Introspection, Monitoring, and Metrics using Spring Boot Actuator

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Estimated Time: 30 minutes

Requirements

Lab Requirements (/spring-boot-primer/requirements)

What You Will Learn

- How to use the endpoints that the `actuator` exposes to manage applications

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Exercises

Set up the Actuator

Spring Boot includes a number of additional features to help you monitor and manage your application when it’s pushed to production. These features are added by adding `spring-boot-starter-actuator` to the classpath.

1) Review the following file: `$SPRING_BOOT_LABS_HOME/hello-spring-boot-actuator/pom.xml.`

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

Introspection Endpoints

1.) Open a new terminal window. Run the `hello-spring-boot-actuator` application:

```
$ cd $SPRING_BOOT_LABS_HOME/hello-spring-boot-actuator
$ mvn clean spring-boot:run
```

Try out the following endpoints. The output is omitted here because it can be quite large:

http://localhost:8080/beans (http://localhost:8080/beans)

Dumps all of the beans in the Spring context.

http://localhost:8080/autoconfig (http://localhost:8080/autoconfig)

Dumps all of the auto-configuration performed as part of application bootstrapping.

http://localhost:8080/configprops (http://localhost:8080/configprops)

Displays a collated list of all `@ConfigurationProperties`.

http://localhost:8080/env (http://localhost:8080/env)

Dumps the application’s shell environment as well as all Java system properties.

http://localhost:8080/mappings (http://localhost:8080/mappings)

Dumps all URI request mappings and the controller methods to which they are mapped.

http://localhost:8080/dump (http://localhost:8080/dump)

Performs a thread dump.

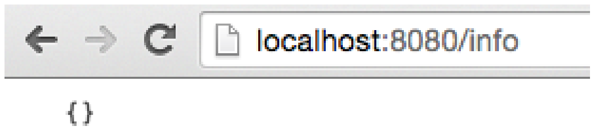
http://localhost:8080/trace (http://localhost:8080/trace)

Displays trace information (by default the last few HTTP requests).

2) Stop the `hello-spring-boot-actuator` application.

Include Version Control Info

Spring Boot provides an endpoint (http://localhost:8080/info (http://localhost:8080/info)) that allows the exposure of arbitrary metadata. By default, it is empty.


localhost:8080/info

```
{}
```

One thing that `actuator` does well is expose information about the specific build and version control coordinates for a given deployment.

1) Edit the following file: `$SPRING_BOOT_LABS_HOME/hello-spring-boot-actuator/pom.xml`. Add the `git-commit-id-plugin` to your Maven build. *You must edit the file.* The `git-commit-id-plugin` adds Git branch and commit coordinates to the `/info` endpoint:

```
<plugin>
        <groupId>pl.project13.maven</groupId>
        <artifactId>git-commit-id-plugin</artifactId>
        <configuration>
                <dotGitDirectory>../.git</dotGitDirectory>
        </configuration>
</plugin>
```

NOTE The path `../.git` refers to the `.git` directory at the root of the lab materials repo.

Completed:

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

        <groupId>io.pivotal</groupId>
        <artifactId>hello-spring-boot-actuator</artifactId>
        <version>0.0.1-SNAPSHOT</version>
        <packaging>jar</packaging>

        <name>hello-spring-boot-actuator</name>
        <description>Hello Spring Boot</description>

        <parent>
                <groupId>org.springframework.boot</groupId>
                <artifactId>spring-boot-starter-parent</artifactId>
                <version>1.2.6.RELEASE</version>
                <relativePath /> <!-- lookup parent from repository -->
        </parent>

        <properties>
                <project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>
                <java.version>1.8</java.version>
        </properties>

        <dependencies>
```

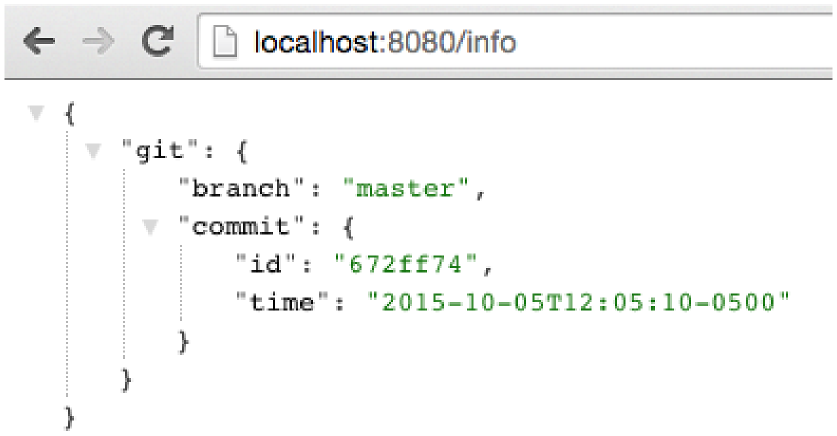
```
		<dependency>
			<groupId>org.springframework.boot</groupId>
			<artifactId>spring-boot-starter-web</artifactId>
		</dependency>
		<dependency>
			<groupId>org.springframework.boot</groupId>
			<artifactId>spring-boot-starter-actuator</artifactId>
		</dependency>
		<dependency>
			<groupId>org.springframework.boot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

	<build>
		<plugins>
			<plugin>
				<groupId>org.springframework.boot</groupId>
				<artifactId>spring-boot-maven-plugin</artifactId>
			</plugin>
			<plugin>
				<groupId>pl.project13.maven</groupId>
				<artifactId>git-commit-id-plugin</artifactId>
				<configuration>
					<dotGitDirectory>../.git</dotGitDirectory>
				</configuration>
			</plugin>
		</plugins>
```

```
    </build>


</project>
```

2) Run the `hello-spring-boot-actuator` application:

```
$ mvn clean spring-boot:run
```

3) Browse to http://localhost:8080/info (http://localhost:8080/info). Git commit information is now included.


localhost:8080/info

```
{
  "git": {
    "branch": "master",
    "commit": {
      "id": "672ff74",
      "time": "2015-10-05T12:05:10-0500"
    }
  }
}
```

4) Stop the `hello-spring-boot-actuator` application.

What Just Happened?

By including the `git-commit-id-plugin`, details about git commit information will be included in the `/info` endpoint. Git information is captured in a `git.properties` file that is generated with the build. Review the following file: `$SPRING_BOOT_LABS_HOME/hello-spring-boot-actuator/target/classes/git.properties`.

Include Build Info

1) Add the following properties to `$SPRING_BOOT_LABS_HOME/hello-spring-boot-actuator/src/main/resources/application.yml`. *You must edit the file.*

```
greeting: Hello
info: # add this section
  build:
    artifact: @project.artifactId@
    name: @project.name@
    description: @project.description@
    version: @project.version@
```

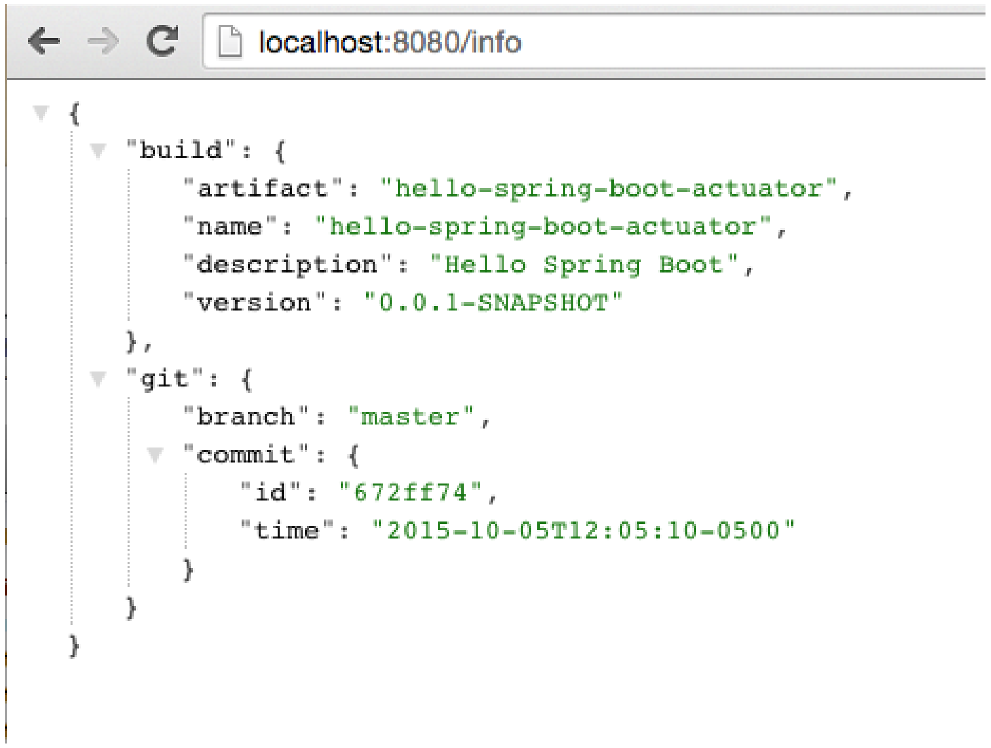
These will add the project's Maven coordinates to the `/info` endpoint. The Spring Boot Maven plugin will cause them to automatically be replaced in the assembled JAR.

NOTE: if STS reports a problem with the `application.yml` due to `@` character the problem can safely be ignored.

2) Build and run the `hello-spring-boot-actuator` application:

```
$ mvn clean package
$ java -jar target/hello-spring-boot-actuator-0.0.1-SNAPSHOT.jar
```

3) Browse to http://localhost:8080/info (http://localhost:8080/info). Build information is now included.



```
{
  "build": {
    "artifact": "hello-spring-boot-actuator",
    "name": "hello-spring-boot-actuator",
    "description": "Hello Spring Boot",
    "version": "0.0.1-SNAPSHOT"
  },
  "git": {
    "branch": "master",
    "commit": {
      "id": "672ff74",
      "time": "2015-10-05T12:05:10-0500"
    }
  }
}
```

4) Stop the `hello-spring-boot-actuator` application.

What Just Happened?

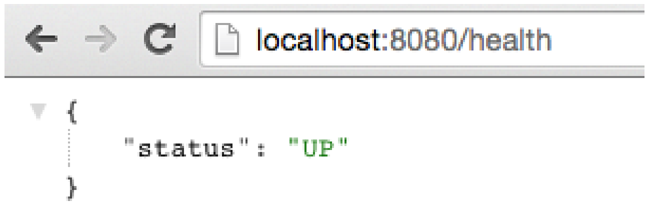
We have mapped Maven properties from the `pom.xml` into the `/info` endpoint.

Read more about exposing data in the `/info` endpoint here (http://docs.spring.io/spring-boot/docs/current/reference/htmlsingle/#production-ready).

Health Indicators

Spring Boot provides an endpoint http://localhost:8080/health (http://localhost:8080/health) that exposes various health indicators that describe the health of the given application.

Normally, when Spring Security is not enabled, the `/health` endpoint will only expose an `UP` or `DOWN` value.



```
{
    "status": "UP"
}
```

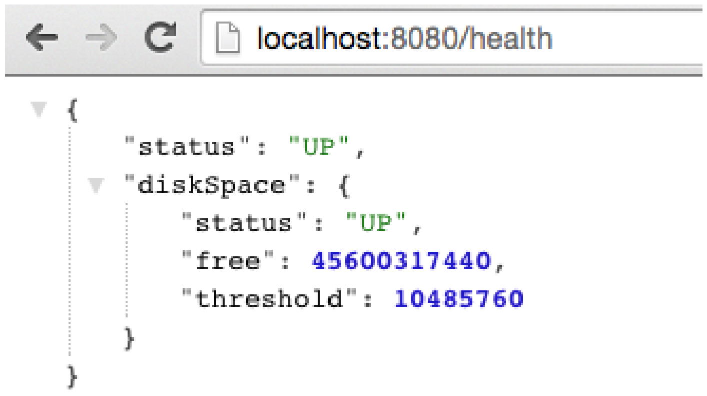
1) To simplify working with the endpoint for this lab, we will turn off its sensitivity. Add the following to `$SPRING_BOOT_LABS_HOME/hello-spring-boot-actuator/src/main/resources/application.yml`:

```
greeting: Hello
info:
  build:
    artifact: @project.artifactId@
    name: @project.name@
    description: @project.description@
    version: @project.version@
endpoints: # add this section
  health:
    sensitive: false
```

2) Build and run the `hello-spring-boot-actuator` application:

```
$ mvn clean package
$ java -jar target/hello-spring-boot-actuator-0.0.1-SNAPSHOT.jar
```

3) Browse to http://localhost:8080/health (http://localhost:8080/health). Out of the box is a `DiskSpaceHealthIndicator` that monitors health in terms of available disk space. Would your Ops team like to know if the app is close to running out of disk space? `DiskSpaceHealthIndicator` can be customized via `DiskSpaceHealthIndicatorProperties`. For instance, setting a different threshold for when to report the status as `DOWN`.



```
{
    "status": "UP",
    "diskSpace": {
        "status": "UP",
        "free": 45600317440,
        "threshold": 10485760
    }
}
```

4) Stop the `hello-spring-boot-actuator` application.

5) Create the class `io.pivotal.hello.FlappingHealthIndicator` (`$SPRING_BOOT_LABS_HOME/hello-spring-boot-actuator/src/main/java/io/pivotal/hello/FlappingHealthIndicator.java`) and into it paste the following code:

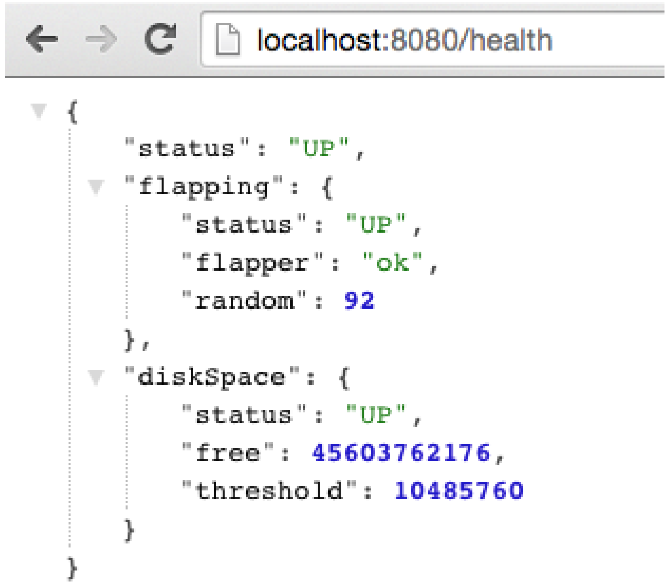
```
package io.pivotal.hello;

import java.util.Random;

import org.springframework.boot.actuate.health.Health;
import org.springframework.boot.actuate.health.HealthIndicator;
import org.springframework.stereotype.Component;

@Component
public class FlappingHealthIndicator implements HealthIndicator {

    private Random random = new Random(System.currentTimeMillis());

    @Override
    public Health health() {
        int result = random.nextInt(100);
        if (result < 50) {
            return Health.down().withDetail("flapper", "failure").withDetail("random", resul
t).build();
        } else {
            return Health.up().withDetail("flapper", "ok").withDetail("random", result).buil
d();
        }
    }
}
```

This demo health indicator will randomize the health check.

6) Build and run the `hello-spring-boot-actuator` application:

```
$ mvn clean package
$ java -jar target/hello-spring-boot-actuator-0.0.1-SNAPSHOT.jar
```

7) Browse to http://localhost:8080/health (http://localhost:8080/health) and verify that the output is similar to the following (and changes randomly!).

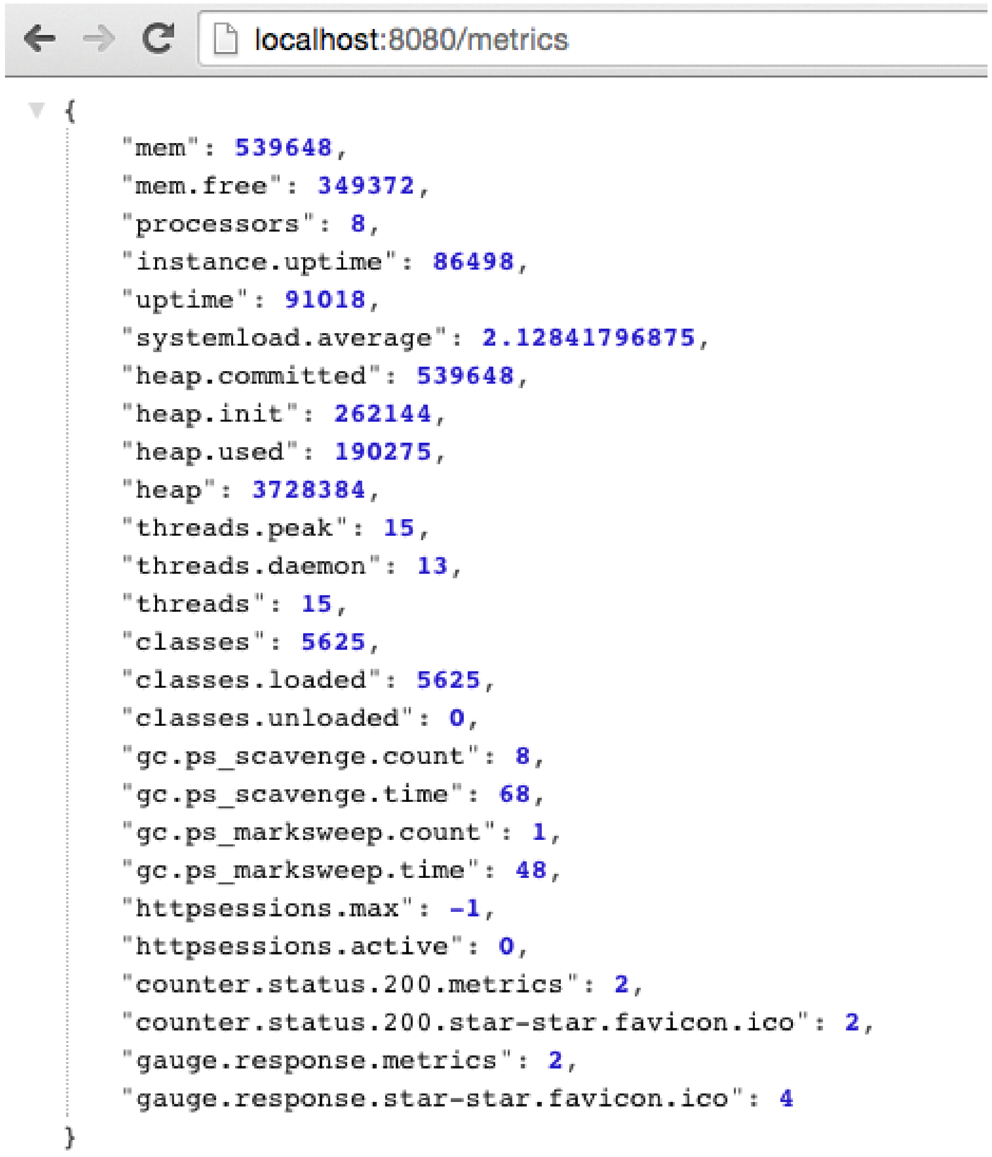


```
{
    "status": "UP",
    "flapping": {
        "status": "UP",
        "flapper": "ok",
        "random": 92
    },
    "diskSpace": {
        "status": "UP",
        "free": 45603762176,
        "threshold": 10485760
    }
}
```

Metrics

Spring Boot provides an endpoint http://localhost:8080/metrics (http://localhost:8080/metrics) that exposes several automatically collected metrics for your application. It also allows for the creation of custom metrics.

1) Browse to http://localhost:8080/metrics (http://localhost:8080/metrics). Review the metrics exposed.



localhost:8080/metrics

```
{
    "mem": 539648,
    "mem.free": 349372,
    "processors": 8,
    "instance.uptime": 86498,
    "uptime": 91018,
    "systemload.average": 2.12841796875,
    "heap.committed": 539648,
    "heap.init": 262144,
    "heap.used": 190275,
    "heap": 3728384,
    "threads.peak": 15,
    "threads.daemon": 13,
    "threads": 15,
    "classes": 5625,
    "classes.loaded": 5625,
    "classes.unloaded": 0,
    "gc.ps_scavenge.count": 8,
    "gc.ps_scavenge.time": 68,
    "gc.ps_marksweep.count": 1,
    "gc.ps_marksweep.time": 48,
    "httpsessions.max": -1,
    "httpsessions.active": 0,
    "counter.status.200.metrics": 2,
    "counter.status.200.star-star.favicon.ico": 2,
    "gauge.response.metrics": 2,
    "gauge.response.star-star.favicon.ico": 4
}
```

2) Stop the `hello-spring-boot-actuator` application.

3) Let’s add some custom metrics. We have refactored the greeting into a service of its own. Open the following file: `$SPRING_BOOT_LABS_HOME/hello-spring-boot-actuator/src/main/java/io/pivotal/hello/GreetingService.java`.

Uncomment this line:

```
                  //counterService.increment("counter.services.greeting.invoked");
```

Notice the `counterService`. This service allows for any metric to be counted.

```
    @Autowired
    CounterService counterService;
```

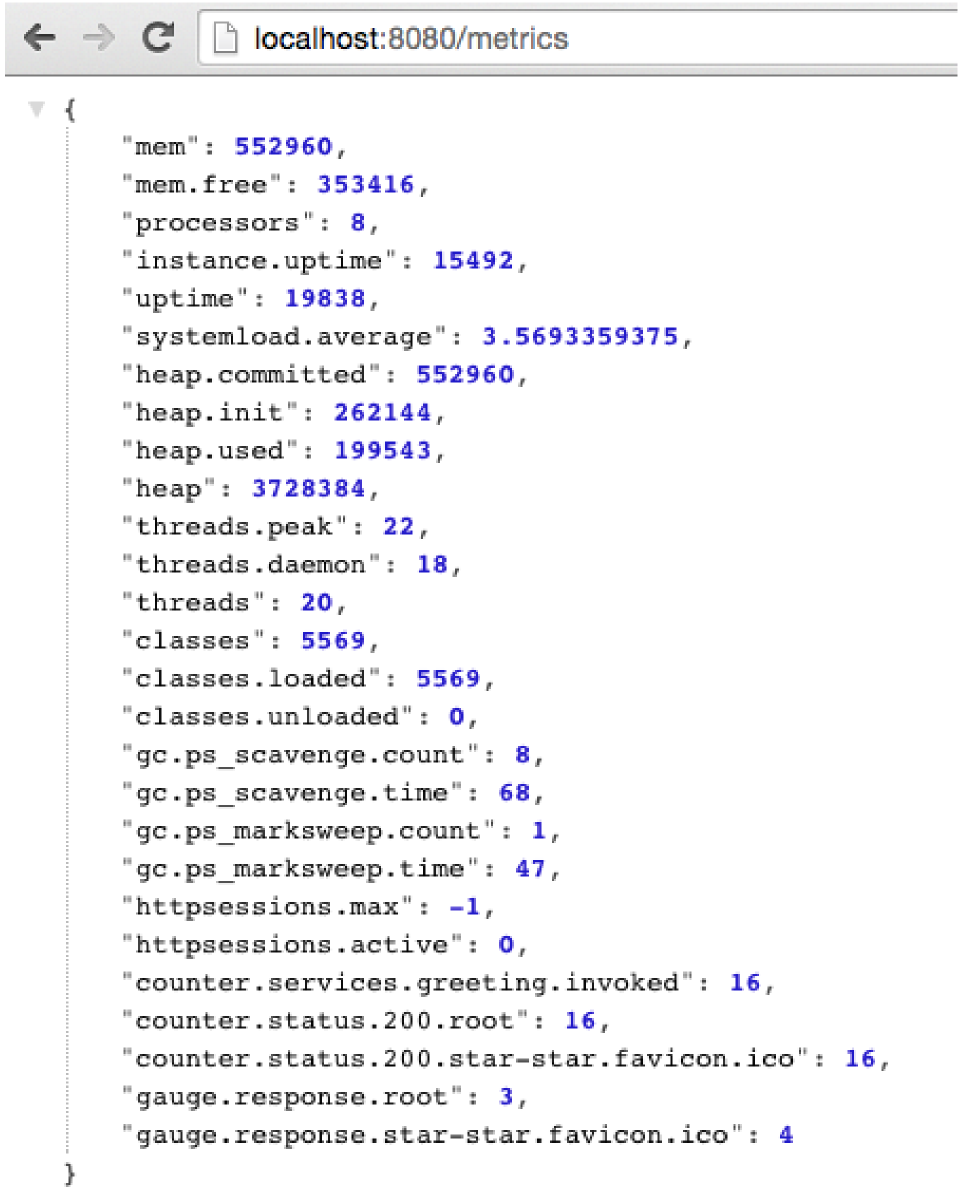
4) Review the following file to see how the `GreetingService` is called: `$SPRING_BOOT_LABS_HOME/hello-spring-boot-actuator/src/main/java/io/pivotal/hello/HelloSpringBootApplication.java`

5) Build and run the `hello-spring-boot-actuator` application:

```
$ mvn clean package
$ java -jar target/hello-spring-boot-actuator-0.0.1-SNAPSHOT.jar
```

6) Visit the application in the browser http://localhost:8080 (http://localhost:8080) and refresh the page several times.

Now visit the `/metrics` endpoint http://localhost:8080/metrics (http://localhost:8080/metrics). Among the autogenerated metrics you should see a counter for the `GreetingService` invocations (`counter.services.greeting.invoked`):


localhost:8080/metrics

```
{
    "mem": 552960,
    "mem.free": 353416,
    "processors": 8,
    "instance.uptime": 15492,
    "uptime": 19838,
    "systemload.average": 3.5693359375,
    "heap.committed": 552960,
    "heap.init": 262144,
    "heap.used": 199543,
    "heap": 3728384,
    "threads.peak": 22,
    "threads.daemon": 18,
    "threads": 20,
    "classes": 5569,
    "classes.loaded": 5569,
    "classes.unloaded": 0,
    "gc.ps_scavenge.count": 8,
    "gc.ps_scavenge.time": 68,
    "gc.ps_marksweep.count": 1,
    "gc.ps_marksweep.time": 47,
    "httpsessions.max": -1,
    "httpsessions.active": 0,
    "counter.services.greeting.invoked": 16,
    "counter.status.200.root": 16,
    "counter.status.200.star-star.favicon.ico": 16,
    "gauge.response.root": 3,
    "gauge.response.star-star.favicon.ico": 4
}
```

To learn more about the autogenerated metrics, visit http://docs.spring.io/spring-boot/docs/current/reference/html/production-ready-metrics.html (http://docs.spring.io/spring-boot/docs/current/reference/html/production-ready-metrics.html).

7) Stop the `hello-spring-boot-actuator` application.

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