

Circuit Breakers

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1. What You Will Learn

- How to protect your application (`greeting-hystrix`) from failures or latency with the circuit breaker pattern
- How to publish circuit-breaking metrics from your application (`greeting-hystrix`)
- How to consume metric streams with the `hystrix-dashboard`

2. Start the `config-server`, `service-registry`, and `fortune-service`

1. Start the `config-server` in a terminal window. You may have terminal windows still open from previous labs. They may be reused for this lab.

```
$ cd config-server  
$ mvn spring-boot:run
```



2. Start the `service-registry`

```
$ cd service-registry  
$ mvn spring-boot:run
```



3. Start the `fortune-service`

```
$ cd fortune-service
$ mvn spring-boot:run
```

3. Set up greeting-hystrix

1. Review the `greeting-hystrix` project's `pom.xml` file. By adding `spring-cloud-services-starter-circuit-breaker` to the classpath this application is eligible to use circuit breakers via Hystrix.

```
<dependency>
  <groupId>io.pivotal.spring.cloud</groupId>
  <artifactId>spring-cloud-services-starter-circuit-breaker</artifactId>
</dependency>
```

2. Review the class `GreetingHystrixApplication.java`. Note the use of the `@EnableCircuitBreaker` annotation. This allows the application to create circuit breakers. Note also how we again configure our `RestTemplate` bean to be load-balanced.

```
package io.pivotal;

import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.client.circuitbreaker.EnableCircuitBreaker;
import org.springframework.cloud.client.discovery.EnableDiscoveryClient;
import org.springframework.cloud.client.loadbalancer.LoadBalanced;
import org.springframework.context.annotation.Bean;
import org.springframework.web.client.RestTemplate;

@SpringBootApplication
@EnableDiscoveryClient
@EnableCircuitBreaker
public class GreetingHystrixApplication {

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

    @LoadBalanced
    @Bean
    RestTemplate restTemplate() {
        return new RestTemplate();
    }
}
```

3. Review the class file `io/pivotal/fortune/FortuneService.java`. Note the use of the `@HystrixCommand`. This is our circuit breaker. If `getFortune()` fails, a fallback method `defaultFortune()` will be invoked.

```
package io.pivotal.fortune;

import com.netflix.hystrix.contrib.javanica.annotation.HystrixCommand;
import org.slf4j.Logger;
import org.slf4j.LoggerFactory;
import org.springframework.stereotype.Service;
import org.springframework.web.client.RestTemplate;

@Service
public class FortuneService {

    private final Logger logger = LoggerFactory.getLogger(FortuneService.class);

    private final RestTemplate restTemplate;

    public FortuneService(RestTemplate restTemplate) {
        this.restTemplate = restTemplate;
    }

    @HystrixCommand(fallbackMethod = "defaultFortune")
    public String getFortune() {
        return restTemplate.getForObject("http://fortune-service", String.class);
    }

    public String defaultFortune() {
        logger.debug("Default fortune used.");
        return "This fortune is no good. Try another.";
    }

}
```



the fallback method signature must match the signature (return type, method arguments) of the method it stands in for.

4. Open a new terminal window, and launch `greeting-hystrix`:

```
$ cd greeting-hystrix
$ mvn spring-boot:run
```

5. Refresh the `greeting-hystrix` root endpoint. You should get fortunes from the `fortune-service`.
6. Stop the `fortune-service`. Now refresh the `greeting-hystrix` root endpoint again. The default fortune is returned.

7. Restart the `fortune-service`. And refresh the `greeting-hystrix` root endpoint again. After some time, fortunes from the `fortune-service` are back.

What Just Happened?

The circuit breaker insulated `greeting-hystrix` from failures when the `fortune-service` was not available. This results in a better experience for our users and can also prevent cascading failures.

4. Set up the `greeting-hystrix` metric stream

Being able to monitor the state of our circuit breakers is highly valuable, but first the `greeting-hystrix` application must expose the metrics. This is accomplished by including the `actuator` dependency in the `greeting-hystrix` project's build file.

1. Review the `greeting-hystrix/pom.xml` file. By adding `spring-boot-starter-actuator` to the classpath, this application will publish metrics at the `/hystrix.stream` endpoint.

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



2. Browse to `http://localhost:8080/hystrix.stream` to review the metric stream.

```
localhost:8080/hystrix.stream

ping:

data:
{"type":"HystrixCommand","name":"getFortune","group":"FortuneService","currentTime":1443629210165,"isCircuitBreakerOpen":false,"errorPercentage":0,"errorCount":0,"requestCount":0,"rollingCountBadRequests":0,"rollingCountCollapsedRequests":0,"rollingCountEmit":0,"rollingCountExceptionsThrown":0,"rollingCountFailure":0,"rollingCountEmit":0,"rollingCountFallbackFailure":0,"rollingCountFallbackRejection":0,"rollingCountFallbackSuccess":0,"rollingCountResponsesFromCache":0,"rollingCountSemaphoreRejected":0,"rollingCountShortCircuited":0,"rollingCountSuccess":0,"rollingCountThreadPoolRejected":0,"rollingCountTimeout":0,"currentConcurrentExecutionCount":0,"rollingMaxConcurrentExecutionCount":0,"latencyExecute_mean":0,"latencyExecute":{"0":0,"25":0,"50":0,"75":0,"90":0,"95":0,"99":0,"99.5":0,"100":0},"latencyTotal_mean":0,"latencyTotal":{"0":0,"25":0,"50":0,"75":0,"90":0,"95":0,"99":0,"99.5":0,"100":0},"propertyValue_circuitBreakerRequestVolumeThreshold":20,"propertyValue_circuitBreakerSleepWindowInMilliseconds":5000,"propertyValue_circuitBreakerErrorThresholdPercentage":50,"propertyValue_circuitBreakerForceOpen":false,"propertyValue_circuitBreakerForceClosed":false,"propertyValue_circuitBreakerEnabled":true,"propertyValue_executionIsolationStrategy":"THREAD","propertyValue_executionIsolationThreadTimeoutInMilliseconds":1000,"propertyValue_executionTimeoutInMilliseconds":1000,"propertyValue_executionIsolationThreadInterruptOnTimeout":true,"propertyValue_executionIsolationThreadPoolKeyOverride":null,"propertyValue_executionIsolationSemaphoreMaxConcurrentRequests":10,"propertyValue_fallbackIsolationSemaphoreMaxConcurrentRequests":10,"propertyValue_metricsRollingStatisticalWindowInMilliseconds":10000,"propertyValue_requestCacheEnabled":true,"propertyValue_requestLogEnabled":true,"reportingHosts":1,"threadPool":"FortuneService"}

data:
{"type":"HystrixThreadPool","name":"FortuneService","currentTime":1443629210165,"currentActiveCount":0,"currentCompletedTaskCount":3,"currentCorePoolSize":10,"currentLargestPoolSize":3,"currentMaximumPoolSize":10,"currentQueueSize":3,"currentTaskCount":3,"rollingCountThreadsExecuted":0,"rollingMaxActiveThreads":0,"rollingCountCommandRejections":0,"propertyValue_queueSizeRejectionThreshold":5,"propertyValue_metricsRollingStatisticalWindowInMilliseconds":10000,"reportingHosts":1}

data:
{"type":"HystrixCommand","name":"getFortune","group":"FortuneService","currentTime":1443629210667,"isCircuitBreakerOpen":false,"errorPercentage":0,"errorCount":0,"requestCount":0,"rollingCountBadRequests":0,"rollingCountCollapsedRequests":0,"rollingCountEmit":0,"rollingCountExceptionsThrown":0,"rollingCountFailure":0,"rollingCountEmit":0,"rollingCountFallbackFailure":0,"rollingCountFallbackRejection":0,"rollingCountFallbackSuccess":0,"rollingCountResponsesFromCache":0,"rollingCountSemaphoreRejected":0,"rollingCountShortCircuited":0,"rollingCountSuccess":0,"rollingCountThreadPoolRejected":0,"rollingCountTimeout":0,"currentConcurrentExecutionCount":0,"rollingMaxConcurrentExecutionCount":0,"latencyExecute_mean":0,"latencyExecute":{"0":0,"25":0,"50":0,"75":0,"90":0,"95":0,"99":0,"99.5":0,"100":0},"latencyTotal_mean":0,"latencyTotal":{"0":0,"25":0,"50":0,"75":0,"90":0,"95":0,"99":0,"99.5":0,"100":0},"propertyValue_circuitBreakerRequestVolumeThreshold":20,"propertyValue_circuitBreakerSleepWindowInMilliseconds":5000,"propertyValue_circuitBreakerErrorThresholdPercentage":50,"propertyValue_circuitBreakerForceOpen":false,"propertyValue_circuitBreakerForceClosed":false,"propertyValue_circuitBreakerEnabled":true,"propertyValue_executionIsolationStrategy":"THREAD","propertyValue_executionIsolationThreadTimeoutInMilliseconds":1000,"propertyValue_executionTimeoutInMilliseconds":1000,"propertyValue_executionIsolationThreadInterruptOnTimeout":true,"propertyValue_executionIsolationThreadPoolKeyOverride":null,"propertyValue_executionIsolationSemaphoreMaxConcurrentRequests":10,"propertyValue_fallbackIsolationSemaphoreMaxConcurrentRequests":10,"propertyValue_metricsRollingStatisticalWindowInMilliseconds":10000,"propertyValue_requestCacheEnabled":true,"propertyValue_requestLogEnabled":true,"reportingHosts":1,"threadPool":"FortuneService"}

data:
{"type":"HystrixThreadPool","name":"FortuneService","currentTime":1443629210667,"currentActiveCount":0,"currentCompletedTaskCount":3,"currentCorePoolSize":10,"currentLargestPoolSize":3,"currentMaximumPoolSize":10,"currentQueueSize":3,"currentTaskCount":3,"rollingCountThreadsExecuted":0,"rollingMaxActiveThreads":0,"rollingCountCommandRejections":0,"propertyValue_queueSizeRejectionThreshold":5,"propertyValue_metricsRollingStatisticalWindowInMilliseconds":10000,"reportingHosts":1}
```

5. Set up hystrix-dashboard

Consuming the metric stream is difficult to interpret on our own. The metric stream can be visualized with the Hystrix Dashboard.

1. Review the `hystrix-dashboard/pom.xml` file. By adding `spring-cloud-starter-hystrix-dashboard` to the classpath, this application exposes a Hystrix Dashboard.

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

2. Review the file `hystrix-dashboard/src/main/java/io/pivotal/HystrixDashboardApplication.java`. Note the use of the `@EnableHystrixDashboard` annotation. This creates a Hystrix Dashboard.

```
package io.pivotal;

import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.netflix.hystrix.dashboard.EnableHystrixDashboard;

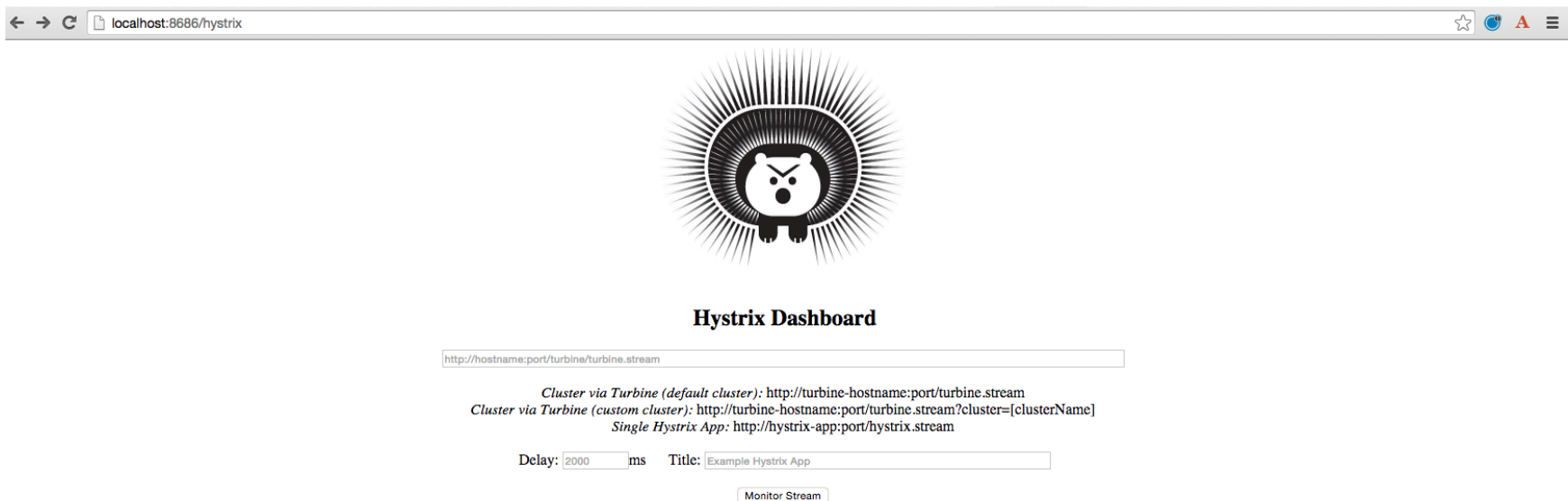
@SpringBootApplication
@EnableHystrixDashboard
public class HystrixDashboardApplication {

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

3. Open a new terminal window. Start the `hystrix-dashboard`

```
$ cd hystrix-dashboard
$ mvn spring-boot:run
```

4. Open a browser to `http://localhost:8686/hystrix`



5. Link the `hystrix-dashboard` to the `greeting-hystrix` app. Enter `http://localhost:8080/hystrix.stream` as the stream to monitor.
6. Experiment! Refresh the `greeting-hystrix` root endpoint several times. Take down the `fortune-service` app. What does the dashboard do? Review the [dashboard doc](https://github.com/Netflix/Hystrix/wiki/Dashboard) (<https://github.com/Netflix/Hystrix/wiki/Dashboard>) for an explanation on metrics.

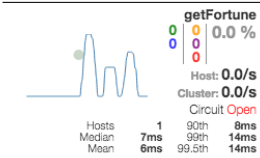
Hystrix Stream: http://localhost:8080/hystrix.stream



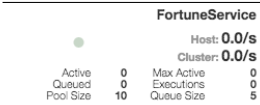
Circuit

Sort: [Error then Volume](#) | [Alphabetical](#) | [Volume](#) | [Error](#) | [Mean](#) | [Median](#) | [90](#) | [99](#) | [99.5](#)

Success | [Short-Circuited](#) | [Timeout](#) | [Rejected](#) | [Failure](#) | [Error %](#)



Thread Pools Sort: [Alphabetical](#) | [Volume](#) |



It's not always convenient to refresh your application's endpoint multiple times to attempt to get a circuit to open or close. Using a tool such as [ab](https://httpd.apache.org/docs/2.4/programs/ab.html) (<https://httpd.apache.org/docs/2.4/programs/ab.html>) is often more practical.