Spring Cloud – Circuit Breaker

Creating Services in a cloud Native architecture that are both fault tolerant and self-healing.

Outline

Spring Cloud Circuit Breaker using Hystrix
by Pratap Kumar

- Failures in a distributed system
  - Cascading failures
  - Circuit breaker pattern
- Netflix Hystrix Project
  - @EnableCircuitBreaker
  - @HystrixCommand
- Hystrix Dashboard
  - @EnableHystrixDashboard
  - Turbine to aggregate Hystrix streams
    - @EnableTurbine

Intro

Spring Cloud Circuit Breaker using Hystrix
by Pratap Kumar

- **In a Distributed System one thing is absolutely certain , i.e. Failure is Inevitable**

Intro

Spring Cloud Circuit Breaker using Hystrix
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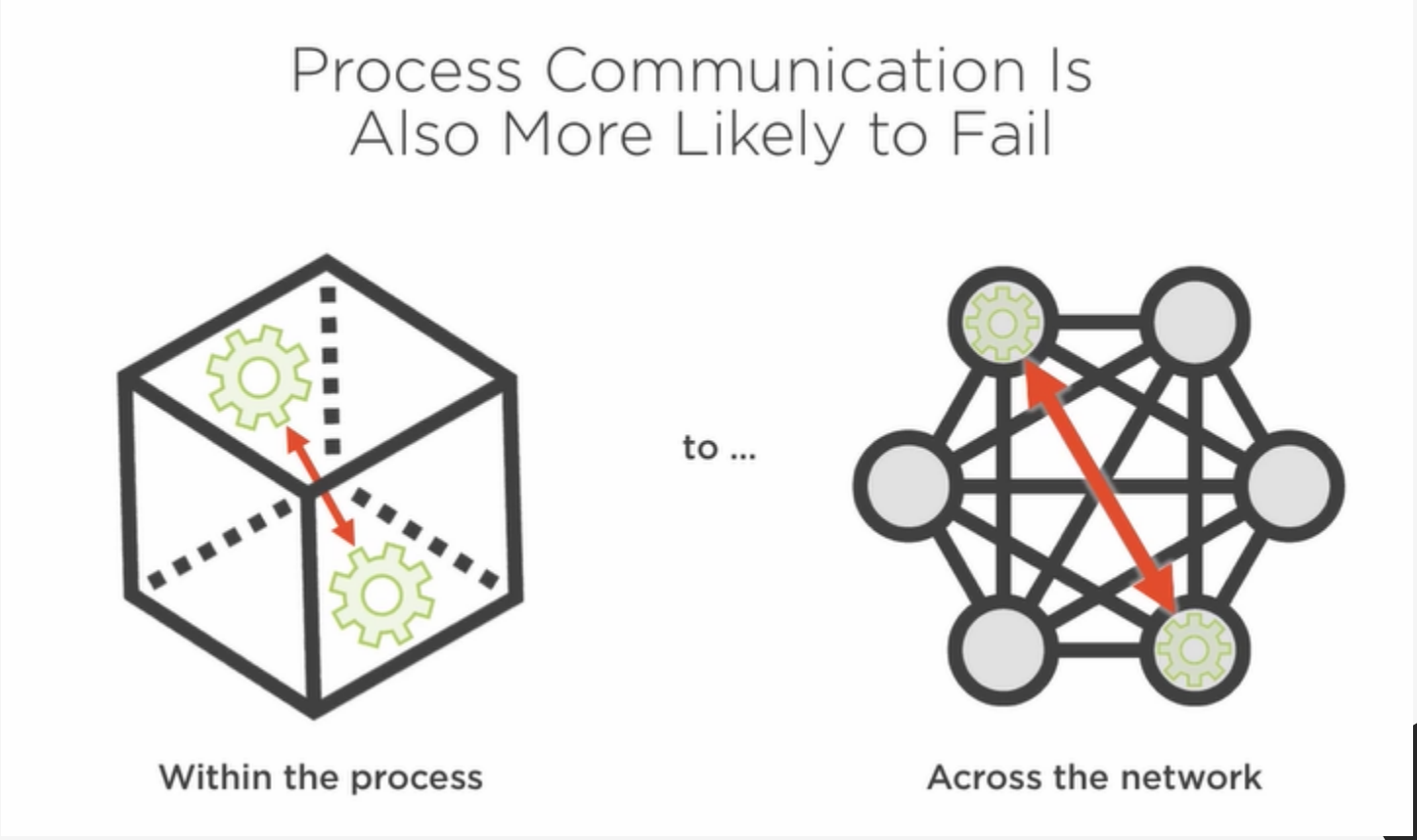
- **The chance of failure becomes multiplied in a distributed system**



Cascading Failure

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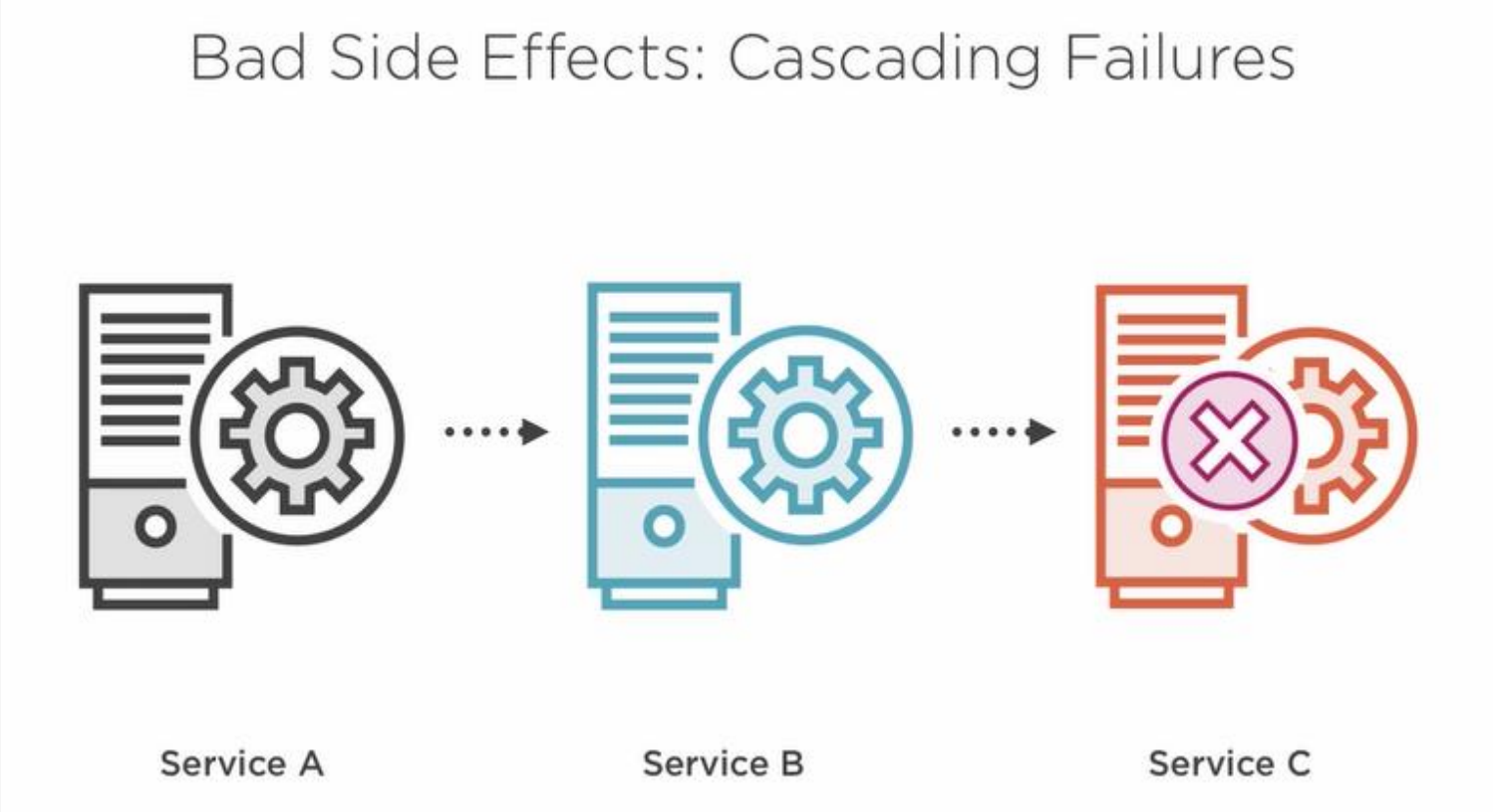
- "... a failure in a system of interconnected parts in which the failure of a part can trigger the failure of successive parts."



Cascading Failure

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- Multiple issues at play
  - Fault tolerance problem
  - Resource overloading problem

Solution

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- So, What can we do?
- How can we solve this?

- Learn to embrace failure
  - Tolerate failures
  - Gracefully degrade

- Limit resources consumed
  - Constrain usages

Circuit Breaker Pattern

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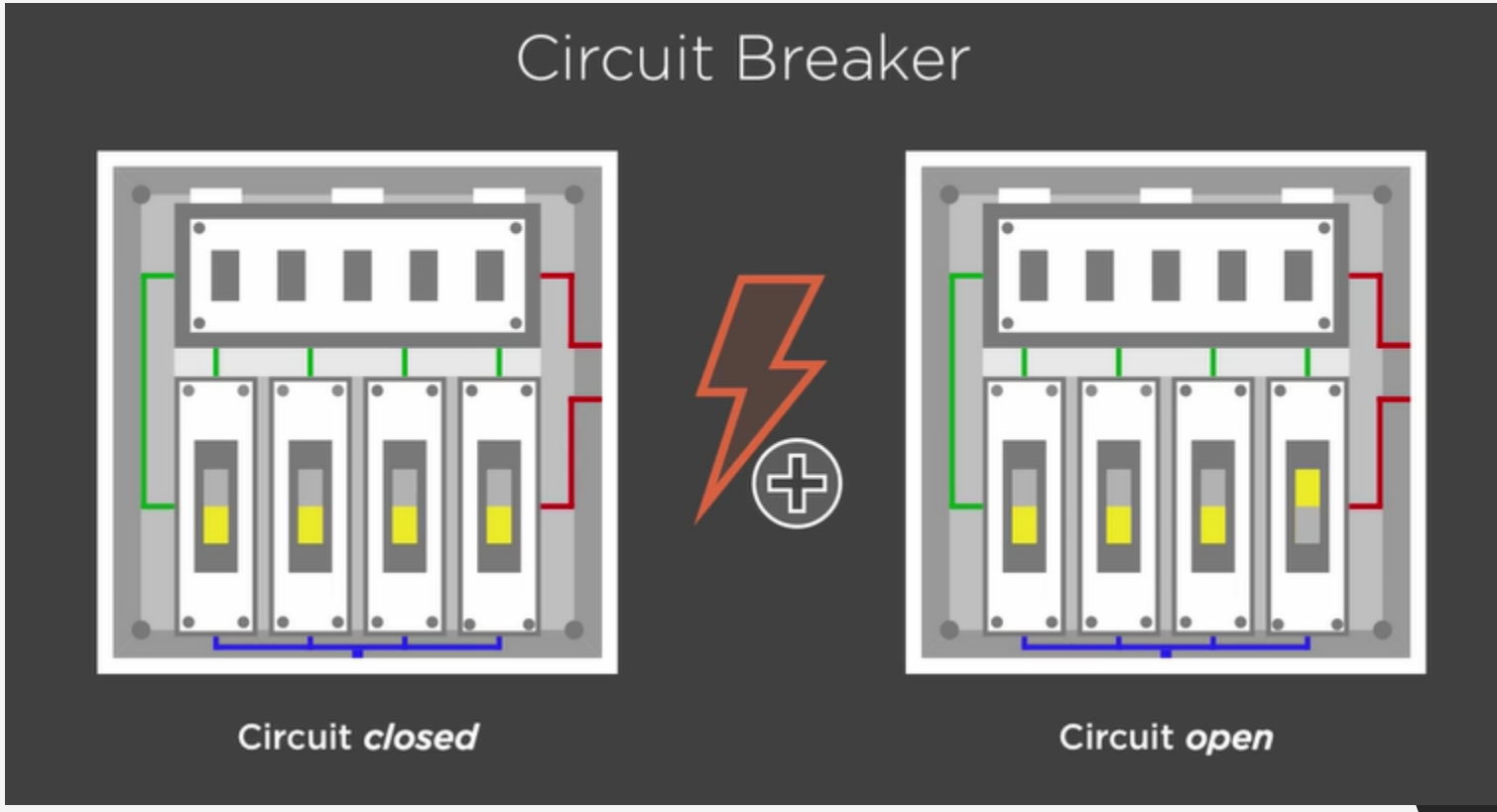
- A design pattern in modern software development used to detect failures and encapsulates logic of preventing a failure to reoccur constantly



Fault Tolerance with Netflix Hystrix and Spring Cloud

- **Hystrix is a latency and fault tolerance library designed to stop cascading failure and enable resilience in complex distributed system where failure is inevitable.**

- **Implements the circuit breaker pattern**
  - Wraps calls and watches for failures
    - 10 sec rolling window
    - 20 request volume
    - >=50% error rate
  - Waits and tries a single request after 5 sec
  - Fallbacks
- **Protects services from being overloaded**
  - Thread pools, semaphores, & cascading failures

Using Spring Cloud & Netflix Hystrix

Spring Cloud Circuit Breaker using Hystrix
by Pratap Kumar

Using Spring Cloud & Netflix Hystrix

pom.xml

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

Using Spring Cloud & Netflix Hystrix

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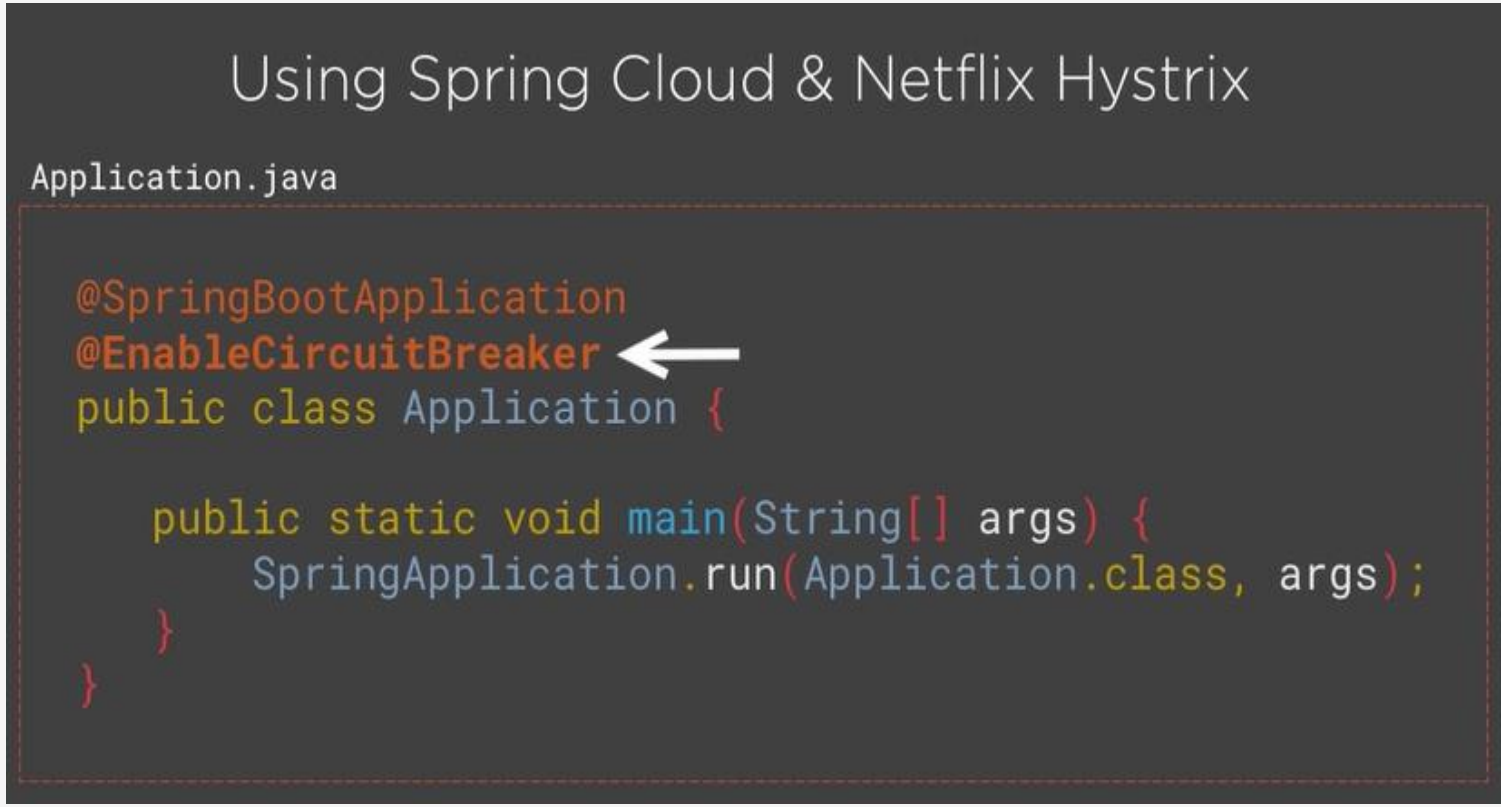

Using Spring Cloud & Netflix Hystrix

Spring Cloud Circuit Breaker using Hystrix
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Using the @HystrixCommand Annotation

Service.java

```java
@Service
public class Service {

    @HystrixCommand(fallbackMethod = "somethingElse")
    public void doSomething() {
        ...
    }

    public void somethingElse() {
        ...
    }
}
```

Spring Cloud Circuit Breaker using Hystrix
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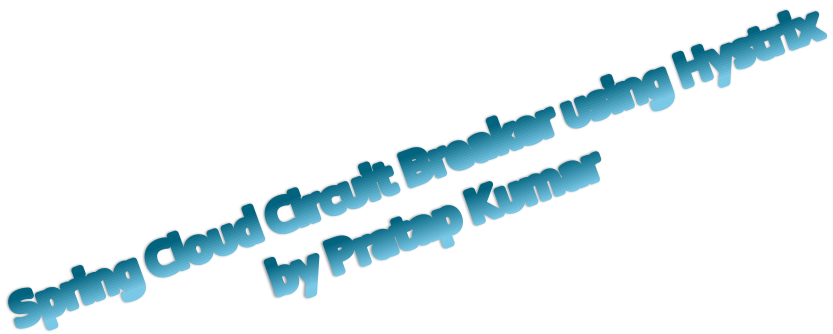
- Be careful with Hystrix timeouts
  - Ensure timeouts encompass caller timeouts plus any retries
  - Default : 1000ms
  - hystrix.command.default.execution.isolation.thread.timeoutInMilliseconds=<timeout_ms>

Setup

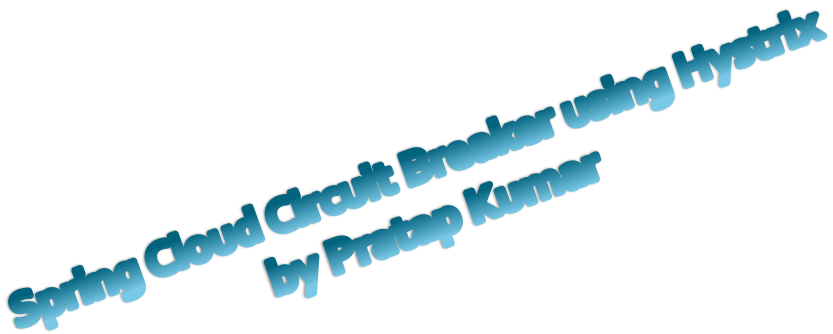
Spring Cloud Circuit Breaker using Hystrix
by Pratap Kumar

- discovery-server
  - actuator, devtools, Eureka Server
- weather-service
  - web , Eureka Discovery
- weather-app
  - web, Eureka Discovery, Hystrix, Actuator
  - Note : @HystrixCommand can be only used with @Component / @Service class

Monitor Hystrix Metrics in Real Time with the Hystrix Dashboard



What is Hystrix Dashboard?



- Netflix Hystrix tracks the execution status of protected calls, so that it knows when to trip the circuit breaker.
- One of the advantage of this is that we can use these metrics to get insight into how our calls are functioning.
- Reading these metrics in its raw form wouldn't be easy or efficient.
- The Hystrix Dashboard helps us here.
- The Dashboard is a web application that helps you to visualize all of those metrics in a quick and easy to use way.

What is Hystrix Dashboard?

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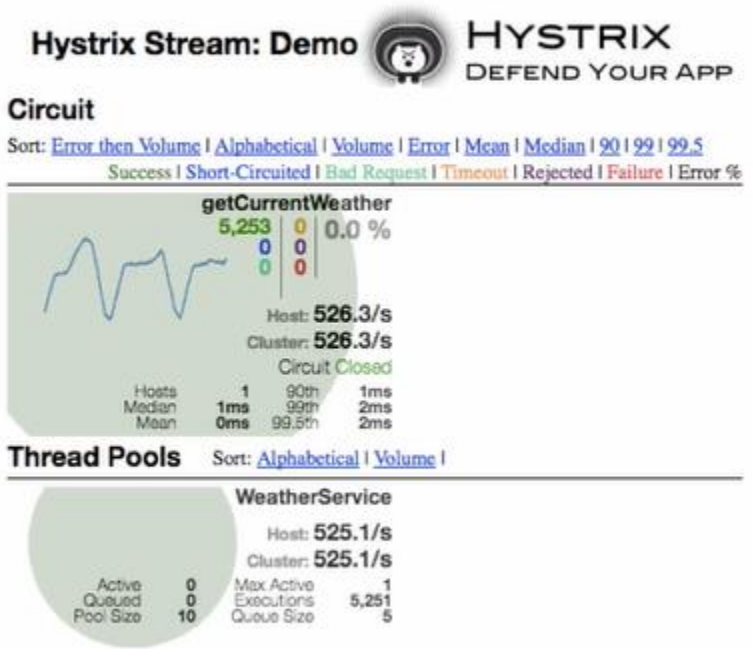
Tracks metrics such as

Circuit state
Error rate
Traffic volume
Successful requests
Rejected requests
Timeouts
Latency percentiles

Monitor protected calls

Single server or cluster



Using Spring Cloud & Hystrix Dashboard

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by Pratap Kumar

pom.xml

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

Using Spring Cloud & Hystrix Dashboard

Application.java

```java
@SpringBootApplication
@EnableHystrixDashboard
public class Application {

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

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Understanding the Dashboard

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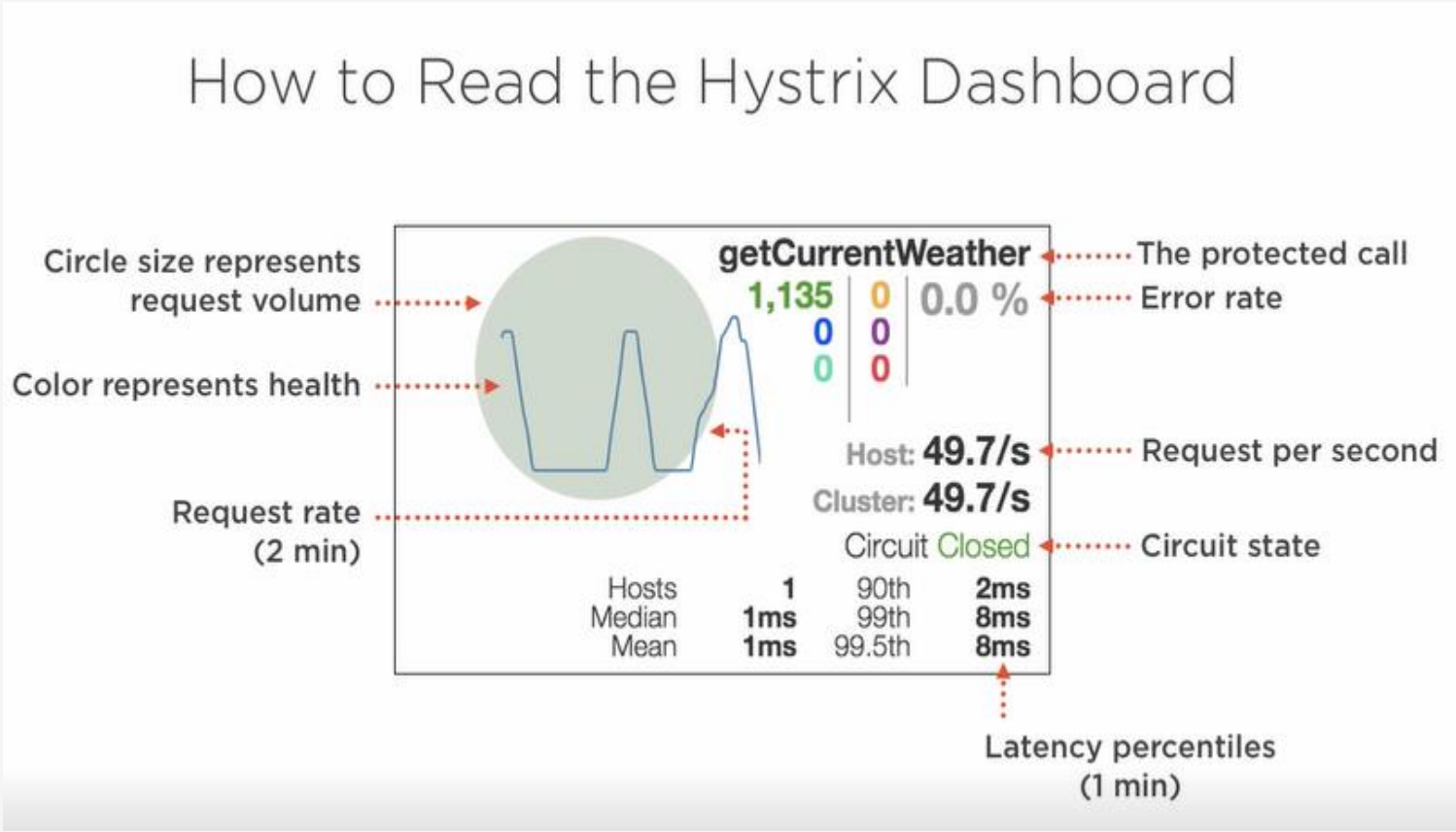

Hystrix Dashboard project

- Hystrix-dashboard
  - Hystrix-dashboard (dependencies)
  - http://localhost:8080/hystrix
  - http://localhost:8000/actuator/hystrix.stream
  - Title WeatherApp
  - Make sure the weatherapp include the following entry in application.properties file
  - management.endpoints.web.exposure.include=*

Limitation of Hystrix Dashboard

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- Hystrix metrics are tracked on a service by service basic.
- A single Hystrix stream might have metrics on more than one Hystrix protected call but those metrics are only for that service.
- The implication of this are that every service has its own Hystrix stream URL
- if you wanted to track the metrics for multiple services then you have to open up multiple Hystrix dashboard and track them independently.
- Viewing multiple Hystrix metrics, all at different URLs, could make you very grumpy!

Using Spring Cloud & Netflix Turbine

To Solve the Limitations of Hystrix, Netflix Developed a tool called as Turbine .

"Turbine is a tool for aggregating streams Server Sent Event (SSE) JSON data into a single stream... "

Turbine

- New Starter project
  - Turbine Dashboard
  - Dependencies
    - Turbine, Hystrix, Hystrix-Dashboard, Actuator

```
@SpringBootApplication
@EnableTurbine
@EnableHystrixDashboard
public class TrubineDashboardApplication {

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

Turbine

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- application.properties
  - server.port=8989
  - spring.application.name=turbine-dashboard
  - eureka.client.service-url.defaultZone=http://localhost:8761/eureka
  - turbine.app-config=weather-app,weather-app-second
  - turbine.cluster-name-expression='default'

Using Spring Cloud & Netflix Turbine

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Res

- https://www.baeldung.com/resilience4j
- https://www.youtube.com/watch?v=ADHcBxEXvFA&list=PLhfHPmPYPPRk5WxsLhQIOEznHEeFJAoVM&index=1