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Java Microservices with Spring Cloud Config and JHipster

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Developing a microservice architecture with Java and Spring Boot is quite popular these days. It's definitely one of the most popular combinations in the Java ecosystem. If you need any proof, just look at all of the similar frameworks that have cropped up in the last few years: MicroProfile, Micronaut, and Quarkus, just to name a few.

Spring Boot provided a much-needed spark to the Spring ecosystem when it was first released in 2014. Instead of making Java developers configure all aspects of their Spring beans, it provided "starters" that contained pre-configured beans with the default settings. This led to less Java code, and also provided the ability to override the defaults via an

```
application.properties
```

file. Yes, there are many ways to modify the defaults in a Spring Boot application, but I'll skip over that for now.

In a previous tutorial on Java Microservices with Spring Boot and Spring Cloud, I showed how you can use OAuth 2.0 and OpenID Connect to secure everything. One of the problems with this example is that you have to configure the OIDC properties in each application. This can be a real pain if you have hundreds of microservices. Yes, you could define them as environment variables and this would solve the problem. However, if you have different microservices stacks using different OIDC client IDs, this approach will be difficult.

Java Microservices with Spring Cloud Config

Spring Cloud Config is a project that provides externalized configuration for distributed systems. Spring Cloud Config has server and client components. You can configure the server to read its configuration from the file system or a source code repository, like Git. On the client, you configure things in a bootstrap configuration file to get configuration data from the server. In a microservices environment, this provides an elegant way to configure *all* your microservices from a central location.

Today I'd like to show you how this works and demo it using one of the hippest microservice solutions I've ever worked with.

The most common way to install JHipster is using npm:

```
npm install -g generator-jhipster@6.0.1
```

You can run the command above without the version number to get the latest version of JHipster. If it's 6.x, this tutorial should work, but I can't guarantee it does.

In a terminal, create a directory to hold all the projects you're about to create. For example,

```
jhipster
```

.

Create an

```
apps.jh
```

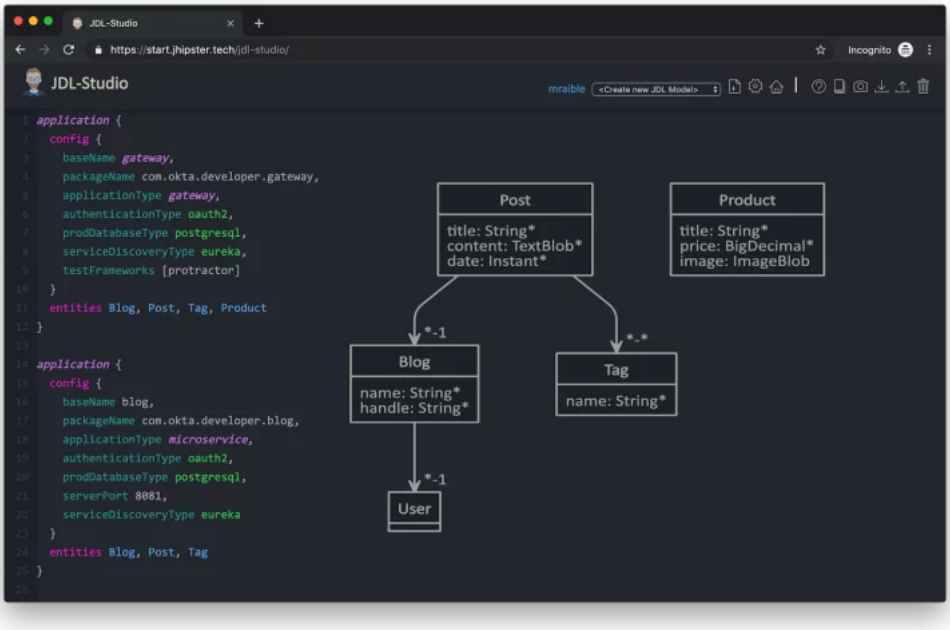
file in this directory and put the following code into it.

```
application {
  config {
    baseName gateway,
    packageName com.okta.developer.gateway,
    applicationType gateway,
    authenticationType oauth2,
    prodDatabaseType postgresql,
    serviceDiscoveryType eureka,
    testFrameworks [protractor]
  }
  entities Blog, Post, Tag, Product
}

application {
  config {
    baseName blog,
    packageName com.okta.developer.blog,
    applicationType microservice,
    authenticationType oauth2,
    prodDatabaseType postgresql,
    serverPort 8081,
    serviceDiscoveryType eureka
  }
  entities Blog, Post, Tag
}

application {
  config {
    baseName store,
    packageName com.okta.developer.store,
    applicationType microservice,
    authenticationType oauth2,
    databaseType mongodb,
    devDatabaseType mongodb,
    prodDatabaseType mongodb,
    enableHibernateCache false,
    serverPort 8082,
    serviceDiscoveryType eureka
  }
  entities Product
}

entity Blog {
  name String required minlength(3),
  handle String required minlength(2)
}

entity Post {
  title String required,
  content TextBlob required,
  date Instant required
}

entity Tag {
  name String required minlength(2)
}
```

```
}

paginate Post, Tag with infinite-scroll
paginate Product with pagination

microservice Product with store
microservice Blog, Post, Tag with blog

// will be created under 'docker-compose' folder
deployment {
  deploymentType docker-compose
  appsFolders [gateway, blog, store]
  dockerRepositoryName "jmicro"
  consoleOptions [zipkin]
}
```

You'll want to change the `dockerRepositoryName` *in the JDL above to use your Docker Hub username if you want to publish your containers. This is not a necessary step to complete this tutorial.*

This code is JDL (JHipster Domain Language) and you can use it to define your app, its entities, and even deployment settings. You can learn more about JDL in JHipster's JDL documentation. Below is a screenshot of JDL Studio, which can be used to edit JDL and see how entities related to each other.



The JDL you just put in `apps.jh` defines three applications:

- **gateway**: a single entry point to your microservices, that will include the UI components.
- **blog**: a blog service that talks to PostgreSQL.
- **store**: a store service that uses MongoDB.

Run the following command to create these projects in your `jhipster` folder.

```
jhipster import-jdl apps.jh
```

This will create all three projects in parallel. You can watch the console recording below to see how it looks. The time it takes to create everything will depend on how fast your computer and internet are.

To make it easier to create Docker images with one command, create an aggregator `pom.xml` in the `jhipster` root directory.

```
<?xml version="1.0" encoding="UTF-8"?>
<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/xsd/maven-4.0.0.xsd">
    <modelVersion>4.0.0</modelVersion>
    <groupId>com.okta.developer</groupId>
    <artifactId>jhipster-parent</artifactId>
    <version>1.0.0-SNAPSHOT</version>
    <packaging>pom</packaging>
    <name>jhipster-parent</name>
    <modules>
        <module>gateway</module>
        <module>blog</module>
        <module>store</module>
    </modules>
</project>
```

Then "just jib it" using Jib

```
mvn -Pprod verify com.google.cloud.tools:jib-maven-plugin:dockerBuild
```

If you don't have Maven installed, use `brew install maven` *on a Mac, or see Maven's installation docs.*

```
[INFO] Skipping containerization because packaging is 'pom'...
[INFO] ------------------------------------------------------------------------
[INFO] Reactor Summary:
[INFO]
[INFO] Gateway 0.0.1-SNAPSHOT ............................. SUCCESS [02:44 min]
[INFO] Blog 0.0.1-SNAPSHOT ................................ SUCCESS [ 34.391 s]
[INFO] Store 0.0.1-SNAPSHOT ............................... SUCCESS [ 28.589 s]
[INFO] jhipster-parent 1.0.0-SNAPSHOT ..................... SUCCESS [  1.096 s]
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time: 03:49 min
[INFO] Finished at: 2019-05-17T07:44:39-06:00
[INFO] ------------------------------------------------------------------------
Execution time: 3 min. 50 s.
```

Run Your Java Microservices Stack with Docker Compose

Once everything has finished building, cd into the `docker-compose` directory and start all your containers.

```
cd docker-compose
docker-compose up -d
```

Remove the `-d` *if you want to see all the logs in your current terminal window.*

It will take several minutes to start all eight of your containers. You can use Kitematic to monitor their startup progress if you like.

```
Creating docker-compose_gateway-app_1               ... done
Creating docker-compose_gateway-postgresql_1        ... done
Creating docker-compose_blog-app_1                  ... done
Creating docker-compose_store-mongodb_1             ... done
Creating docker-compose_keycloak_1                  ... done
Creating docker-compose_blog-postgresql_1           ... done
Creating docker-compose_jhipster-registry_1         ... done
Creating docker-compose_store-app_1                 ... done
```

JHipster Registry for Service Discovery with Java Microservices

includes Spring Cloud Config, among other features.

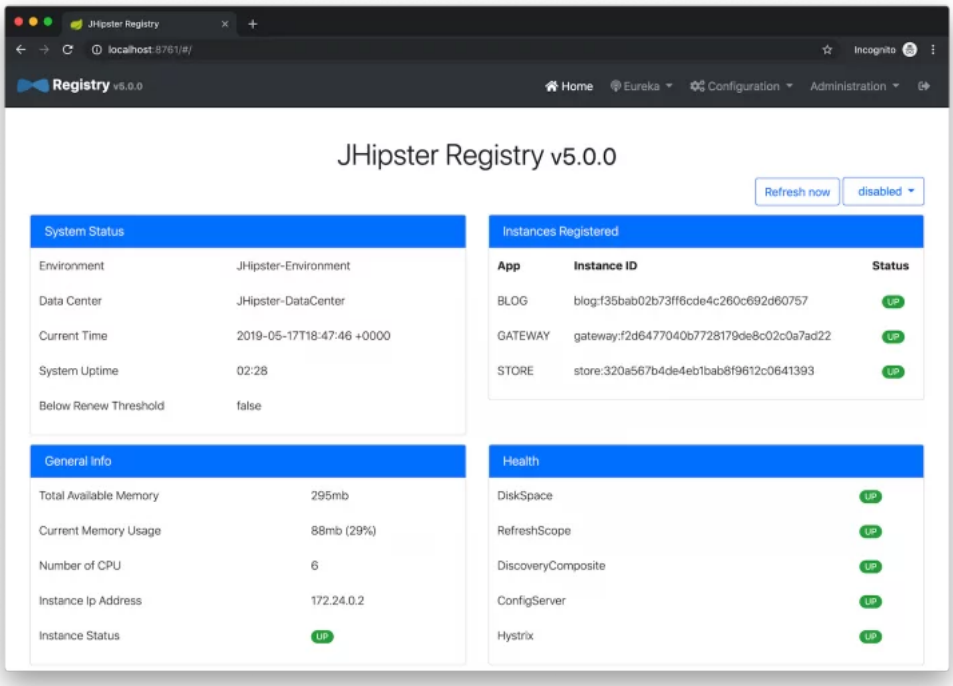
JHipster also supports Hashicorp Consul for service discovery.

Because you chose OAuth 2.0/OIDC for authentication, you'll need to create an entry in your `hosts` file (`/etc/hosts` on Linux/Mac, `C:\Windows\System32\Drivers\etc\hosts` on Windows) for Keycloak.

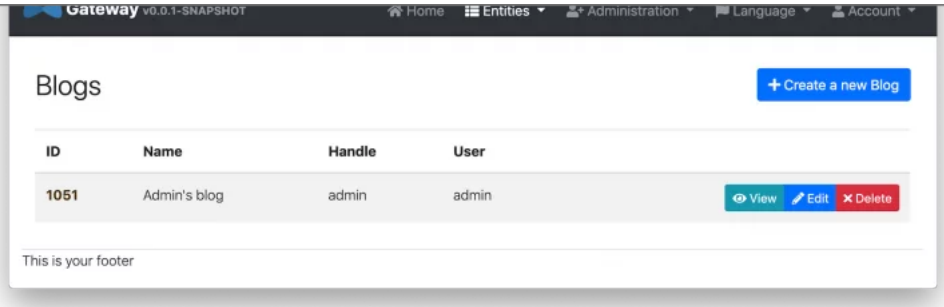
```
127.0.0.1  keycloak
```

This is because the Docker network recognizes `keycloak` as a registered hostname, but it also redirects you to `keycloak`. Your browser is not aware of that hostname without the `hosts` entry.

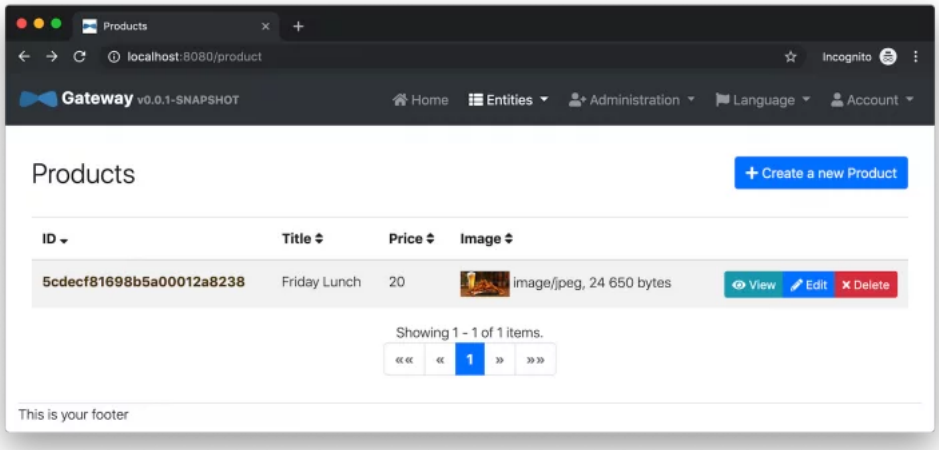
Open your browser and navigate to `http://localhost:8761`. You'll be redirected to Keycloak to login. Enter `admin/admin` for credentials and you'll be redirected back to JHipster Registry. You'll see all your microservice instances have been registered.



Navigate to



Go to **Entities** > **Product** and you can add a product too.



Pretty slick, don't you think?!

Configure JHipster Microservices to Use Okta for Identity

One of the problems you saw in the bare-bones Spring Boot + Spring Cloud setup is you have to configure

```
okta.oauth2.*
```

properties in every microservice. JHipster doesn't use the Okta Spring Boot starter. It uses

```
oauth2-client
```

and

```
oauth2-resource-server
```

Spring Boot starters instead. The configuration for OAuth 2.0 is contained in each app's

```
src/main/resources/config/application.yml
```

file.

```
spring:
  ...
  security:
    oauth2:
      client:
        provider:
          oidc:
            issuer-uri: http://localhost:9080/auth/realms/jhipster
        registration:
          oidc:
            client-id: internal
            client-secret: internal
```

Why Okta?

You might be wondering why you should use Okta instead of Keycloak? Keycloak works great for development and testing, and especially well if you're on a plane with no wi-fi. However, in production, you want a system that's **always on**. That's where Okta comes in. To begin, you'll

`http://localhost:8080/login/oauth2/code/okta`

as a Login redirect URI, select **Refresh Token** (in addition to **Authorization Code**), and click **Done**.

4. To configure Logout to work in JHipster, **Edit** your app, add

`http://localhost:8080`

as a Logout redirect URI, then click **Save**.

Configure Your OpenID Connect Settings with Spring Cloud Config

Rather than modifying each of your apps for Okta, you can use Spring Cloud Config in JHipster Registry to do it. Open

`docker-compose/central-server-config/application.yml`

and add your Okta settings.

The client ID and secret are available on your app settings page. You can find the issuer under **API** > **Authorization Servers**.

```
spring:
  security:
    oauth2:
      client:
        provider:
          oidc:
            issuer-uri: https://{yourOktaDomain}/oauth2/default
        registration:
          oidc:
            client-id: {yourClientId}
            client-secret: {yourClientSecret}
```

The registry, gateway, blog, and store applications are all configured to read this configuration on startup.

Restart all your containers for this configuration to take effect.

```
docker-compose restart
```

Before you can log in, you'll need to add redirect URIs for JHipster Registry, ensure your user is in a

`ROLE_ADMIN`

group and that groups are included in the ID token.

Log in to your Okta dashboard, edit your OIDC app, and add the following Login redirect URI:

- `http://localhost:8761/login/oauth2/code/oidc`

You'll also need to add a Logout redirect URI:

- `http://localhost:8761`

Then, click **Save**.

Create Groups and Add Them as Claims to the ID Token

JHipster is configured by default to work with two types of users: administrators and users. Keycloak is configured with users and groups automatically, but you need to do some one-time configuration for your Okta organization.

Create a

`ROLE_ADMIN`

group (**Users** > **Groups** > **Add Group**) and add your user to it. Navigate to **API** > **Authorization Servers**, and click on the the

`default`

server. Click the **Claims** tab and **Add Claim**. Name it

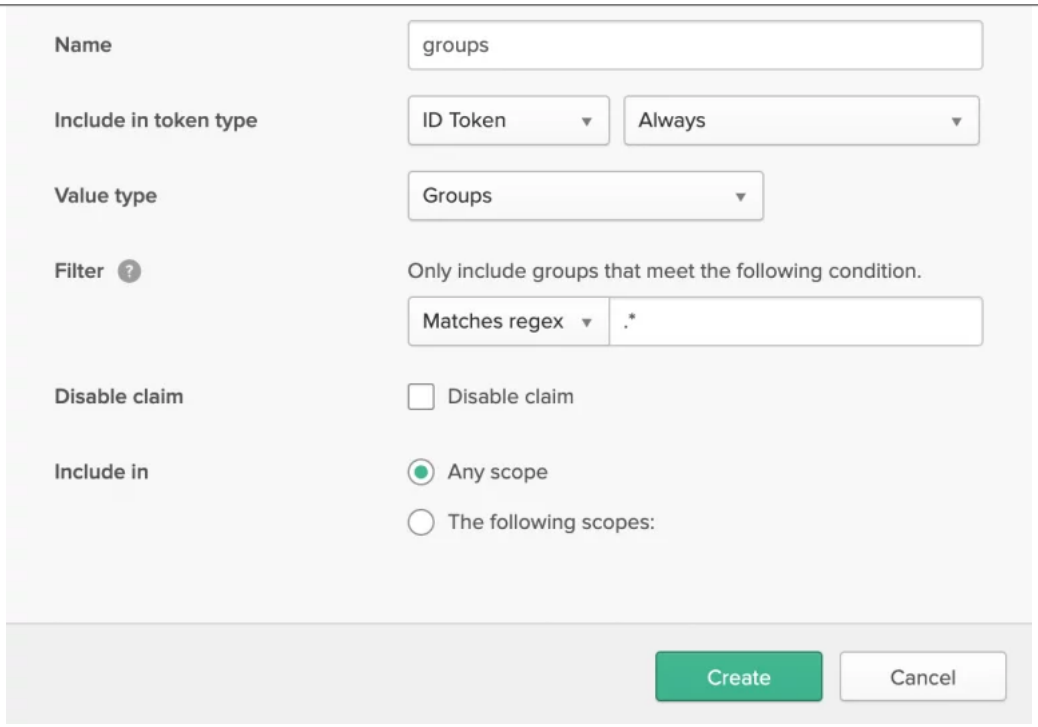
`groups`

, and include it in the ID Token. Set the value type to

`Groups`

and set the filter to be a Regex of

`.*`



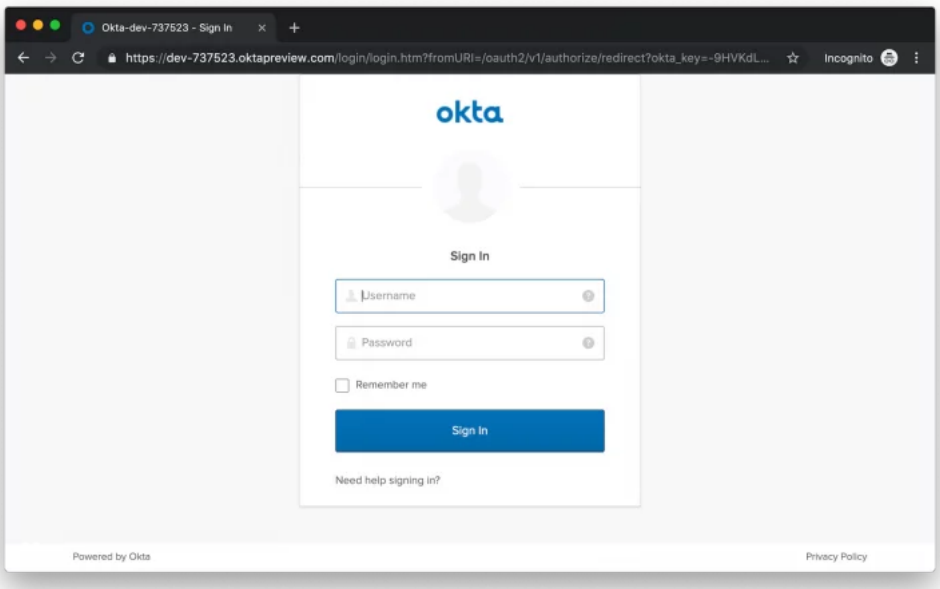
Now when you hit

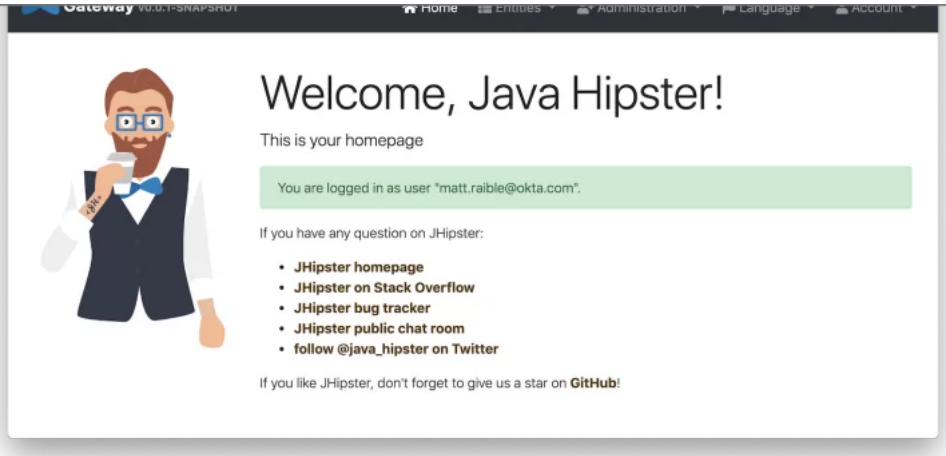
```
http://localhost:8761
```

or

```
http://localhost:8080
```

, you'll be prompted to log in with Okta!





It's pretty nifty how you can configure your service registry and all your microservices in one place with Spring Cloud Config, don't you think?! 🔌

Configuring Spring Cloud Config with Git

JHipster Registry and its Spring Cloud Config server support two kinds of configuration sources:

`native`

and

`git`

. Which one is used is determined by a

`spring.cloud.config.server.composite`

property. If you look in

`docker-compose/jhipster-registry.yml`

, you'll see that

`native`

is enabled and

`git`

is commented out.

```
- SPRING_CLOUD_CONFIG_SERVER_COMPOSITE_0_TYPE=native
- SPRING_CLOUD_CONFIG_SERVER_COMPOSITE_0_SEARCH_LOCATIONS=file:./central-config
# - SPRING_CLOUD_CONFIG_SERVER_COMPOSITE_0_TYPE=git
# - SPRING_CLOUD_CONFIG_SERVER_COMPOSITE_0_URI=https://github.com/jhipster/jhipster-registry/
# - SPRING_CLOUD_CONFIG_SERVER_COMPOSITE_0_SEARCH_PATHS=central-config
# For Keycloak to work, you need to add '127.0.0.1 keycloak' to your hosts file
```

You can see the default configuration for Git at @jhipster/jhipster-registry/central-config/application.yml. You can learn more about application configuration with Spring Cloud Config in JHipster Registry's documentation. It includes a section on encrypting configuration values.

What About Kotlin Microservices?

In the first post of this series, I told you why I wrote this post in Java:

I wrote this post with Java because it's the most popular language in the Java ecosystem. However, Kotlin is on the rise, according to RedMonk's programming language rankings from January 2019.

If you'd like to see us write more posts using Kotlin, please let us know in the comments!

Learn More about Spring Cloud Config, Java Microservices, and JHipster

I hope you enjoyed learning how to build Java microservice architectures with JHipster and configure them with Spring Cloud Config. You learned how to generate everything from a single JDL file, package your apps in Docker containers, run them with Docker Compose, and authenticate with OIDC using Keycloak and Okta.

You can find all the code shown in this tutorial on GitHub in the

```
jhipster
```

directory.

We're big fans of Spring Boot, Spring Cloud, and JHipster on this blog. Here are a few other posts you might find interesting:

- Java Microservices with Spring Boot and Spring Cloud
- Build a Microservice Architecture with Spring Boot and Kubernetes
- Build Spring Microservices and Dockerize Them for Production
- Better, Faster, Lighter Java with Java 12 and JHipster 6

Please follow us on Twitter @oktadev and subscribe to our YouTube channel for more Spring and Spring Security tips.

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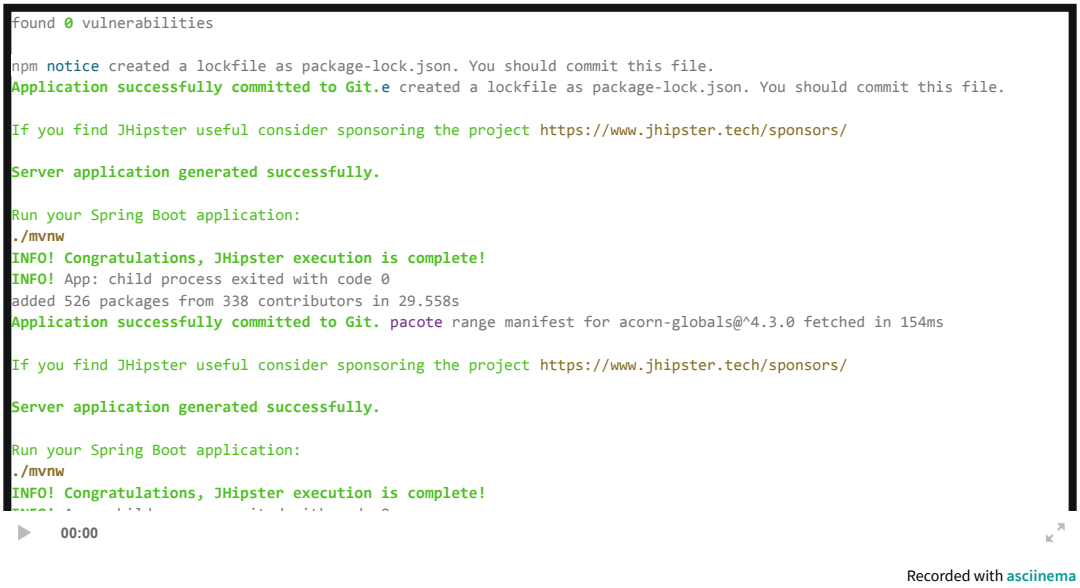

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