTA)
□ Cache　□ DevTools　□ Validation　□ Session
□ Retry　□ Lombok

- ▸ Experimental
- ▸ I/O
- ▸ NoSQL
- ▸ Ops
- ▸ Pivotal Cloud Foundry
- ▾ SQL

□ JPA　□ JOOQ　□ JDBC　□ H2
□ HSQLDB　□ Apache Derby　□ MySQL　□ PostgreSQL

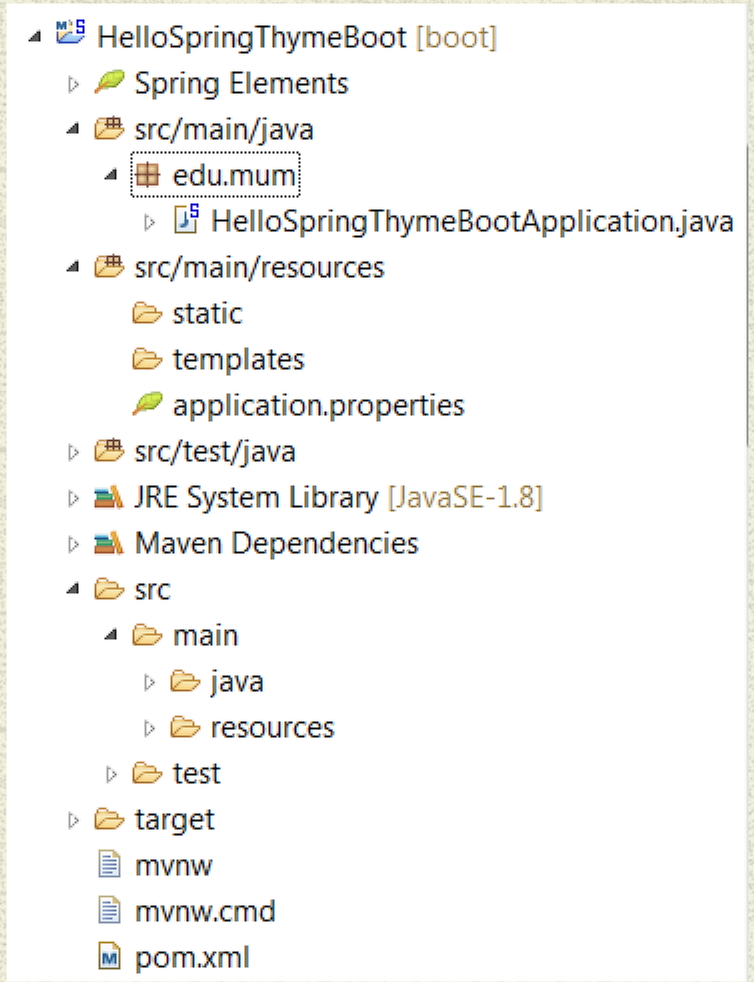
- ▸ Social
- ▾ Template Engines

□ Freemarker　□ Velocity　□ Groovy Templates　☑ Thymeleaf
□ Mustache

- ▾ Web

☑ Web　□ Websocket　□ Web Services　□ Jersey (JAX-RS)
□ Ratpack　□ Vaadin　□ Rest Repositories　□ HATEOAS
□ Rest Repositories HAL Browser　□ Mobile　□ REST Docs

HelloSpringThyme
with Spring Boot Project layout



```
HelloSpringThymeBoot [boot]
  Spring Elements
  src/main/java
    edu.mum
      HelloSpringThymeBootApplication.java
  src/main/resources
    static
    templates
    application.properties
  src/test/java
  JRE System Library [JavaSE-1.8]
  Maven Dependencies
  src
    main
      java
      resources
    test
  target
  mvnw
  mvnw.cmd
  pom.xml
```

Application Start

- The @SpringBootApplication annotation is equivalent to using @Configuration, **@EnableAutoConfiguration** and @ComponentScan with their default attributes

- It is on “main” method in ROOT package…

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

- @SpringBootApplication also for customization of the attributes of @EnableAutoConfiguration and @ComponentScan.

@AutoConfiguration

- Guess and configure beans that you are likely to need.
- Auto-configuration classes are usually applied based on your classpath and what beans you have defined.
- Auto-configuration tries to be as intelligent as possible and will back-away as you define more of your own configuration.

Spring Boot JSPs

- Spring Boot has limitations in JSP support.
- It should work if you use **war** packaging [Spring Boot JSP limitations]
- **A jar will not work because of a hard coded file pattern in Tomcat.*****
- **For WAR:**
- **ADDED:**

```
<dependency>
   <groupId>javax.servlet</groupId>
   <artifactId>jstl</artifactId>
</dependency>
```

- **REMOVED: multiple SLF4J bindings conflict when deployed to Cloud**

```
<dependency>
   <groupId>org.springframework.boot</groupId>
   <artifactId>spring-boot-starter-log4j</artifactId>
</dependency>
```

*** Spring Boot Jar version is possible although NOT documented

Spring Boot JSPs [Cont.]

Or define in application.properties

```
 @Bean
    InternalResourceViewResolver internalResourceViewResolver () {
        InternalResourceViewResolver viewResolver = new
                                 InternalResourceViewResolver();
        viewResolver.setPrefix("/WEB-INF/views/");
        viewResolver.setSuffix(".jsp");

        return viewResolver;
    }

public class ServletInitializer extends SpringBootServletInitializer {

@Override
protected SpringApplicationBuilder
           configure(SpringApplicationBuilder application) {
                return application.sources(HelloSpringBootApplication.class);
}
```

See Demo HelloSpringBoot [WAR]

Spring Boot JSP Jar with embedded Tomcat

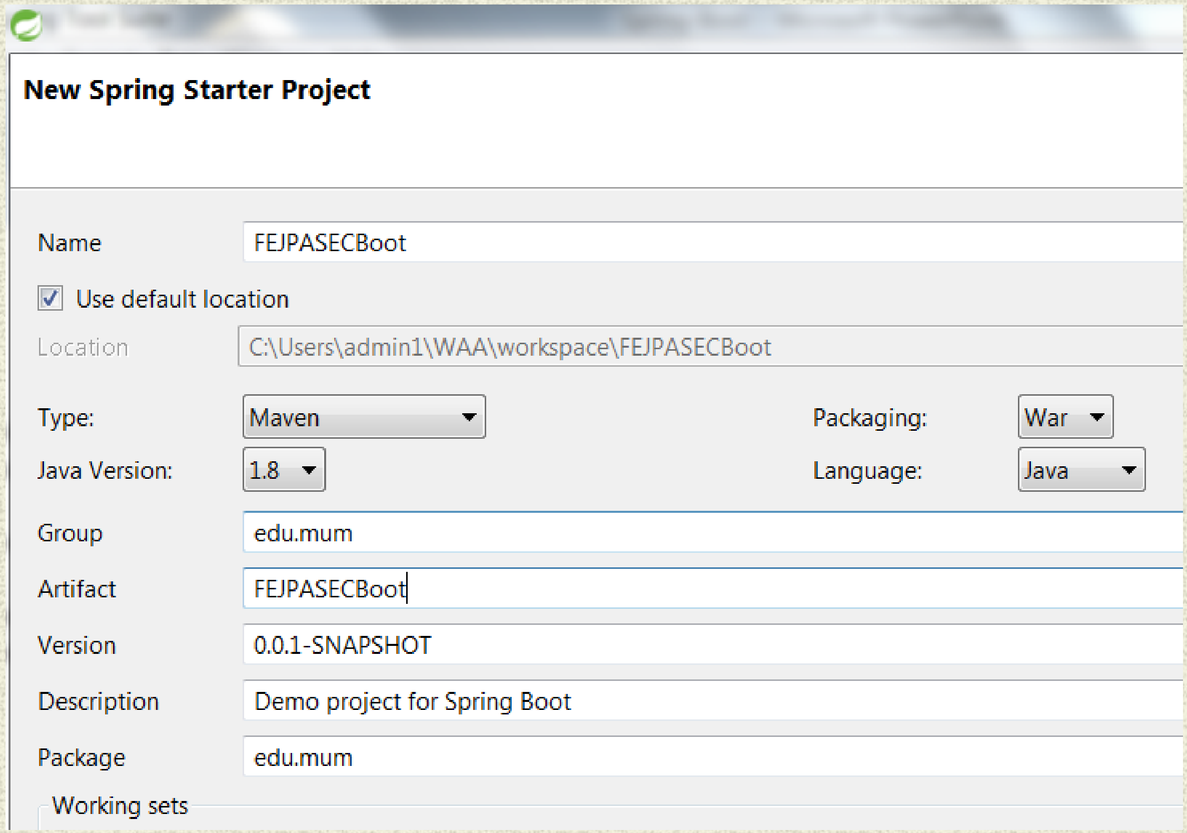
Provides support for .jsp file compilation/rendering.

```
<dependency>
        <groupId>org.apache.tomcat.embed</groupId>
        <artifactId>tomcat-embed-jasper</artifactId>
        <scope>provided</scope>
 </dependency>
```

NOTE: Does not run when deployed to Cloud

See Demo HelloSpringBootJar

“Robust” Spring Boot Project



New Spring Starter Project

Name: FEJPASECBoot

☑ Use default location

Location: C:\Users\admin1\WAA\workspace\FEJPASECBoot

Type: Maven

Packaging: War

Java Version: 1.8

Language: Java

Group: edu.mum

Artifact: FEJPASECBoot

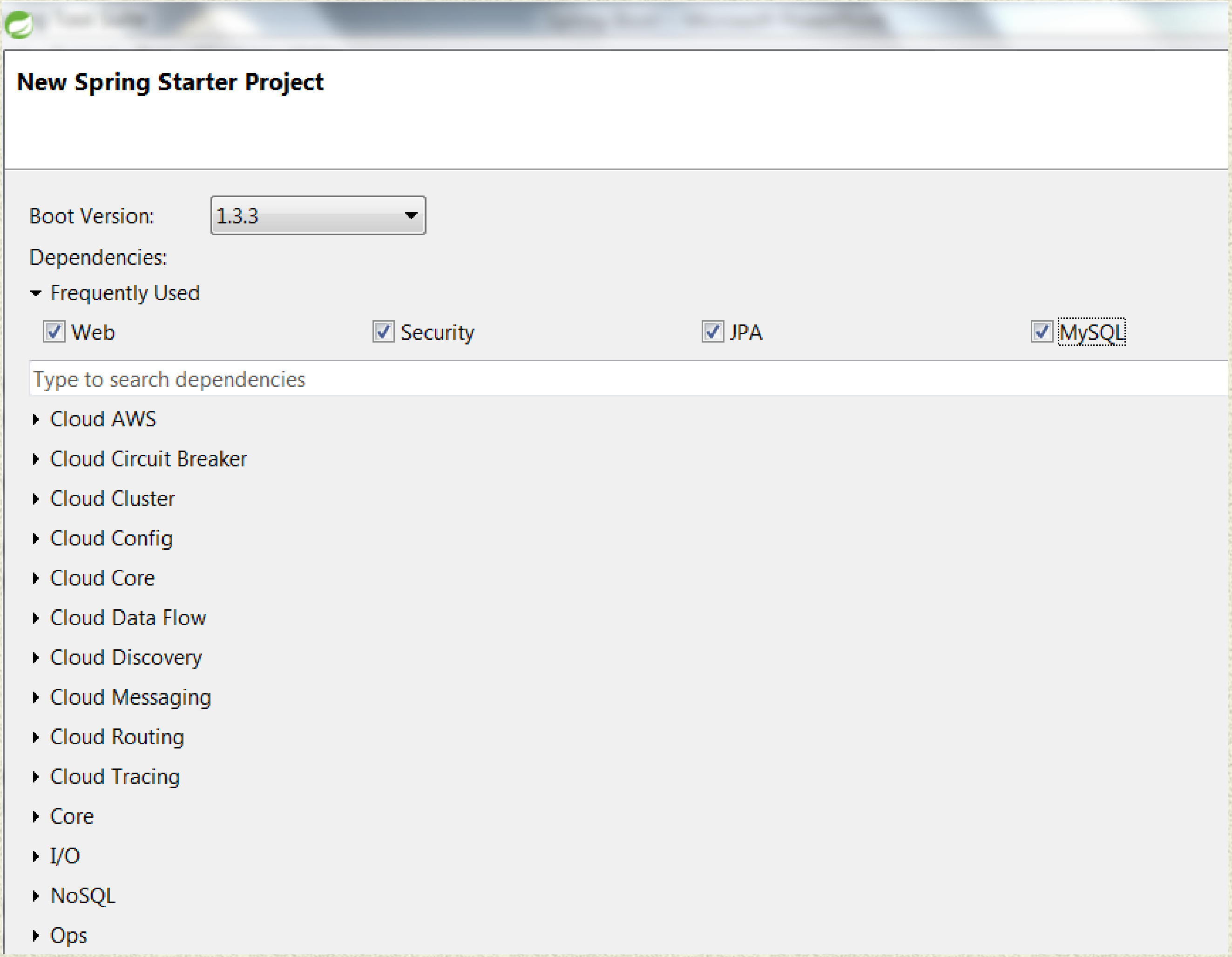
Version: 0.0.1-SNAPSHOT

Description: Demo project for Spring Boot

Package: edu.mum

Working sets

“Robust” Spring Boot Project [Cont.]



New Spring Starter Project

Boot Version: 1.3.3

Dependencies:

▾ Frequently Used

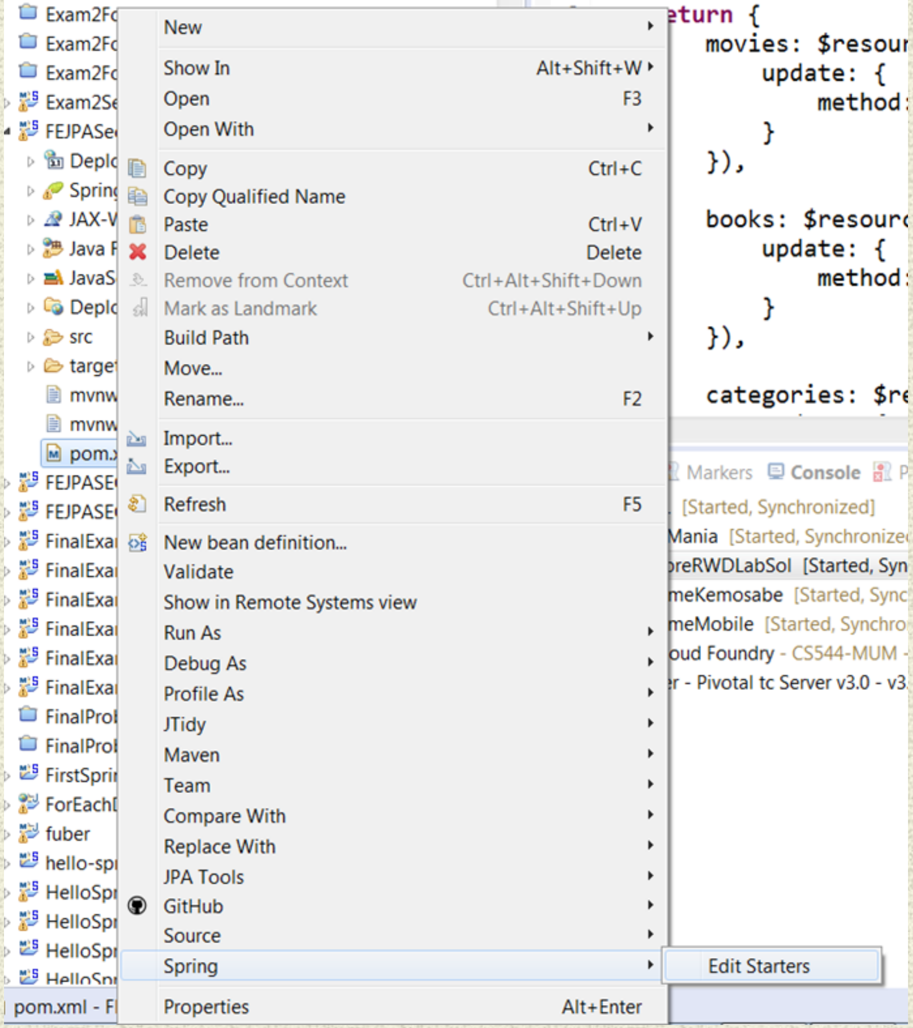
☑ Web ☑ Security ☑ JPA ☑ MySQL

Type to search dependencies

- ▸ Cloud AWS
- ▸ Cloud Circuit Breaker
- ▸ Cloud Cluster
- ▸ Cloud Config
- ▸ Cloud Core
- ▸ Cloud Data Flow
- ▸ Cloud Discovery
- ▸ Cloud Messaging
- ▸ Cloud Routing
- ▸ Cloud Tracing
- ▸ Core
- ▸ I/O
- ▸ NoSQL
- ▸ Ops

Edit an Existing Boot Project

- The *Edit Starters* wizard is accessible by right-clicking a Maven project's pom.xml, from menu *Spring >> Edit Starters*.



```
eturn {
  movies: $resour
     update: {
        method:
     }
  }),

  books: $resourc
     update: {
        method:
     }
  }),

  categories: $re
```

Main Point

Spring Boot simplifies dependency management AND application configuration by adhering to a set of rules that apply to all applications.

Adhering to the fundamental Laws of Nature allows life to be lived simply and easily.

Cloud Migration Strategies

Lift-and-shift [Rehosting]

Reduction of cost and improved performance and resiliency.

applications are easier to optimize/re-architect once they’re already running in the cloud.

Replatforming [“lift-tinker-and-shift.”]

Database-as-a-service

Embedded Tomcat

Refactoring / Re-architecting

AKA use cloud-native features AKA use microservices

driven by a strong business need – use case

most expensive, but, if you have a good product-market fit

The Cloud

- Very broad concept
- covers just about every possible sort of online service
- USUALLY refers to

Software as a Service (SaaS)

3rd party software [SalesForce, DropBox, etc.]

Platform as a Service (PaaS)

Platform on which software is developed/deployed.

Infrastructure as a Service (IaaS).

Automated and scalable computing resources, cloud storage and networks. Client control over infrastructure

Cloud Deployment Types [W/R to Application Servers]

Containerless

Package the application, with all its dependencies, into a single “fat” JAR file - can include an embedded framework with optional third-party libraries that will be compatible.

{Spring Boot w/Embedded Tomcat}

Container

Package a **container [e.g** Java EE,Tomcat **]** and its service implementation in a Container [Linux - Docker,Heruku]. Layered, cached dependencies; Linux type/version agnostic **{Spring Boot w/WAR file}**

Cloud Foundry
A multi-cloud Approach

Cloud Foundry is an application PaaS, and let's you concentrate on your application and its associated services instead of the infrastructure itself.

Can be built on a range of cloud providers. [AWS, Microsoft Azure, Google Cloud Platform]

- Single platform for application development.
- Removes grunt work of running the infrastructure
- No infrastructure platform lock in.
- Easily move applications from one cloud to another (or use multiple clouds simultaneously)
- Open Source Foundation [70+ members] includes Microsoft, Google, IBM
-

Cloud Foundry, Pivotal Cloud Foundry Pivotal Web Services

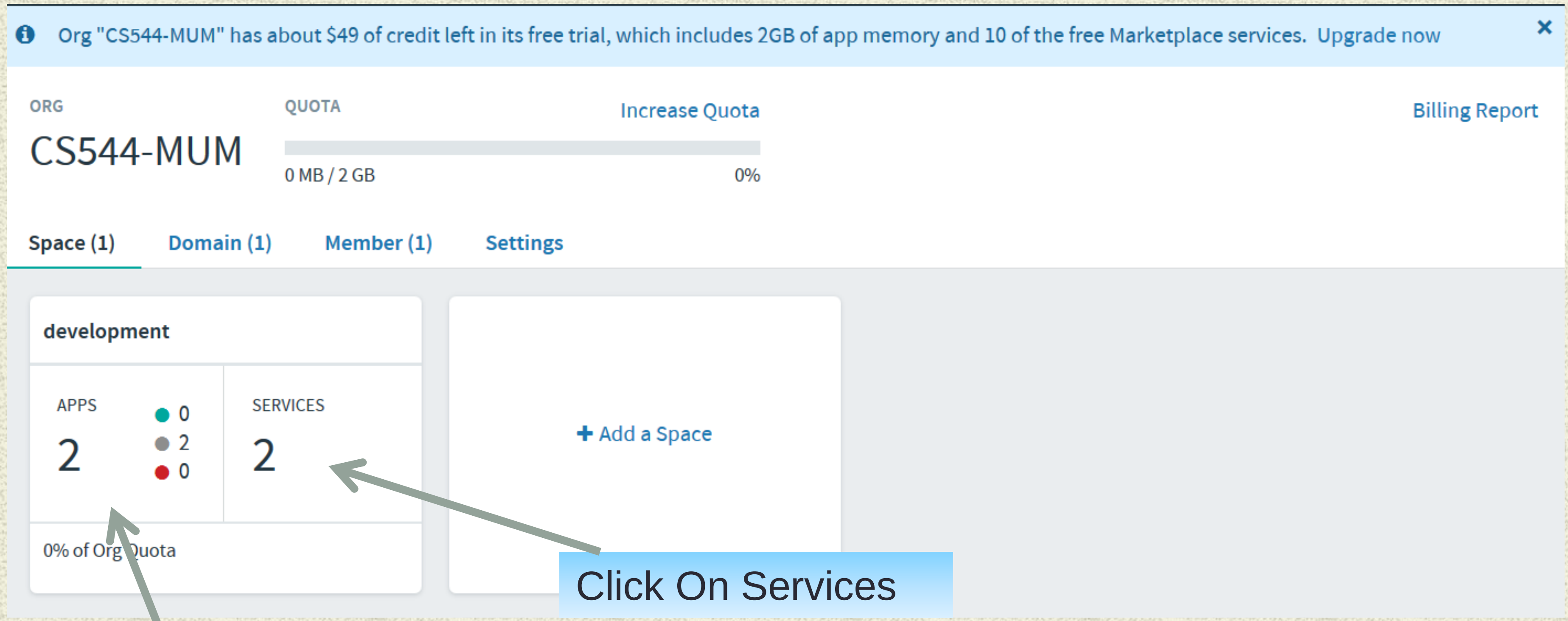
- **DEFINITIONS:**
- **Cloud Foundry** open source software is the community maintained , community supported software and tools required to run Cloud Foundry on your own infrastructure.
- https://cloudfoundry.org

- **Pivotal Cloud Foundry** is a Pivotal branded installation of Cloud Foundry on your own infrastructure (AWS, VMware, OpenStack, Azure, etc) which has enterprise grade support. It also offers an array of services like MySQL,, RabbitMQ, etc. that can leverage their cloudfoundry installation and have applications that use these services. Pivotal Cloud Foundry

- **Pivotal Web Services** is a Pivotal's hosted Cloudfoundry for people and companies who want to develop cloudfoundry applications but don't want to operate and manage their own infrastructure and Cloud Foundry installation. ***Deployed on AWS***
- https://run.pivotal.io
-

Cloud Foundry

- Pivotal Web Services Home
- LOGIN…



Org "CS544-MUM" has about $49 of credit left in its free trial, which includes 2GB of app memory and 10 of the free Marketplace services. Upgrade now

ORG

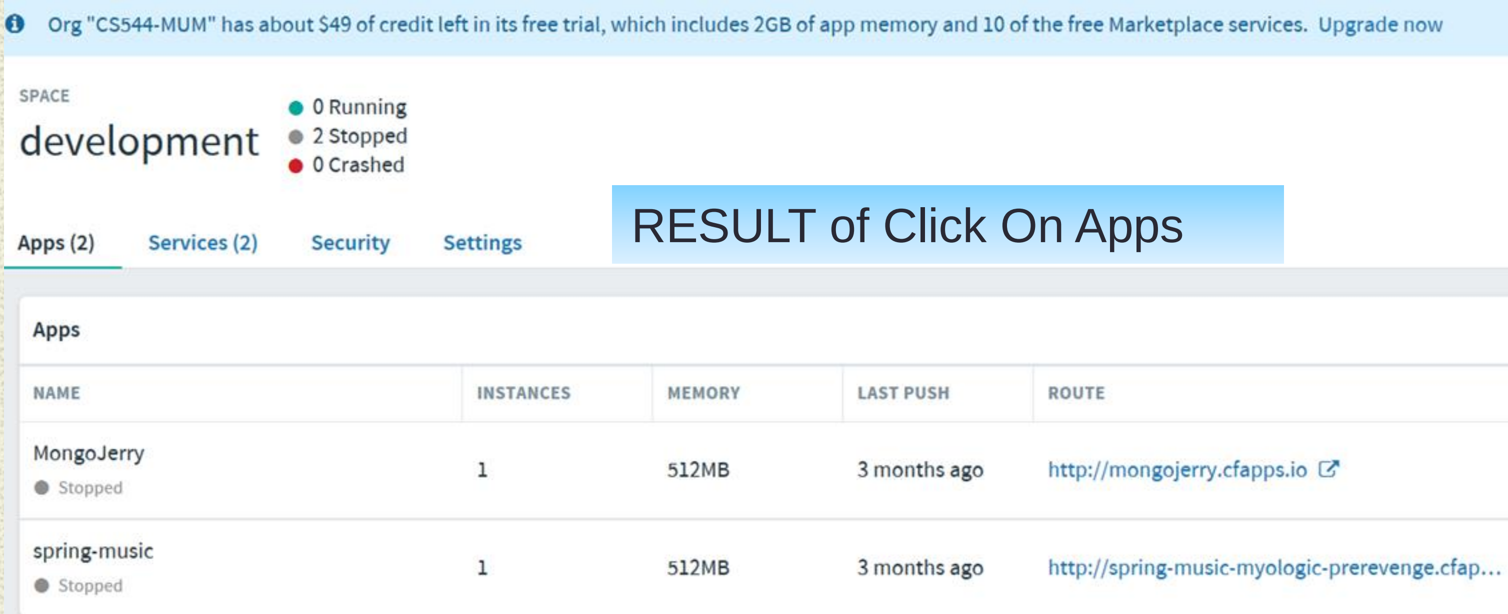
CS544-MUM

QUOTA

0 MB / 2 GB 0%

Click On Services

Click On Apps



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SPACE

development

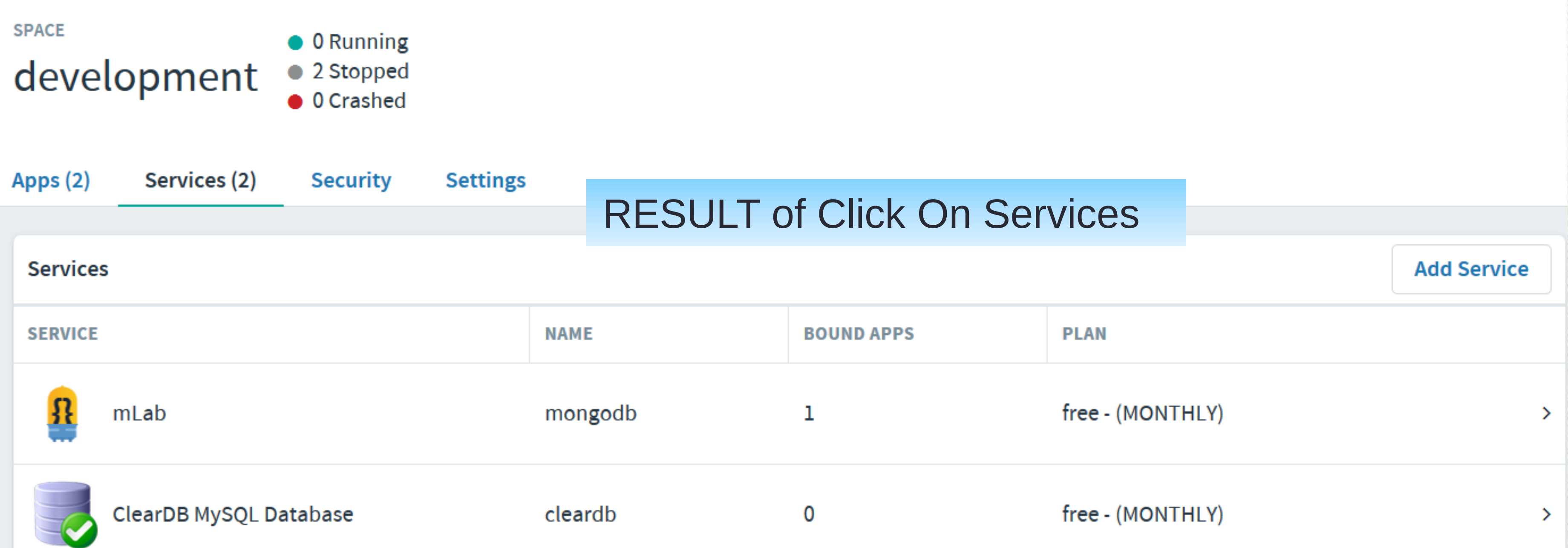
● 0 Running
● 2 Stopped
● 0 Crashed

Apps (2) | Services (2) | Security | Settings

RESULT of Click On Apps

Apps

NAME	INSTANCES	MEMORY	LAST PUSH	ROUTE
MongoJerry ● Stopped	1	512MB	3 months ago	http://mongojerry.cfapps.io
spring-music ● Stopped	1	512MB	3 months ago	http://spring-music-myologic-prerevenge.cfap…



SPACE

development

● 0 Running
● 2 Stopped
● 0 Crashed

Apps (2) | Services (2) | Security | Settings

RESULT of Click On Services

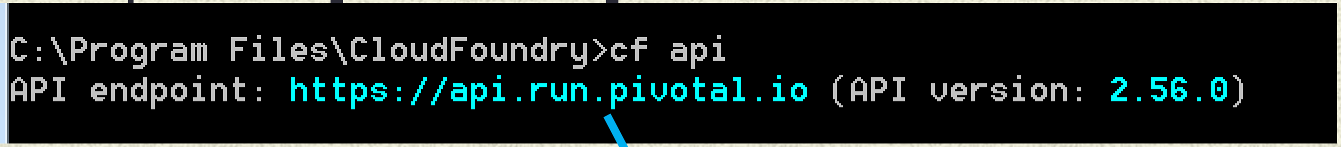
Services

Add Service

SERVICE	NAME	BOUND APPS	PLAN
mLab	mongodb	1	free - (MONTHLY)
ClearDB MySQL Database	cleardb	0	free - (MONTHLY)

Cloud Foundry Command Line

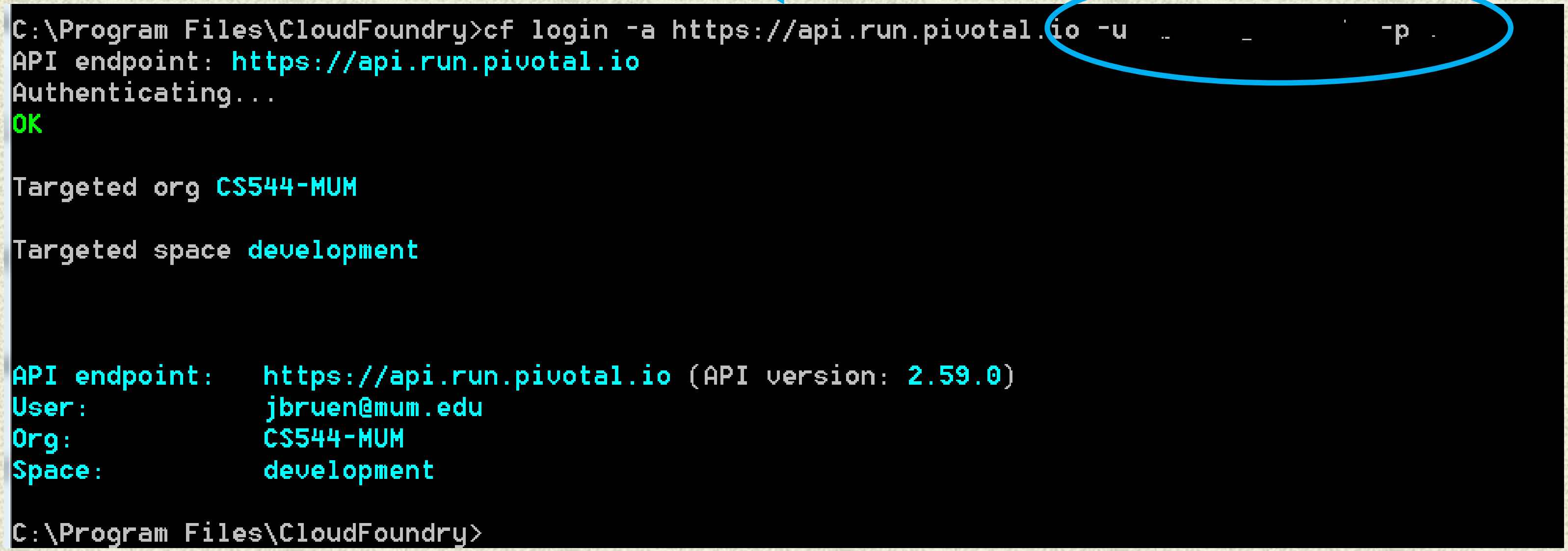
- Cloud Foundry Command Line Interface
- Get endpoint…[version #]



```
C:\Program Files\CloudFoundry>cf api
API endpoint: https://api.run.pivotal.io (API version: 2.56.0)
```

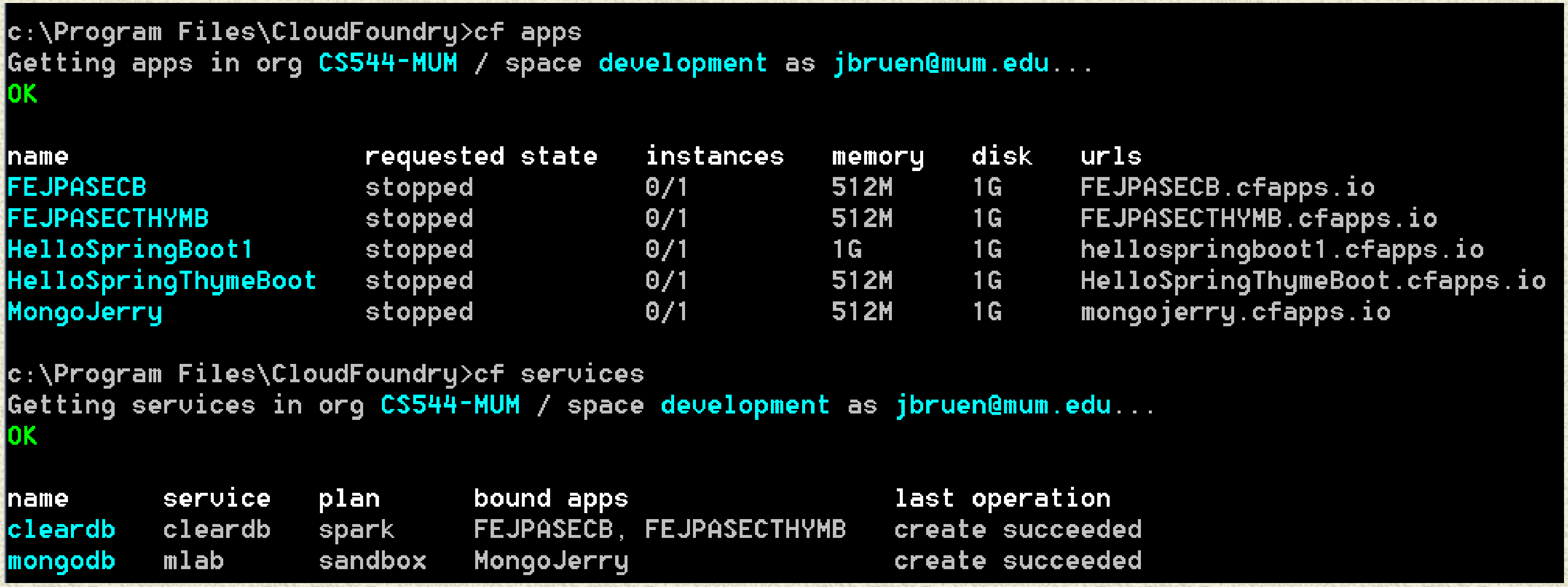
- Login [for endpoint]:

User Name - Password



```
C:\Program Files\CloudFoundry>cf login -a https://api.run.pivotal.io -u [redacted] -p [redacted]
API endpoint: https://api.run.pivotal.io
Authenticating...
OK

Targeted org CS544-MUM

Targeted space development



API endpoint:   https://api.run.pivotal.io (API version: 2.59.0)
User:           jbruen@mum.edu
Org:            CS544-MUM
Space:          development

C:\Program Files\CloudFoundry>
```

View Apps & Services

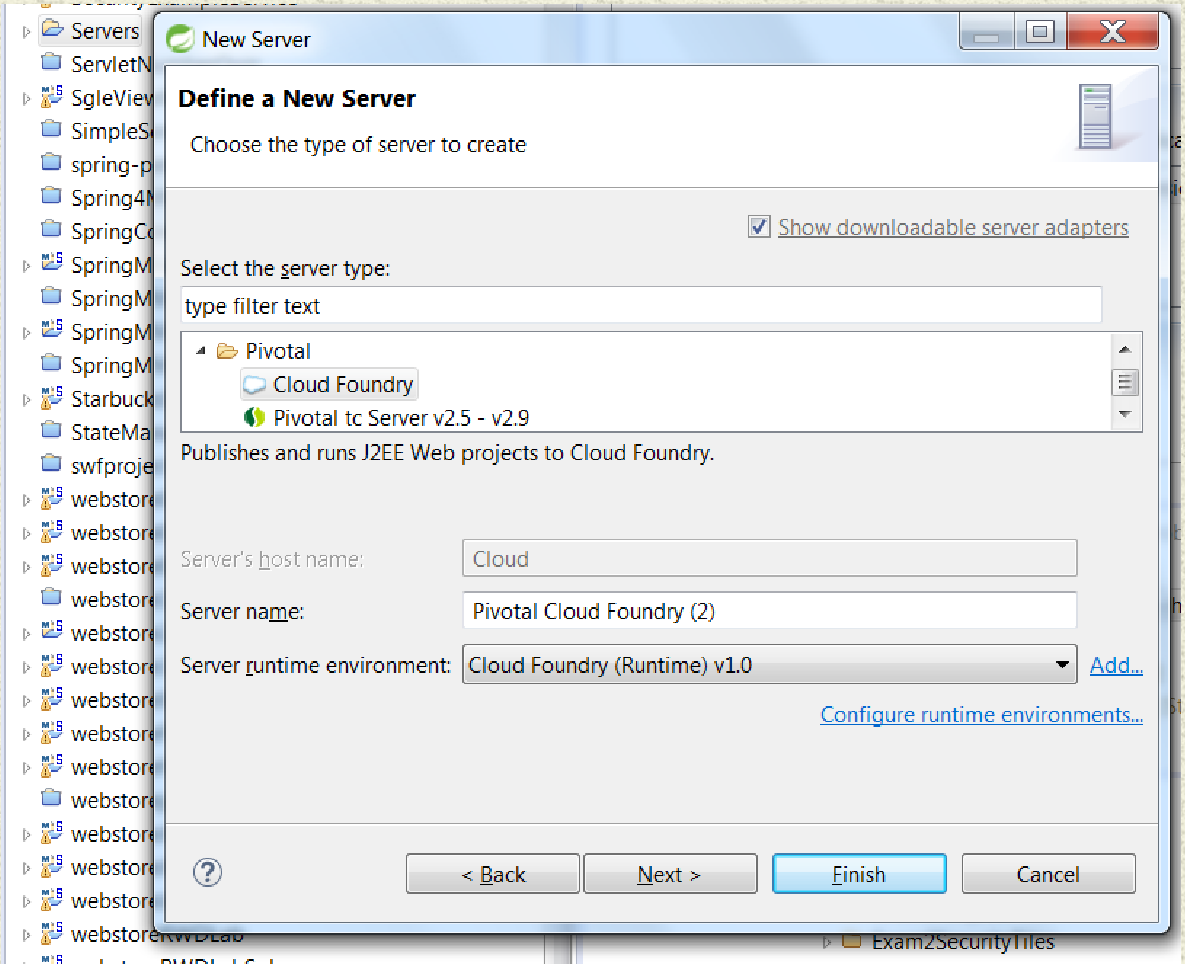


```
c:\Program Files\CloudFoundry>cf apps
Getting apps in org CS544-MUM / space development as jbruen@mum.edu...
OK

name                   requested state   instances   memory   disk   urls
FEJPASECB              stopped           0/1         512M     1G     FEJPASECB.cfapps.io
FEJPASECTHYMB          stopped           0/1         512M     1G     FEJPASECTHYMB.cfapps.io
HelloSpringBoot1       stopped           0/1         1G       1G     hellospringboot1.cfapps.io
HelloSpringThymeBoot   stopped           0/1         512M     1G     HelloSpringThymeBoot.cfapps.io
MongoJerry             stopped           0/1         512M     1G     mongojerry.cfapps.io

c:\Program Files\CloudFoundry>cf services
Getting services in org CS544-MUM / space development as jbruen@mum.edu...
OK

name      service   plan      bound apps                 last operation
cleardb   cleardb   spark     FEJPASECB, FEJPASECTHYMB   create succeeded
mongodb   mlab      sandbox   MongoJerry                 create succeeded
```

Using Eclipse Plugin

- [Cloud Foundry Eclipse Plugin]()
- Start new server right click servers [project explorer]

  new >> other >> servers >> server …Pivotal >> Cloud Foundry



Define a New Server

Choose the type of server to create

☑ Show downloadable server adapters

Select the server type:

type filter text

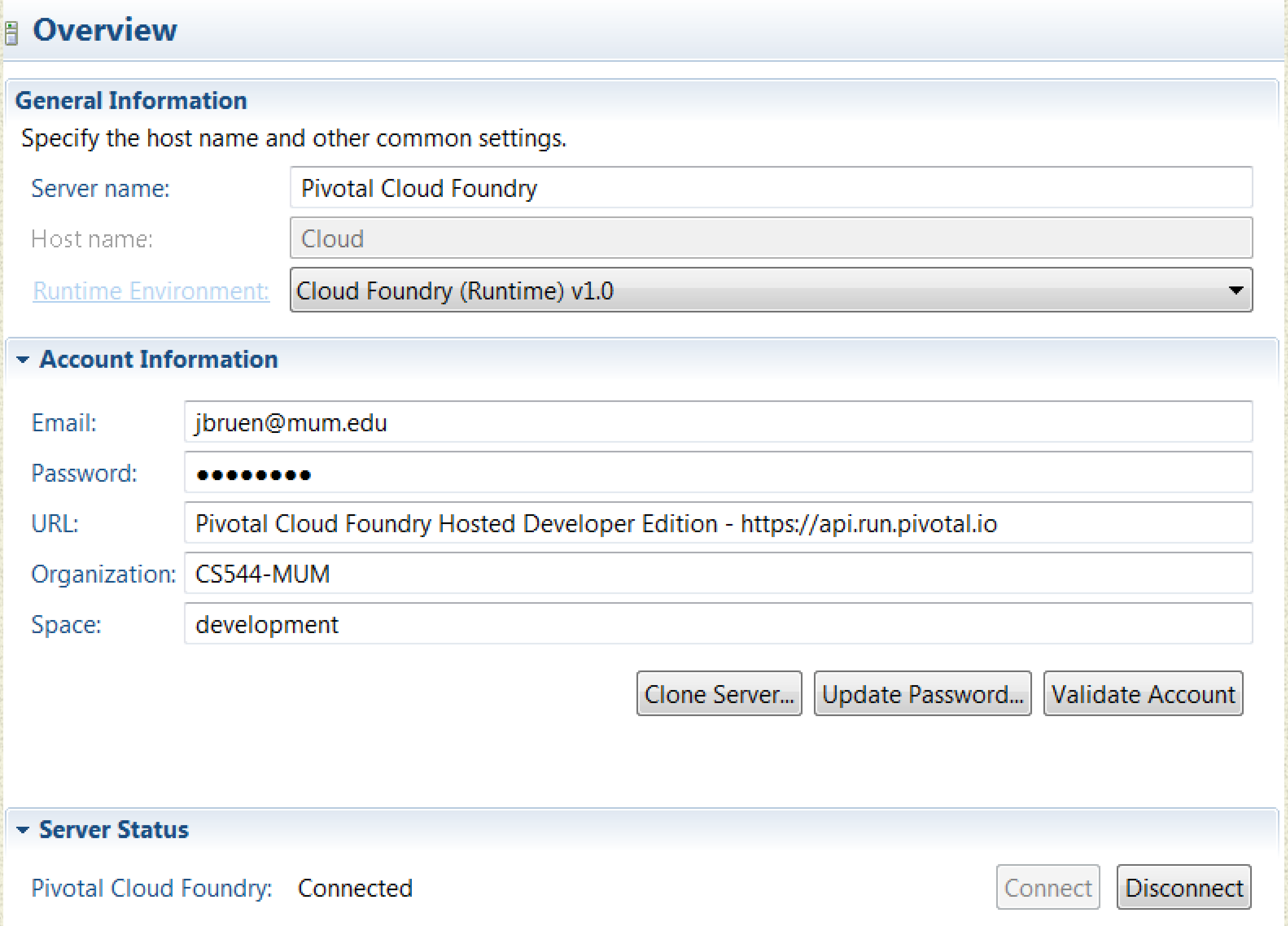
- Pivotal
  - Cloud Foundry
  - Pivotal tc Server v2.5 - v2.9

Publishes and runs J2EE Web projects to Cloud Foundry.

Server's host name: Cloud

Server name: Pivotal Cloud Foundry (2)

Server runtime environment: Cloud Foundry (Runtime) v1.0



Overview

General Information

Specify the host name and other common settings.

Server name: Pivotal Cloud Foundry

Host name: Cloud

Runtime Environment: Cloud Foundry (Runtime) v1.0

Account Information

Email: jbruen@mum.edu

Password: •••••••••

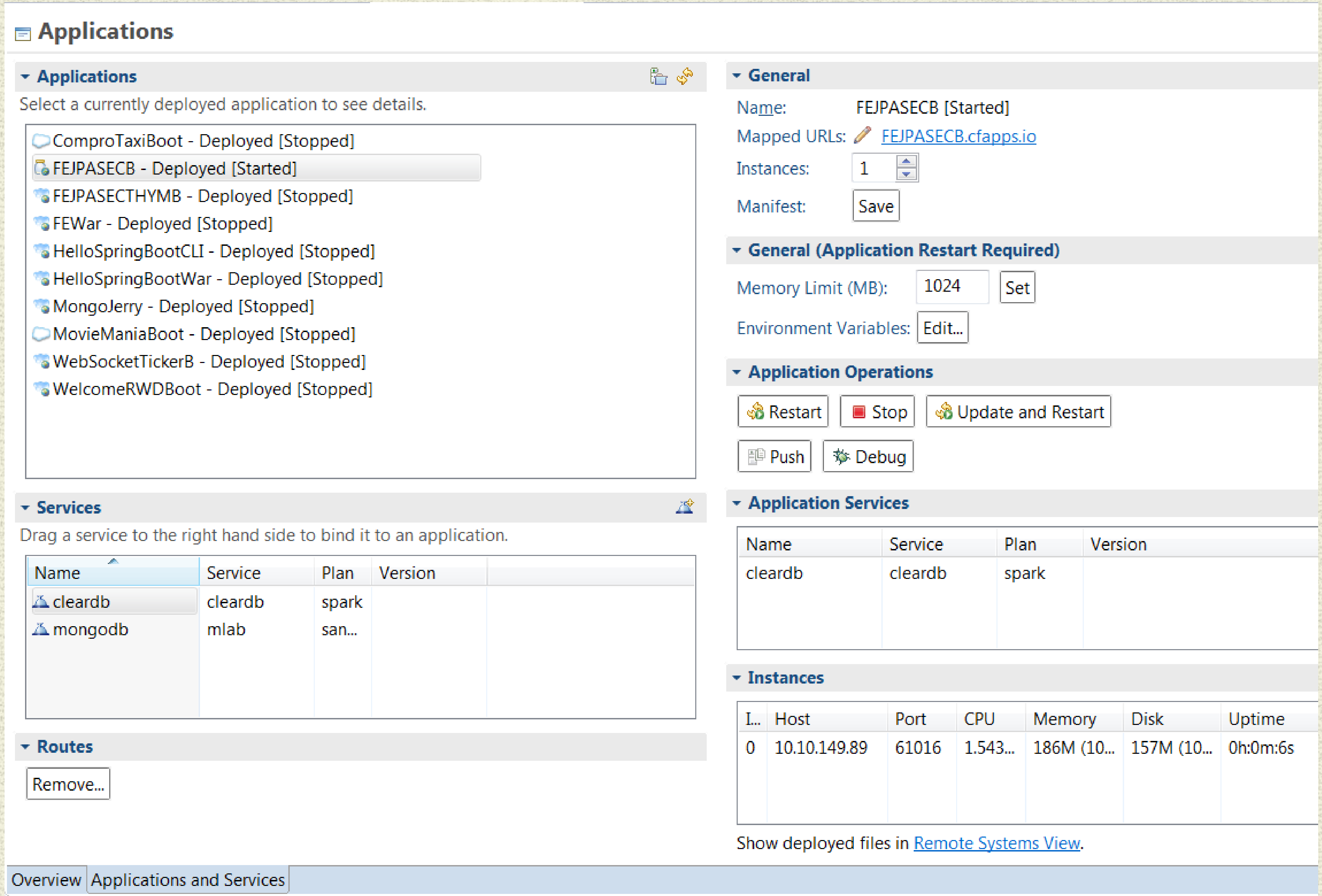
URL: Pivotal Cloud Foundry Hosted Developer Edition - https://api.run.pivotal.io

Organization: CS544-MUM

Space: development

Server Status

Pivotal Cloud Foundry: Connected



Applications

Applications

Select a currently deployed application to see details.

- ComproTaxiBoot - Deployed [Stopped]
- FEJPASECB - Deployed [Started]
- FEJPASECTHYMB - Deployed [Stopped]
- FEWar - Deployed [Stopped]
- HelloSpringBootCLI - Deployed [Stopped]
- HelloSpringBootWar - Deployed [Stopped]
- MongoJerry - Deployed [Stopped]
- MovieManiaBoot - Deployed [Stopped]
- WebSocketTickerB - Deployed [Stopped]
- WelcomeRWDBoot - Deployed [Stopped]

Services

Drag a service to the right hand side to bind it to an application.

Name	Service	Plan	Version
cleardb	cleardb	spark	
mongodb	mlab	san...	

Routes

General

Name: FEJPASECB [Started]

Mapped URLs: FEJPASECB.cfapps.io

Instances: 1

Manifest:

General (Application Restart Required)

Memory Limit (MB): 1024

Environment Variables:

Application Operations

Application Services

Name	Service	Plan	Version
cleardb	cleardb	spark	

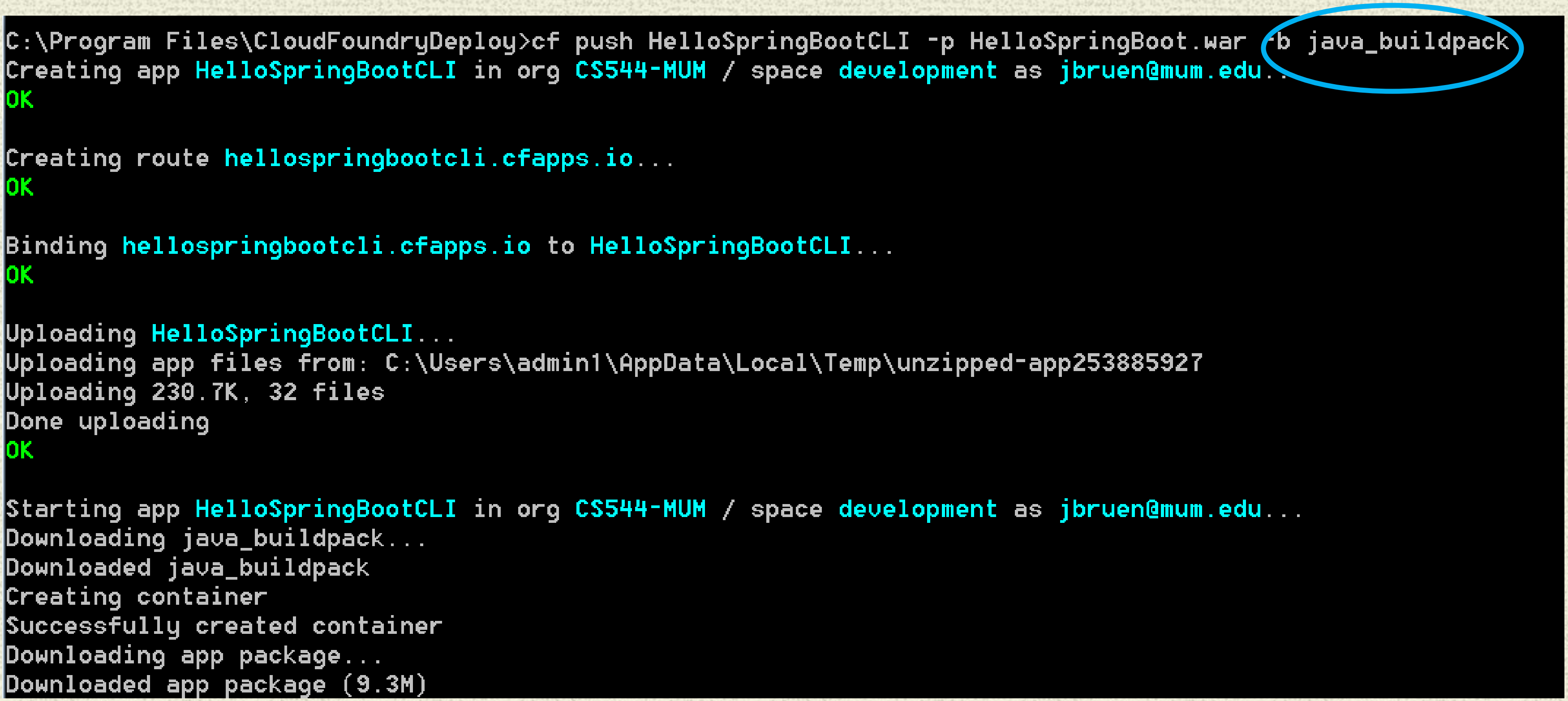
Instances

I...	Host	Port	CPU	Memory	Disk	Uptime
0	10.10.149.89	61016	1.543...	186M (10...	157M (10...	0h:0m:6s

Show deployed files in Remote Systems View.

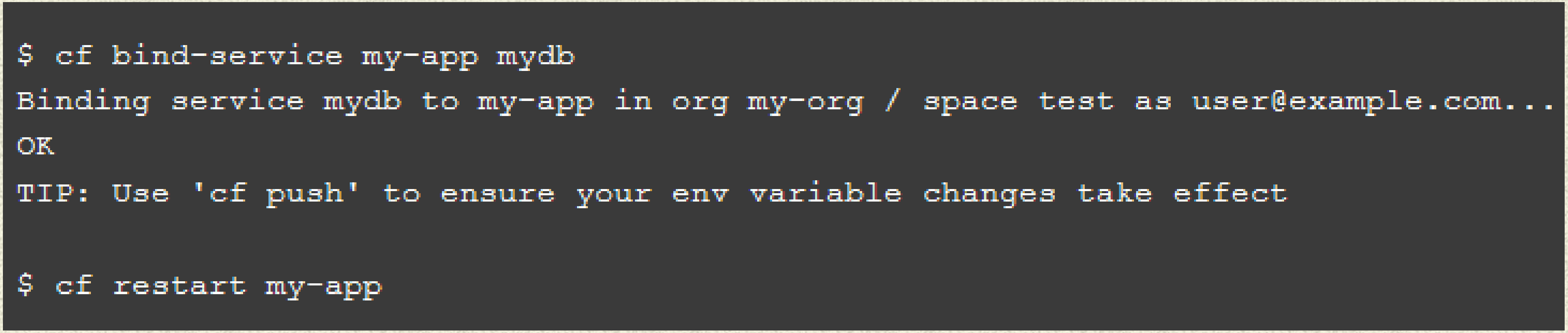
Deploy WAR to Cloud Foundry [CLI]

- Moved WAR to C:\Program Files/CloudFoundry
- Actual command used is:
- cf push “name to give app” –p [find by path] “path/war name”
- -b “build pack”   -- dependency & configuration management



```
C:\Program Files\CloudFoundryDeploy>cf push HelloSpringBootCLI -p HelloSpringBoot.war -b java_buildpack
Creating app HelloSpringBootCLI in org CS544-MUM / space development as jbruen@mum.edu...
OK

Creating route hellospringbootcli.cfapps.io...
OK

Binding hellospringbootcli.cfapps.io to HelloSpringBootCLI...
OK

Uploading HelloSpringBootCLI...
Uploading app files from: C:\Users\admin1\AppData\Local\Temp\unzipped-app253885927
Uploading 230.7K, 32 files
Done uploading
OK

Starting app HelloSpringBootCLI in org CS544-MUM / space development as jbruen@mum.edu...
Downloading java_buildpack...
Downloaded java_buildpack
Creating container
Successfully created container
Downloading app package...
Downloaded app package (9.3M)
```

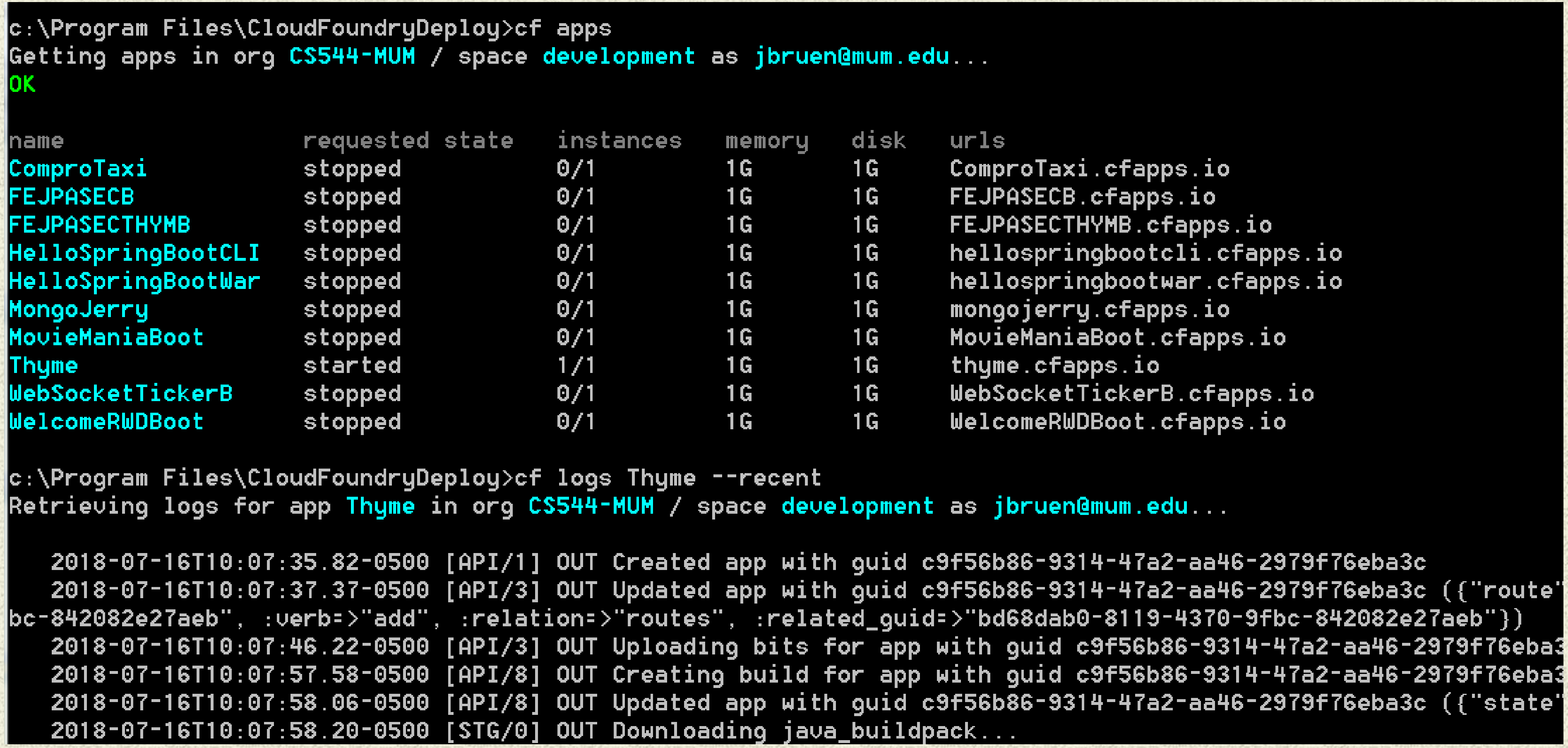
CLI Bind service to app



```
$ cf bind-service my-app mydb
Binding service mydb to my-app in org my-org / space test as user@example.com...
OK
TIP: Use 'cf push' to ensure your env variable changes take effect

$ cf restart my-app
```

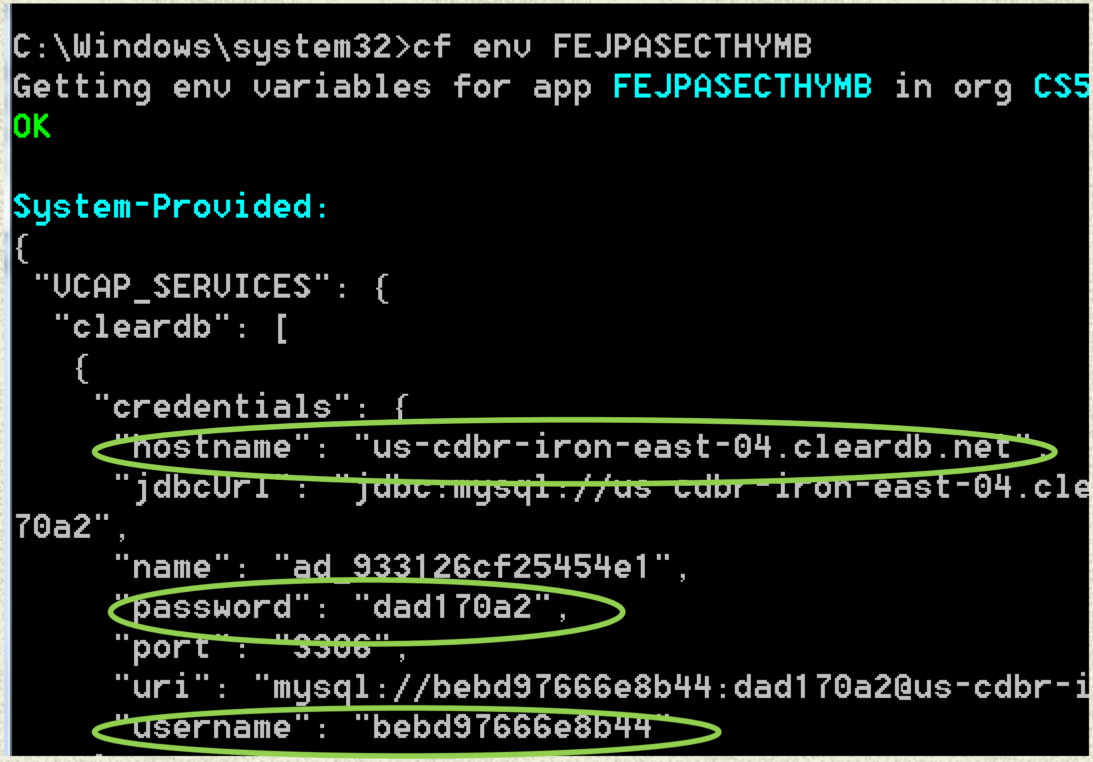
Application log file inspection

- You view logs in the CLI using the cf logs command. You can tail, dump, or filter log output.



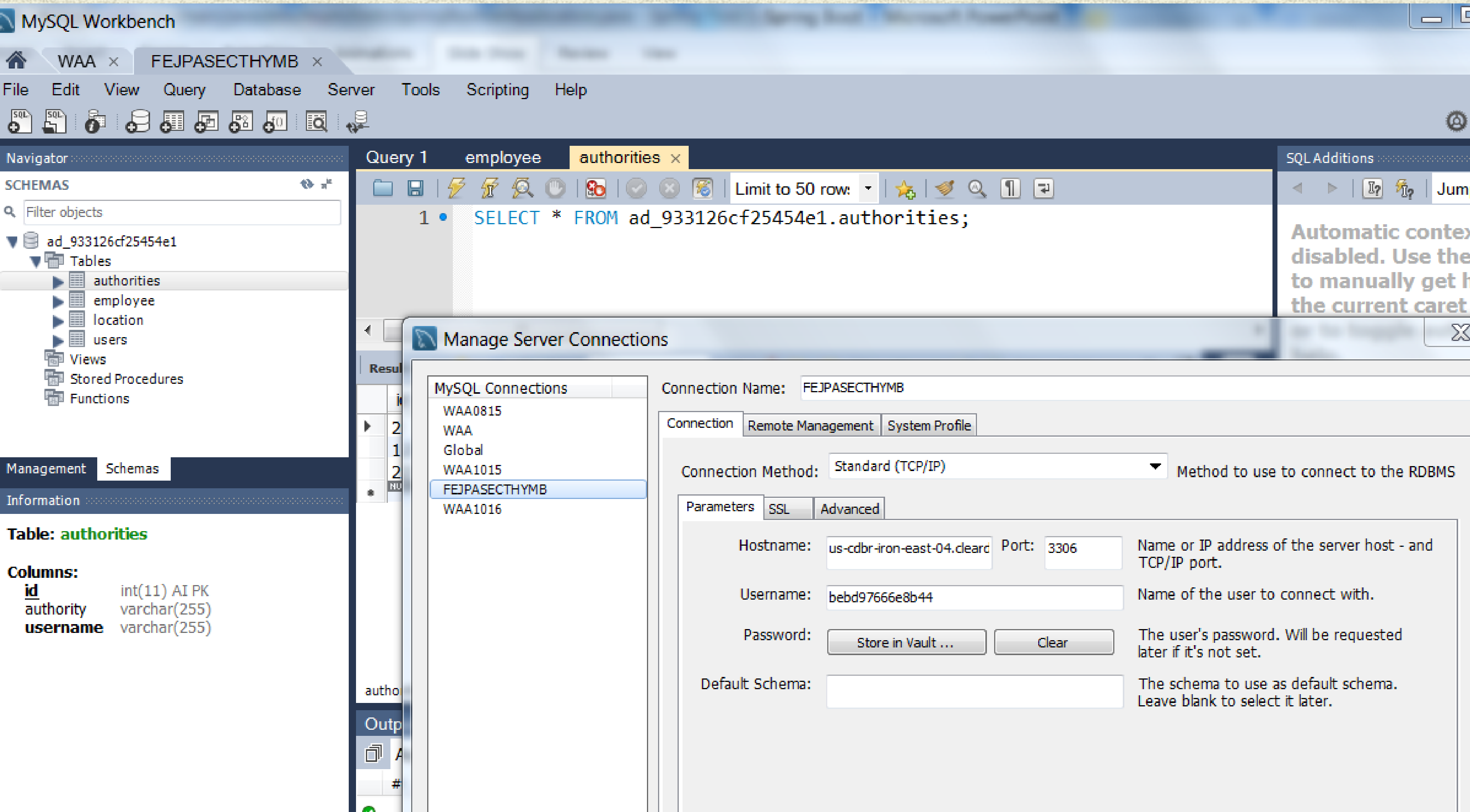
```
c:\Program Files\CloudFoundryDeploy>cf apps
Getting apps in org CS544-MUM / space development as jbruen@mum.edu...
OK

name                 requested state   instances   memory   disk   urls
ComproTaxi           stopped           0/1         1G       1G     ComproTaxi.cfapps.io
FEJPASECB            stopped           0/1         1G       1G     FEJPASECB.cfapps.io
FEJPASECTHYMB        stopped           0/1         1G       1G     FEJPASECTHYMB.cfapps.io
HelloSpringBootCLI   stopped           0/1         1G       1G     hellospringbootcli.cfapps.io
HelloSpringBootWar   stopped           0/1         1G       1G     hellospringbootwar.cfapps.io
MongoJerry           stopped           0/1         1G       1G     mongojerry.cfapps.io
MovieManiaBoot       stopped           0/1         1G       1G     MovieManiaBoot.cfapps.io
Thyme                started           1/1         1G       1G     thyme.cfapps.io
WebSocketTickerB     stopped           0/1         1G       1G     WebSocketTickerB.cfapps.io
WelcomeRWDBoot       stopped           0/1         1G       1G     WelcomeRWDBoot.cfapps.io

c:\Program Files\CloudFoundryDeploy>cf logs Thyme --recent
Retrieving logs for app Thyme in org CS544-MUM / space development as jbruen@mum.edu...

   2018-07-16T10:07:35.82-0500 [API/1] OUT Created app with guid c9f56b86-9314-47a2-aa46-2979f76eba3c
   2018-07-16T10:07:37.37-0500 [API/3] OUT Updated app with guid c9f56b86-9314-47a2-aa46-2979f76eba3c ({"route"
bc-842082e27aeb", :verb=>"add", :relation=>"routes", :related_guid=>"bd68dab0-8119-4370-9fbc-842082e27aeb"})
   2018-07-16T10:07:46.22-0500 [API/3] OUT Uploading bits for app with guid c9f56b86-9314-47a2-aa46-2979f76eba3
   2018-07-16T10:07:57.58-0500 [API/8] OUT Creating build for app with guid c9f56b86-9314-47a2-aa46-2979f76eba3
   2018-07-16T10:07:58.06-0500 [API/8] OUT Updated app with guid c9f56b86-9314-47a2-aa46-2979f76eba3c ({"state"
   2018-07-16T10:07:58.20-0500 [STG/0] OUT Downloading java_buildpack...
```

Set up MySQLAdmin



```
C:\Windows\system32>cf env FEJPASECTHYMB
Getting env variables for app FEJPASECTHYMB in org CS5
OK

System-Provided:
{
 "VCAP_SERVICES": {
  "cleardb": [
   {
    "credentials": {
     "hostname": "us-cdbr-iron-east-04.cleardb.net",
     "jdbcUrl": "jdbc:mysql://us-cdbr-iron-east-04.cle
70a2",
     "name": "ad_933126cf25454e1",
     "password": "dad170a2",
     "port": "3306",
     "uri": "mysql://bebd97666e8b44:dad170a2@us-cdbr-i
     "username": "bebd97666e8b44"
```

MySQL Workbench



```
SELECT * FROM ad_933126cf25454e1.authorities;
```

Table: authorities

Columns:

id	int(11) AI PK
authority	varchar(255)
username	varchar(255)

Connection Name: FEJPASECTHYMB

Connection Method: Standard (TCP/IP) — Method to use to connect to the RDBMS

Hostname: us-cdbr-iron-east-04.clearc Port: 3306 — Name or IP address of the server host - and TCP/IP port.

Username: bebd97666e8b44 — Name of the user to connect with.

Password: — The user's password. Will be requested later if it's not set.

Default Schema: — The schema to use as default schema. Leave blank to select it later.

Spring Cloud Support

- Spring Cloud Config
- Centralized external configuration management backed by a git repository. The configuration resources map directly to Spring `Environment` but could be used by non-Spring applications if desired.
- Spring Cloud Netflix
- Integration with various Netflix OSS components (Eureka, Hystrix, Zuul, Archaius, etc.)
- Spring Cloud Bus
- An event bus for linking services and service instances together with distributed messaging. Useful for propagating state changes across a cluster (e.g. config change event)
- Spring Cloud for Cloud Foundry
- Integrates your application with Pivotal Cloudfoundry. Provides a service discovery implementation and also makes it easy to implement SSO and OAuth2 protected resources, and also to create a Cloud Foundry service broker.
- Spring Cloud Cluster
- Leadership election and common stateful patterns with an abstraction and implementation for Zookeeper, Redis, Hazelcast, Consul.
- Spring Cloud Consul
- Service discovery and configuration management with Hashicorp Consul.
- **ETC…, ETC…, ETC…**

Main Point

The Cloud is a broad concept that spans virtually every possible online service. *The Unified Field is broad [universal] concept that spans all of Life.*