How to Make Microservices More Resilient

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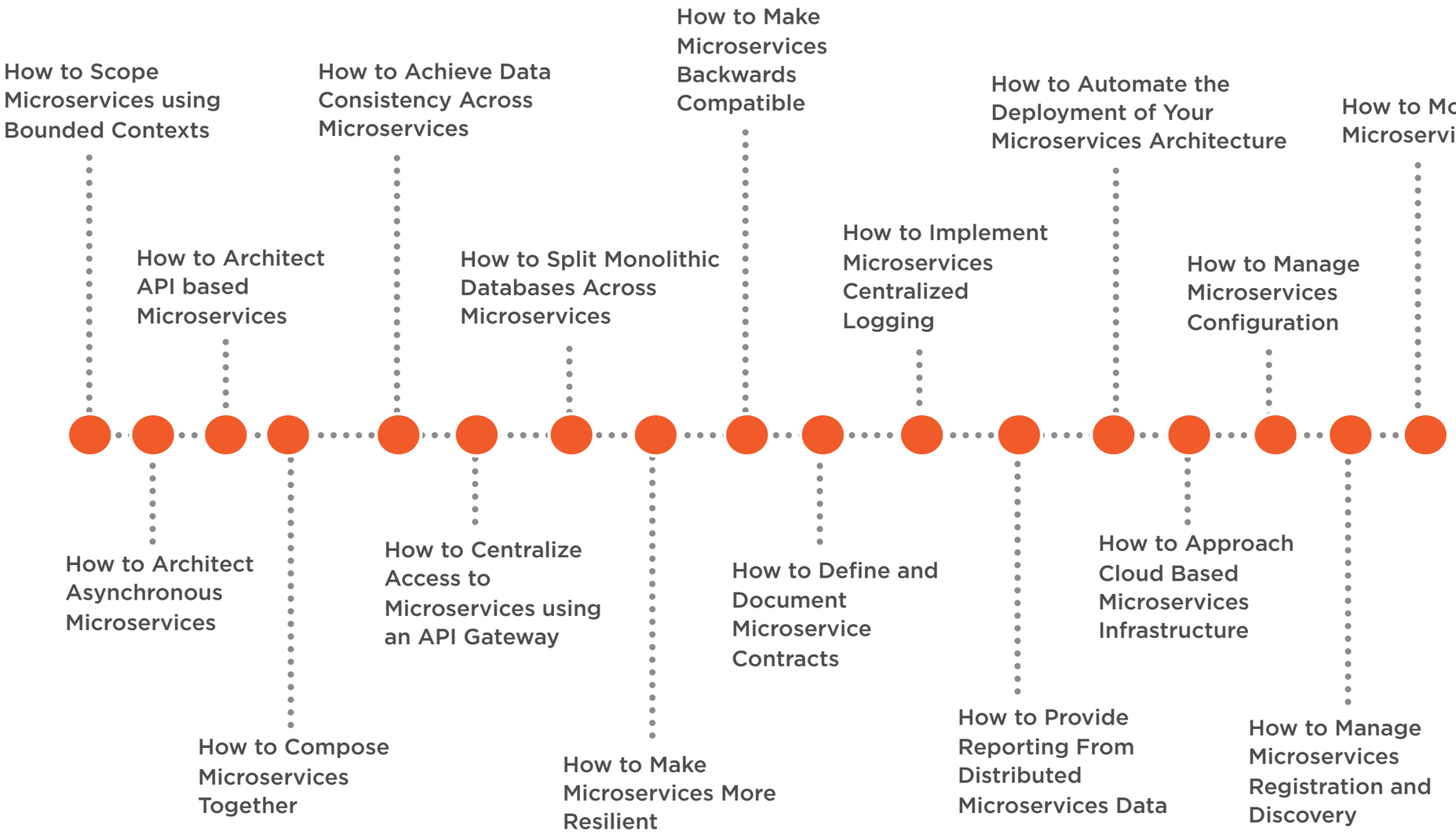
Microservices Architectural Design Patterns Playbook



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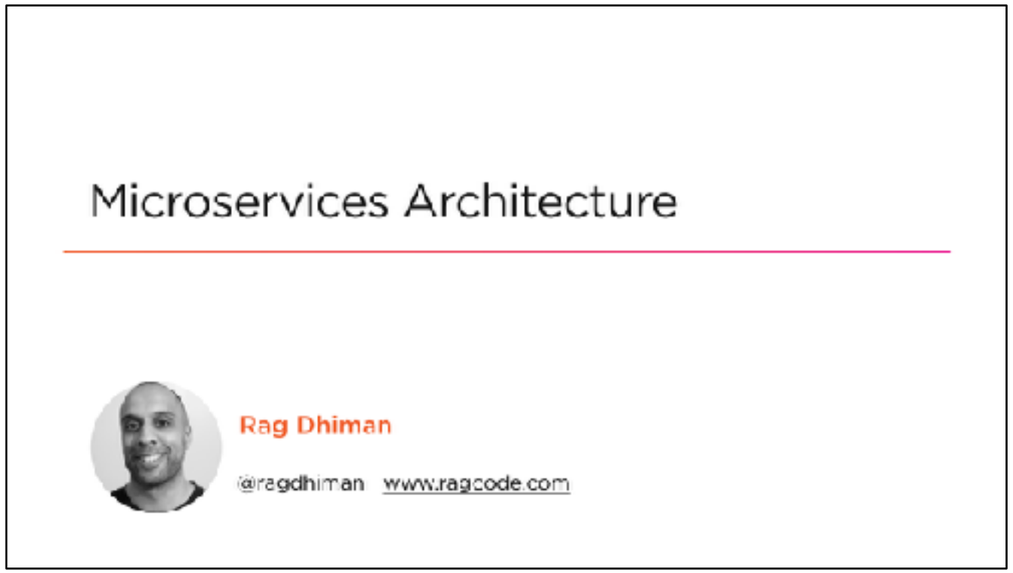


Overview

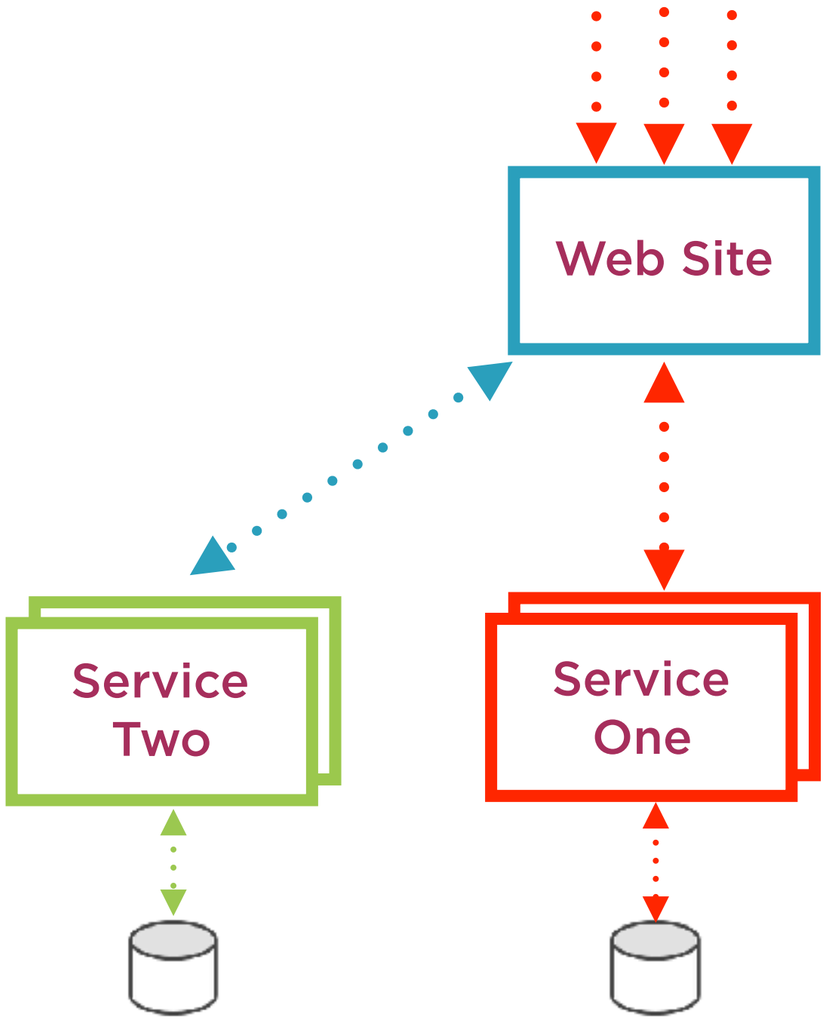
Introduction

Patterns and Approach

Design Patterns

Approach to Design

Introduction



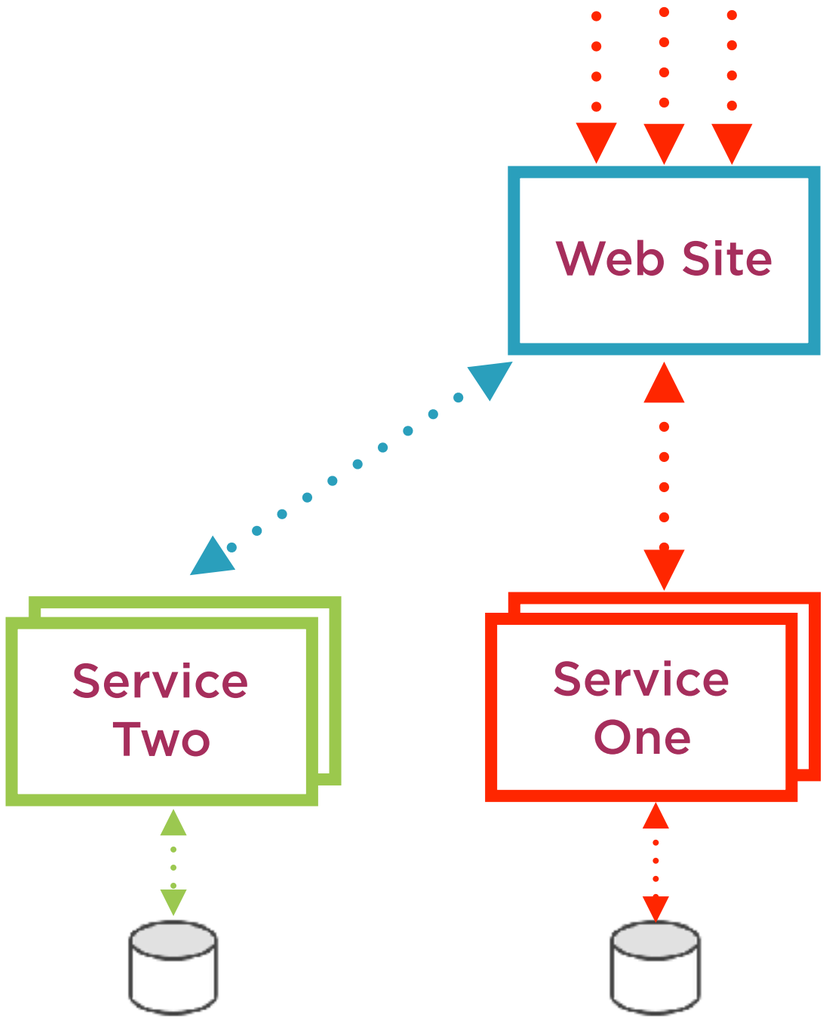
Need for resiliency

- Distributed architecture
- Communication over a network
- Fault tolerance required
- Avoid cascading failures
- Avoid exhausting resource pools

Types of failure

- Hardware
- Infrastructure
- Communication layer
- Dependencies
- Microservices

Patterns and Approach



Design patterns for resiliency

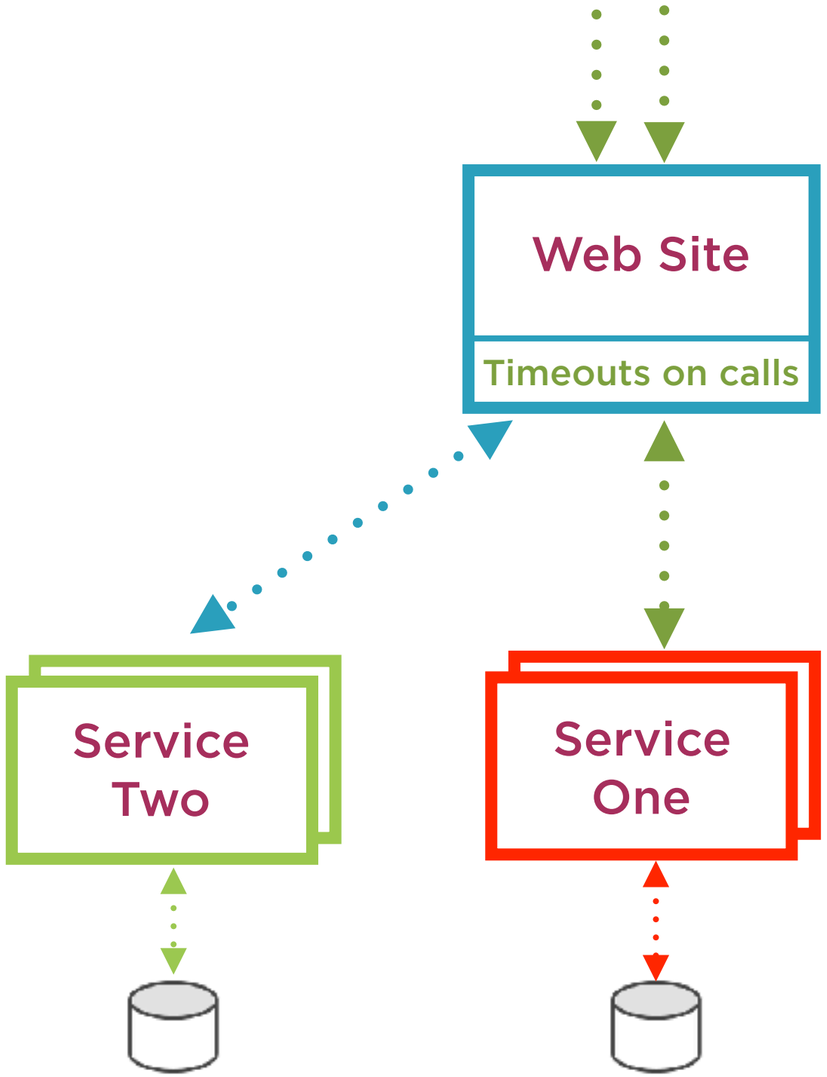
- Timeouts
- Circuit Breaker
- Retry
- Bulkhead

Approach to software development

- Design for known failures
- Embrace failures
- Fail fast
- Degrade or default functionality

Timeouts Design Pattern

Timeouts



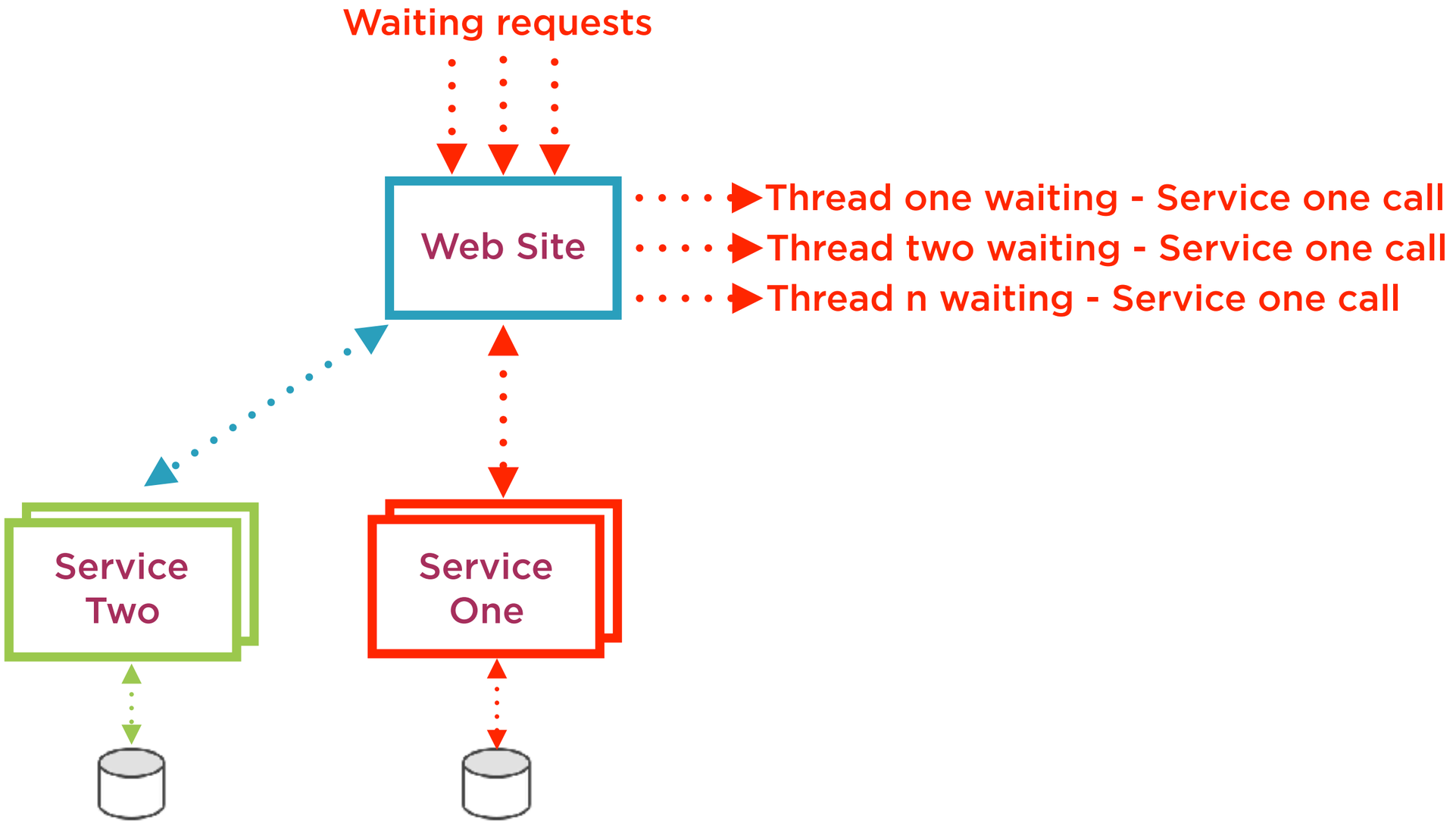
Client calling code

- Explicitly configure timeout value
- Do not rely on default timeout values
- Configurable value
- Can be used with retries

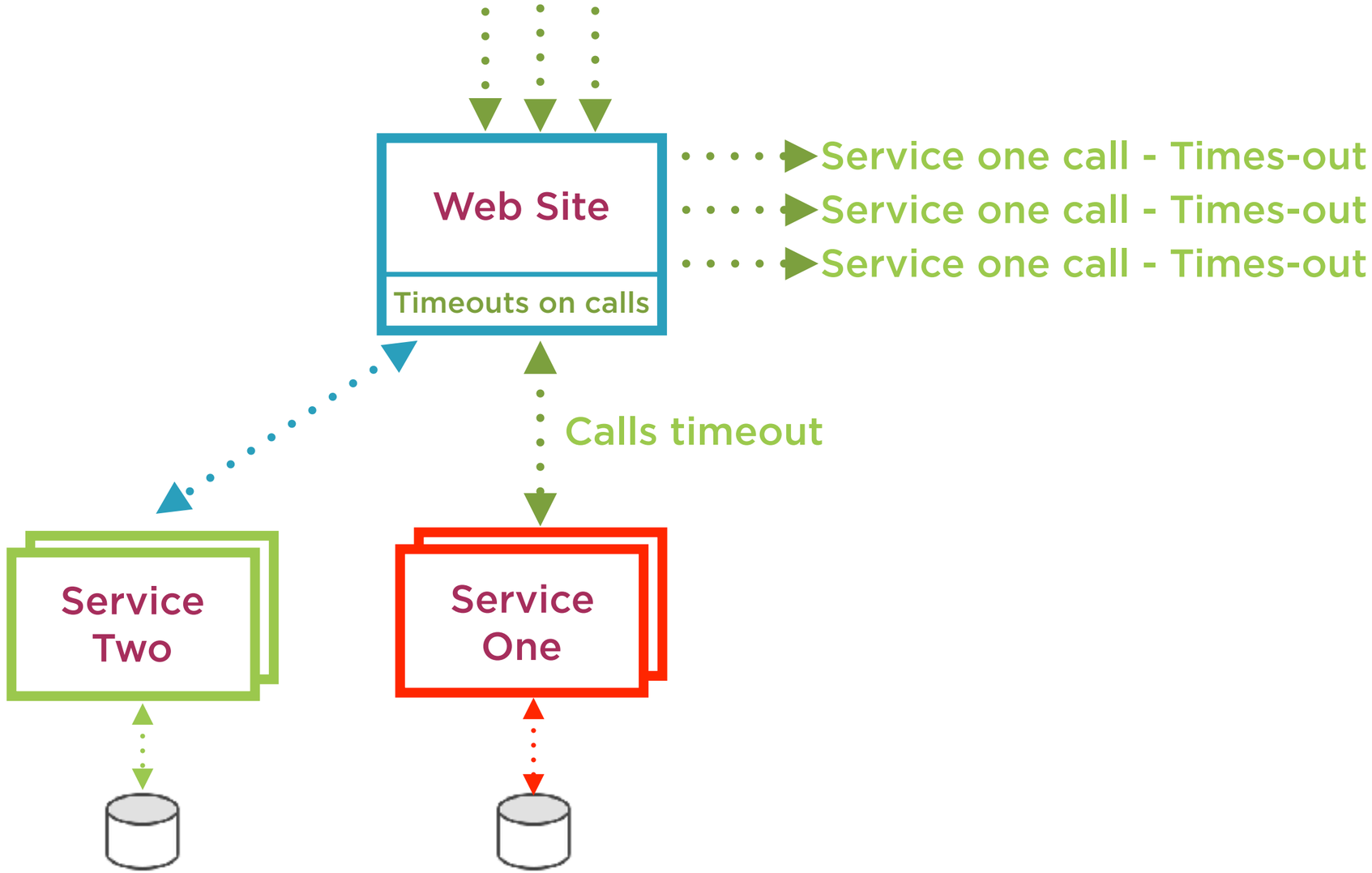
Advantage of timeouts

- Avoid waiting for a response forever
- Frees up calling thread
- Allows you to handle call failure
- Supported by nearly all client technologies

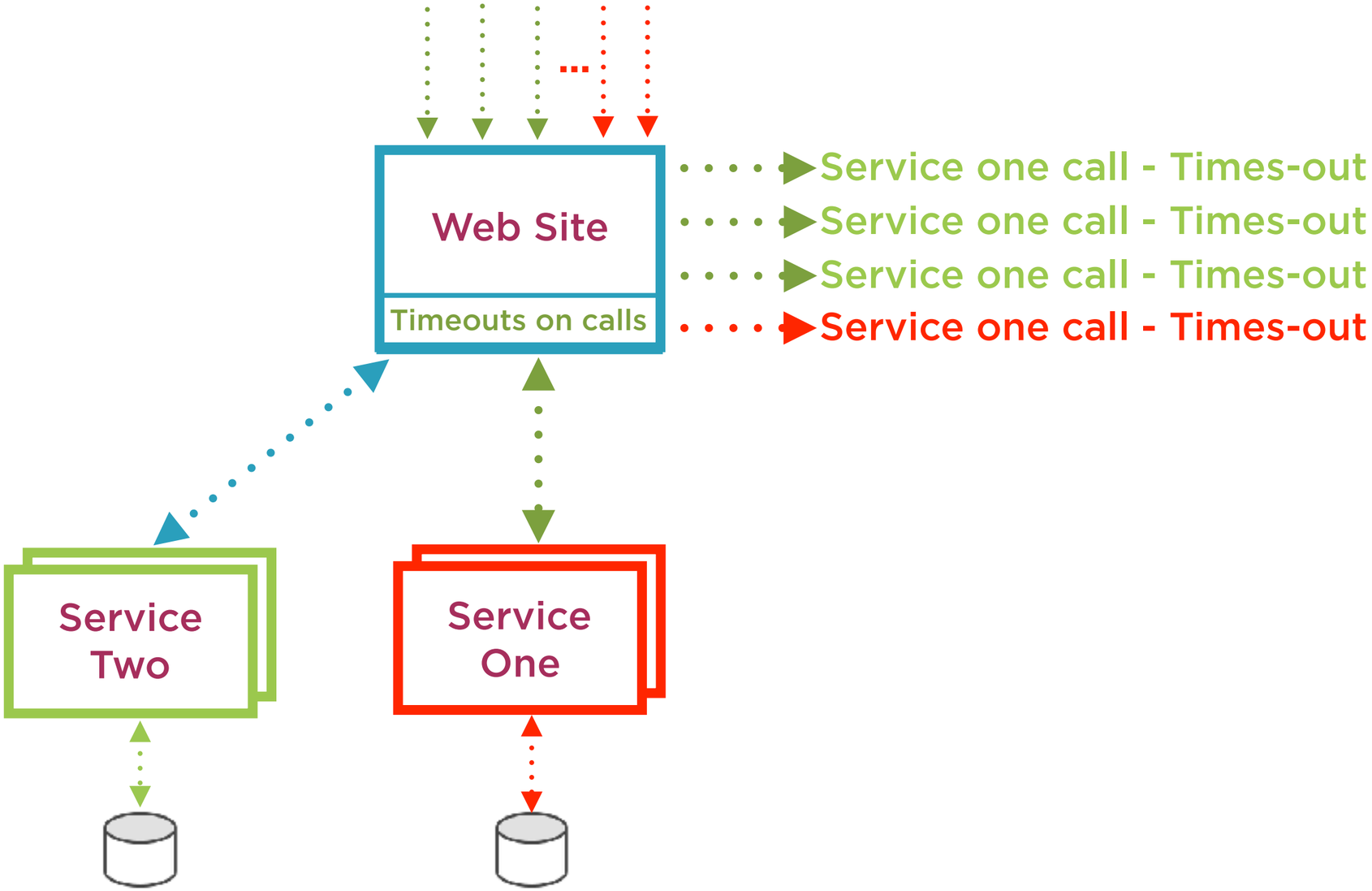
Example of Failure



Example of Timeouts Handling Failure

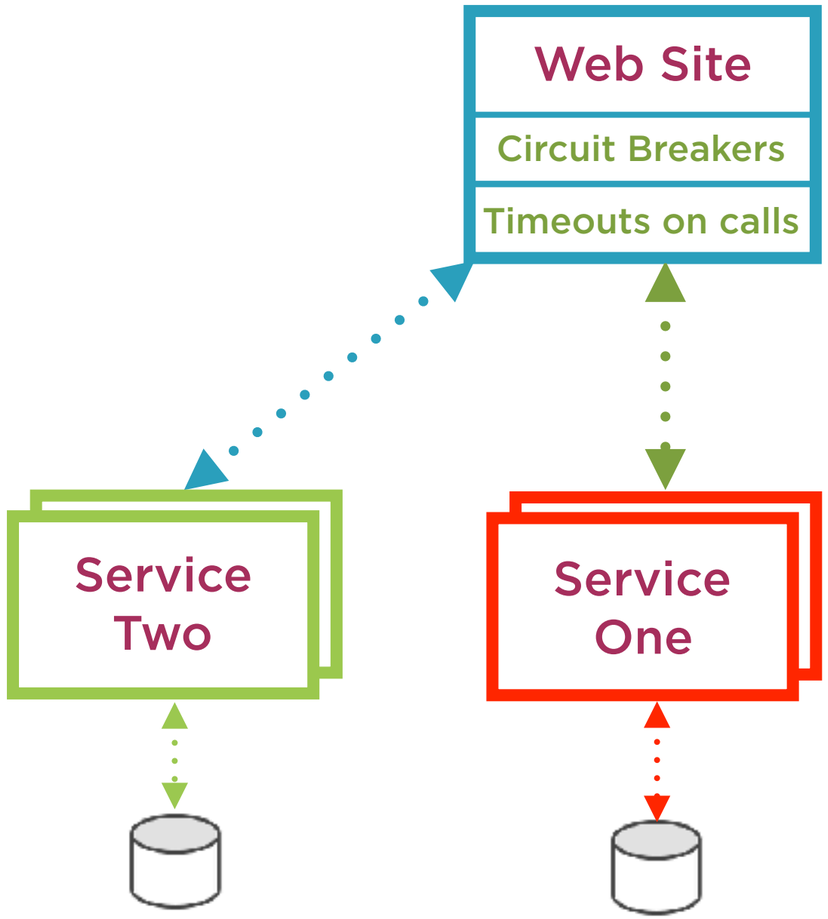


Example of Failure With Timeouts



Circuit Breaker Design Pattern

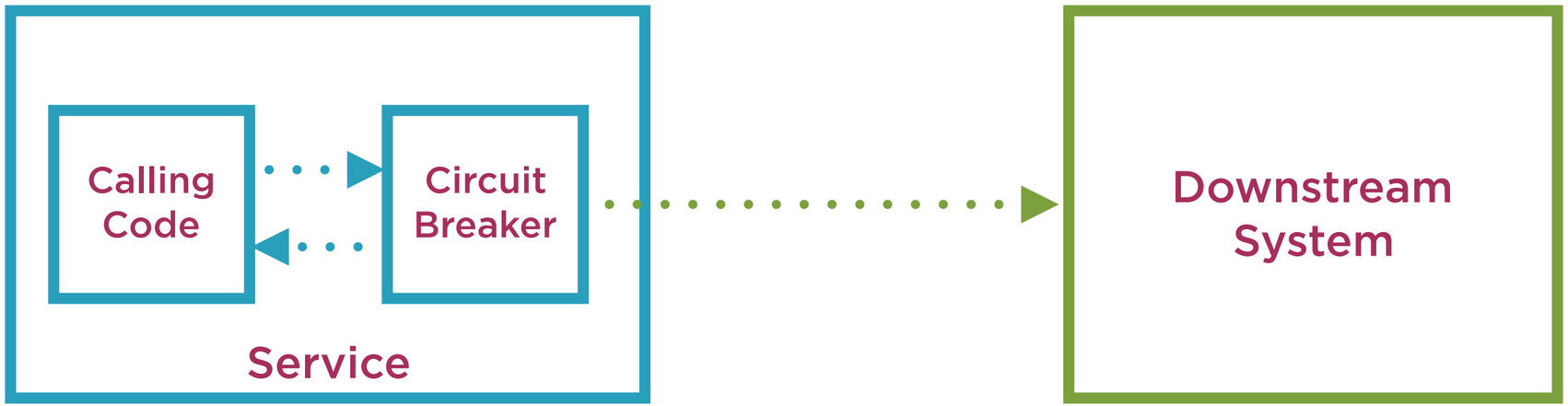
Circuit Breaker Design Pattern



Circuit breaker

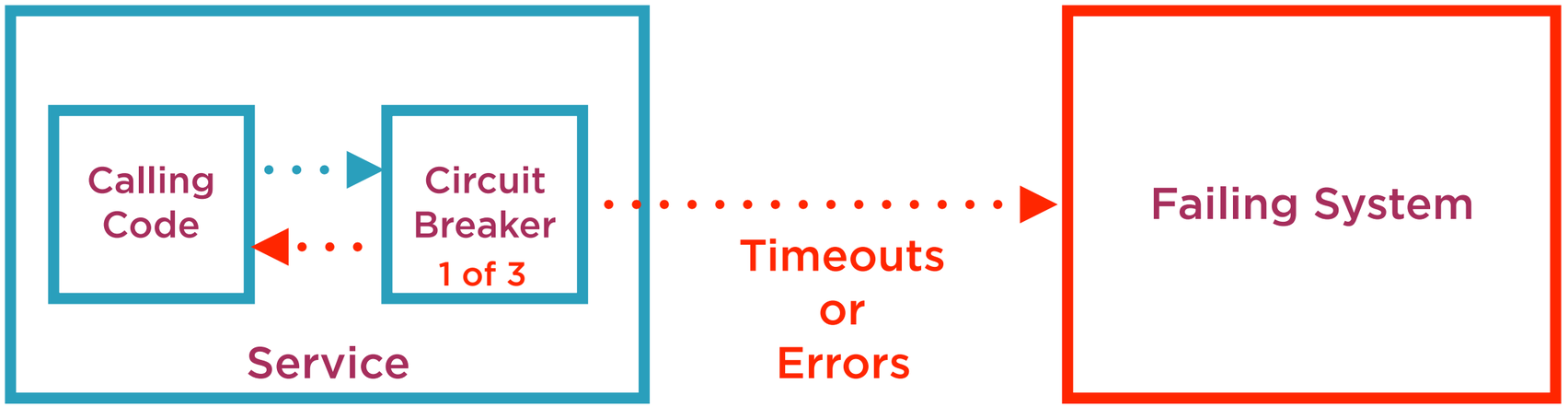
- Object which wraps calls
- Monitors for failures
- Trips after reaching threshold
  - Circuit is open
  - Returns an error without making call
- Different thresholds for different issues
- Reset after a number of tries
- Way to default of degrade functionality
- Avoids cascading failures
- Use for all synchronous calls
- Always report: monitor and log state

Circuit Breaker Design Pattern



Circuit Closed State

Circuit Breaker Design Pattern



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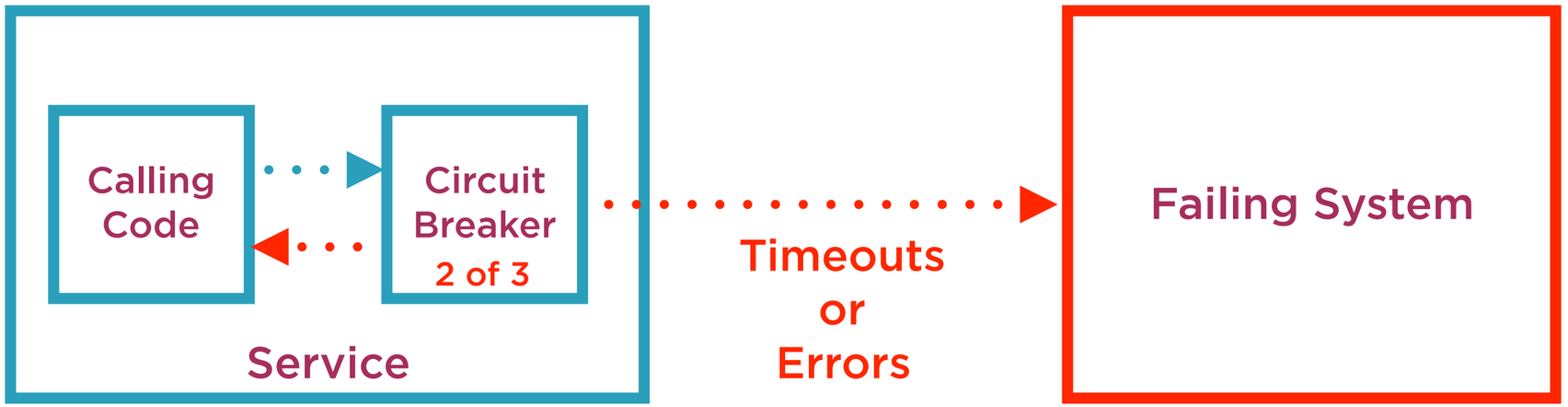

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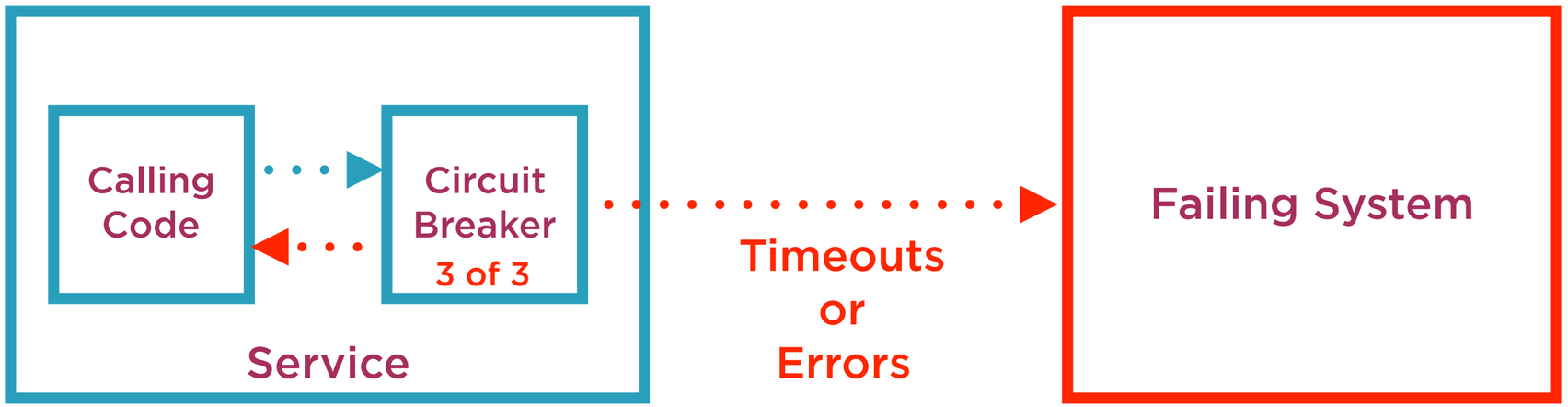


Circuit Closed State

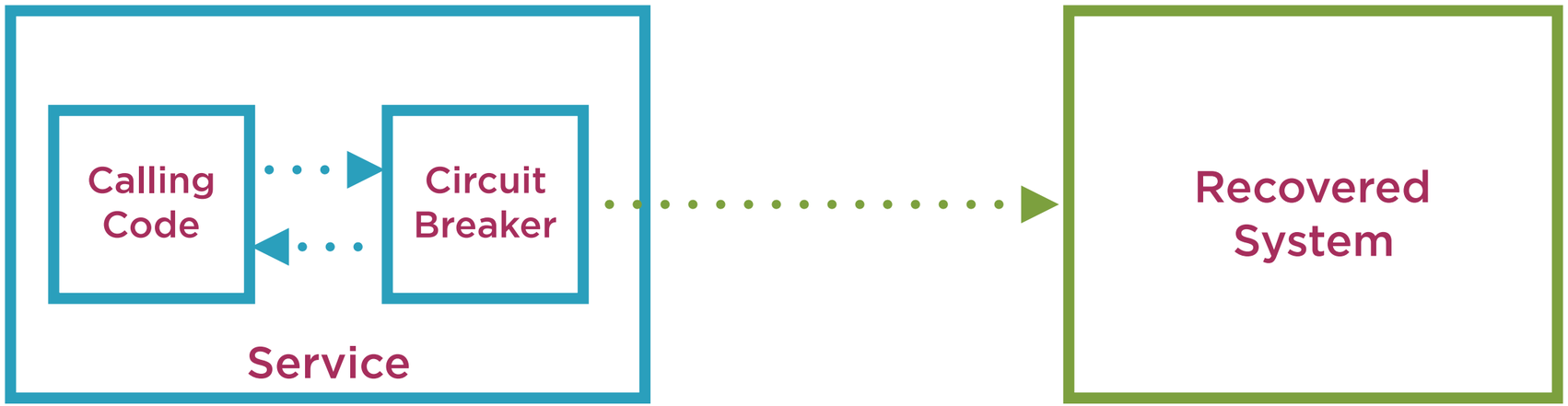
Circuit Breaker Design Pattern

Circuit Open State

Circuit Breaker Design Pattern

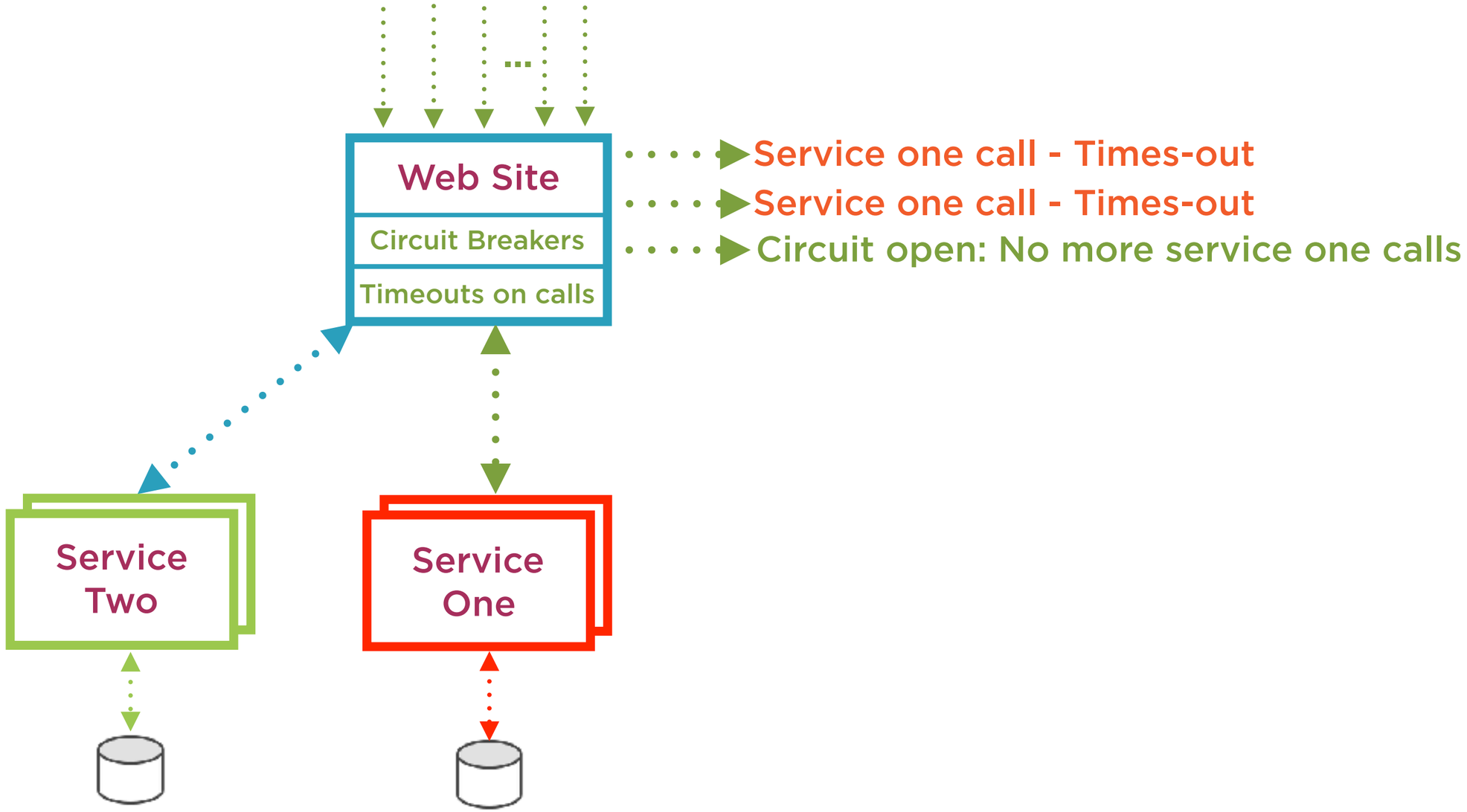
Circuit Half-Open State

Circuit Breaker Design Pattern

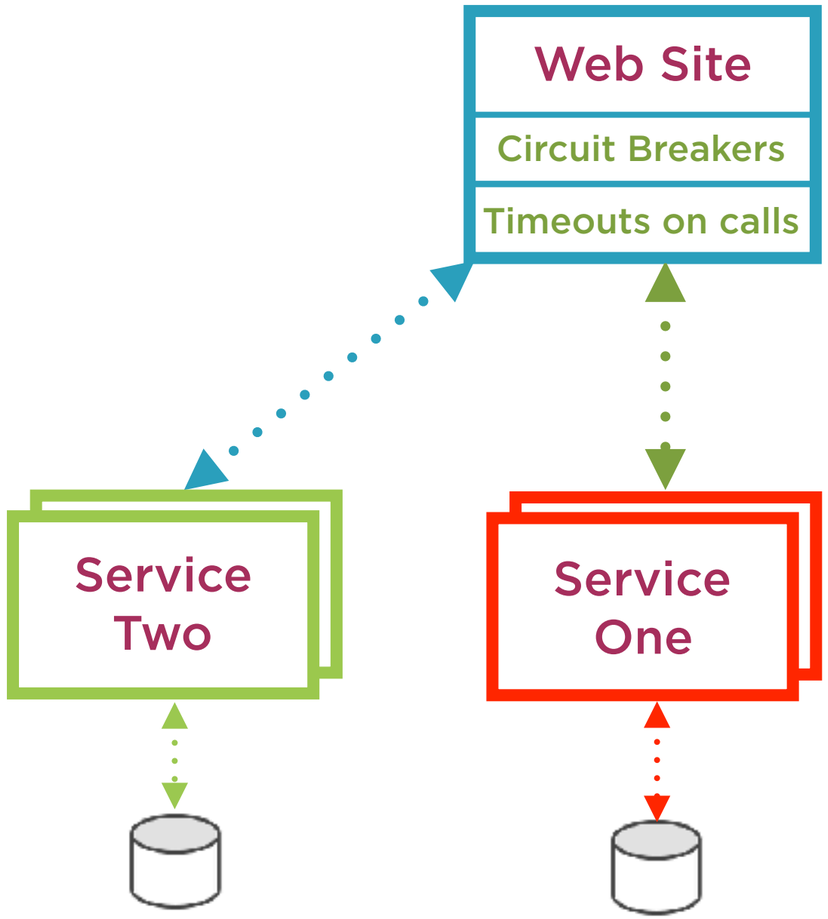


Circuit Closed State

Example of Circuit Breaker Handling Failure



Implementing Circuit Breaker



Develop your own

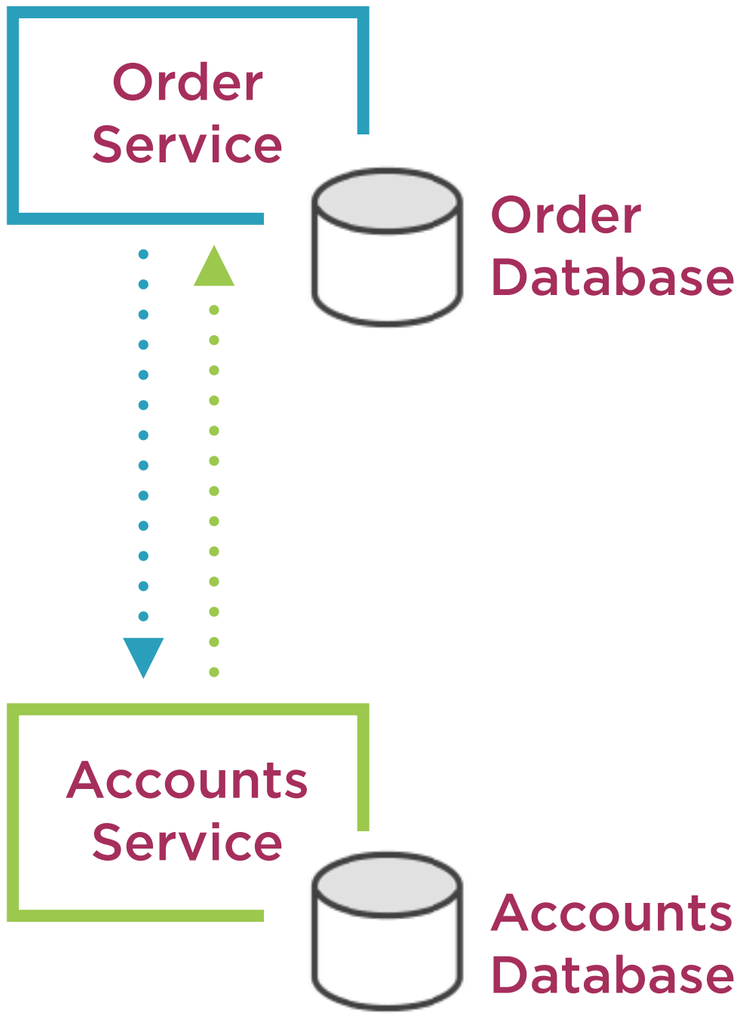
- Many open source examples
- Make thread safe
- Make configurable
  - Failure/timeout threshold
  - Open state duration

Third-party libraries

- Thepollyproject.org
- Hystrix
- and many more...

Retry Design Pattern

Retry Design Pattern



Ideal for transient faults

- Momentary loss of connectivity
- Temporary unavailability of service
- Timeouts when service is busy
- Service throttles accepted requests
- Faults self correct

Strategies

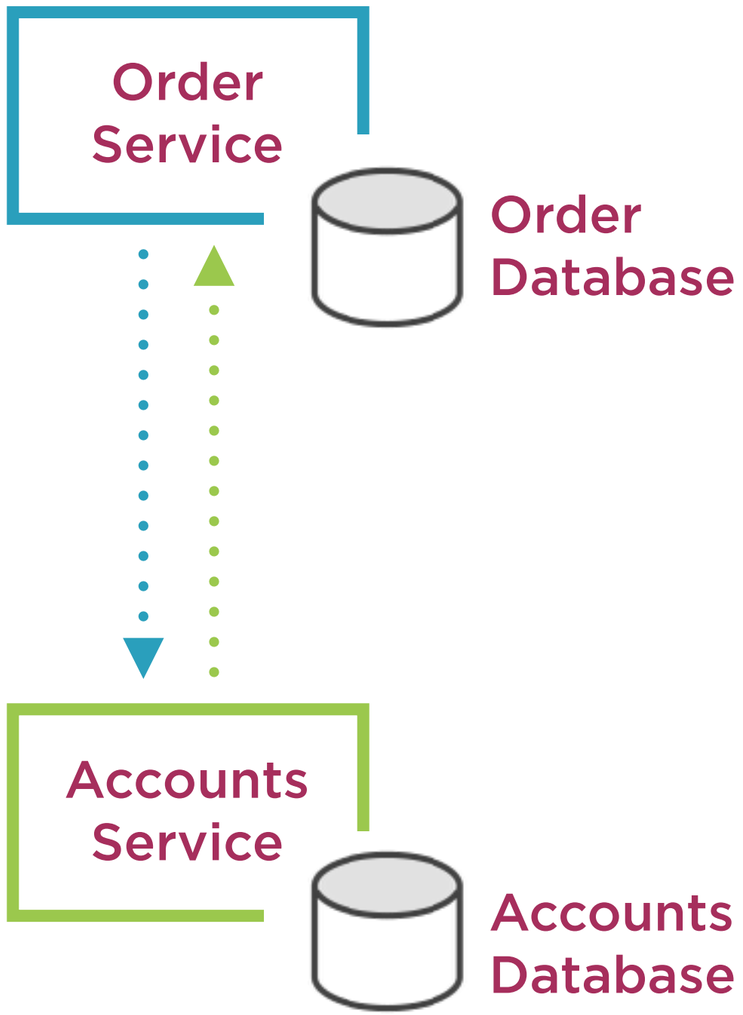
- Retry
- Retry after delay
- Cancel

Log and monitor occurrences

Use in conjunction with circuit breakers

Bulkheads Design Pattern

Bulkheads Design Pattern



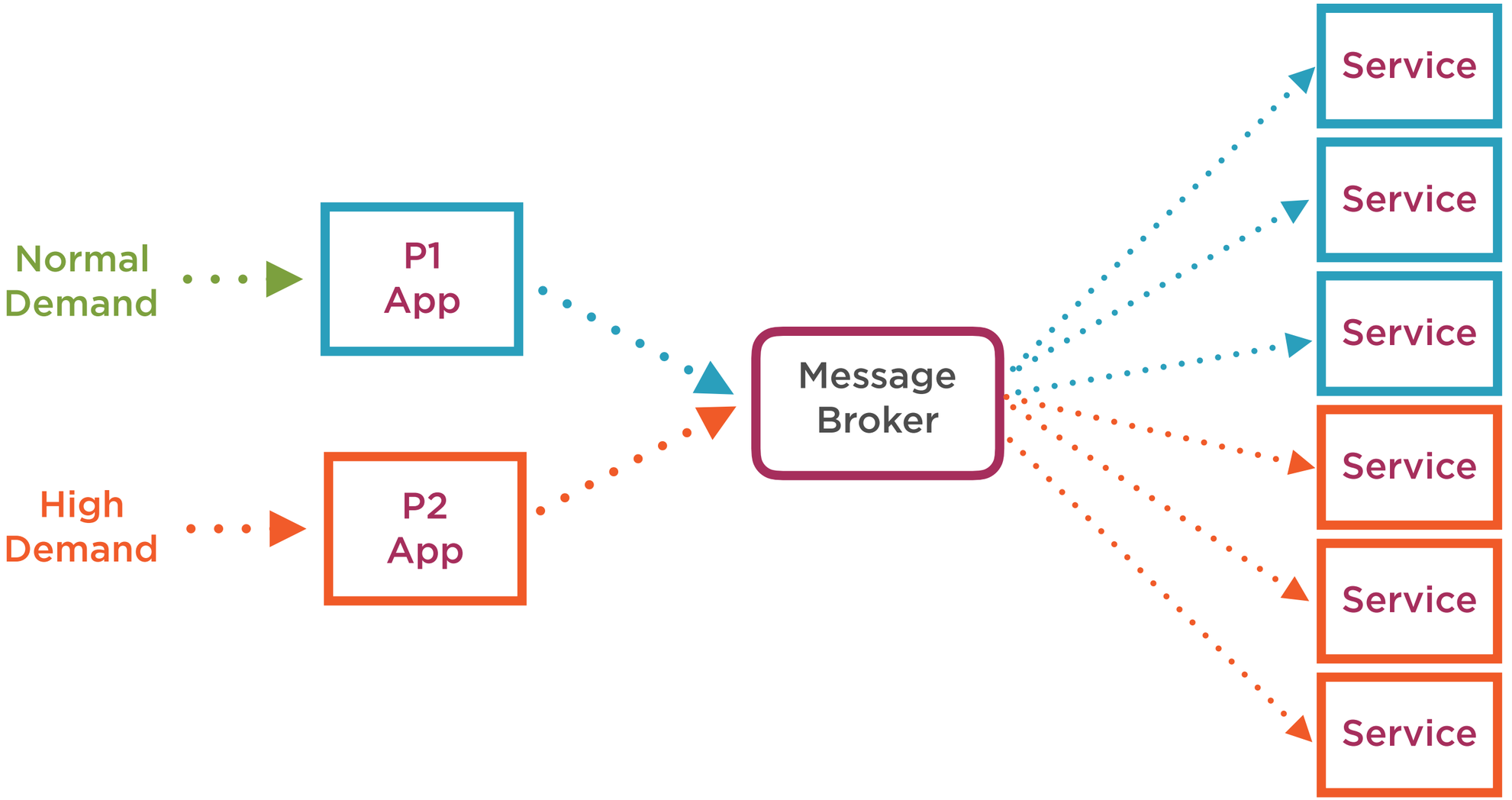
High-level design pattern

- Way of sealing off failure
- Shipping bulkhead analogy
- Avoid cascading failures
- Separate from failed component
- Ensure degraded functionality

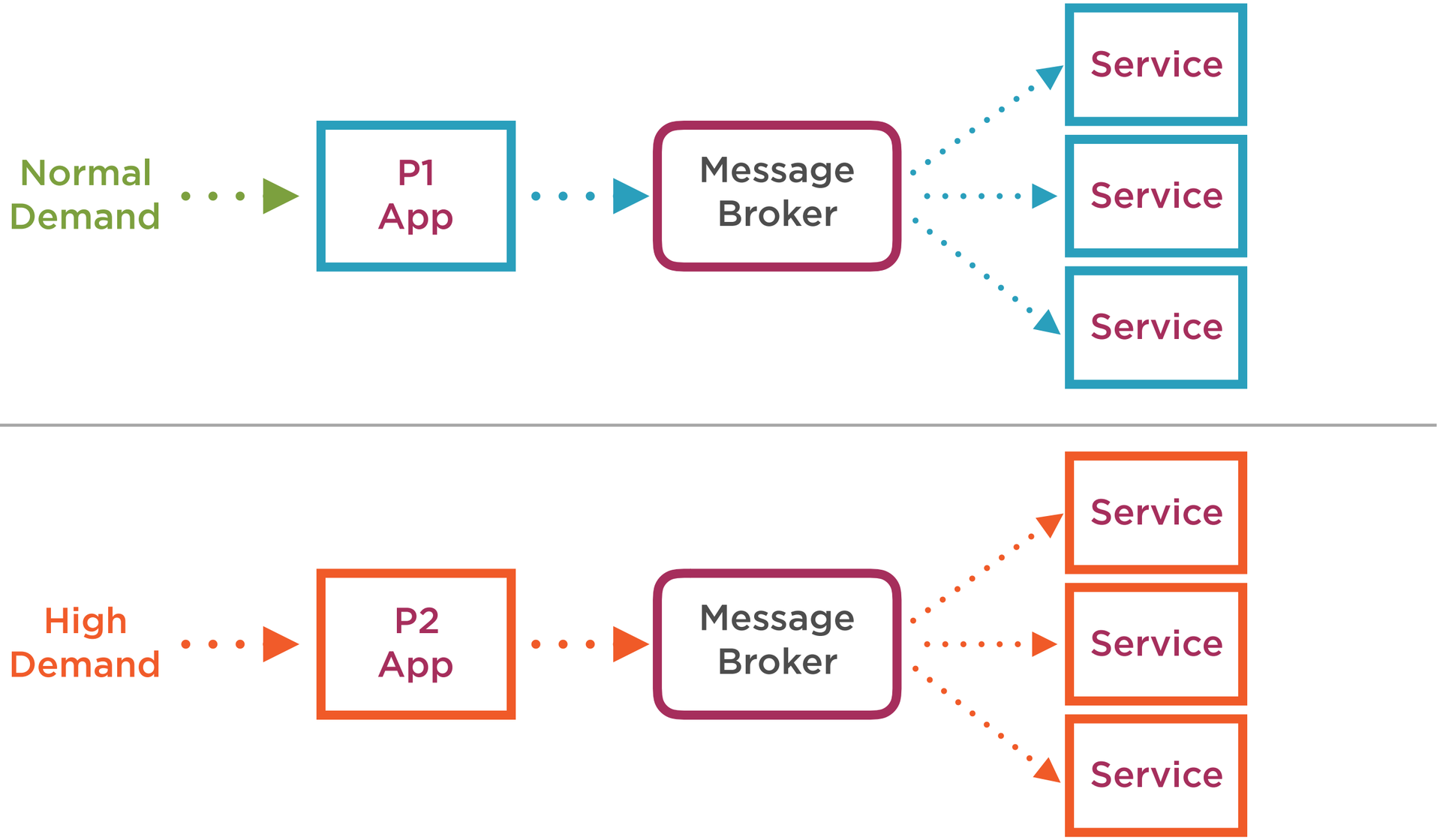
How?

- Separation by criticality
- Isolated microservices
- Redundancy
- Circuit breakers for all synchronous calls
- Rejecting calls using Load Shedding

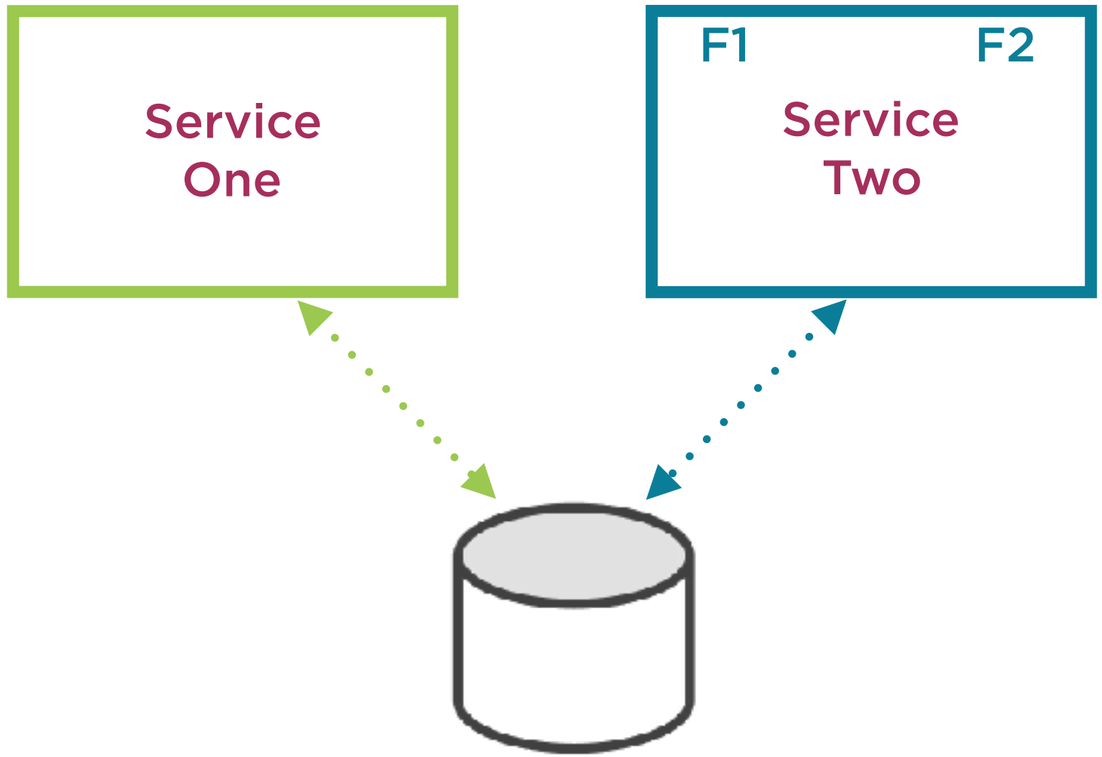
Bulkhead Pattern: Separation by Criticality



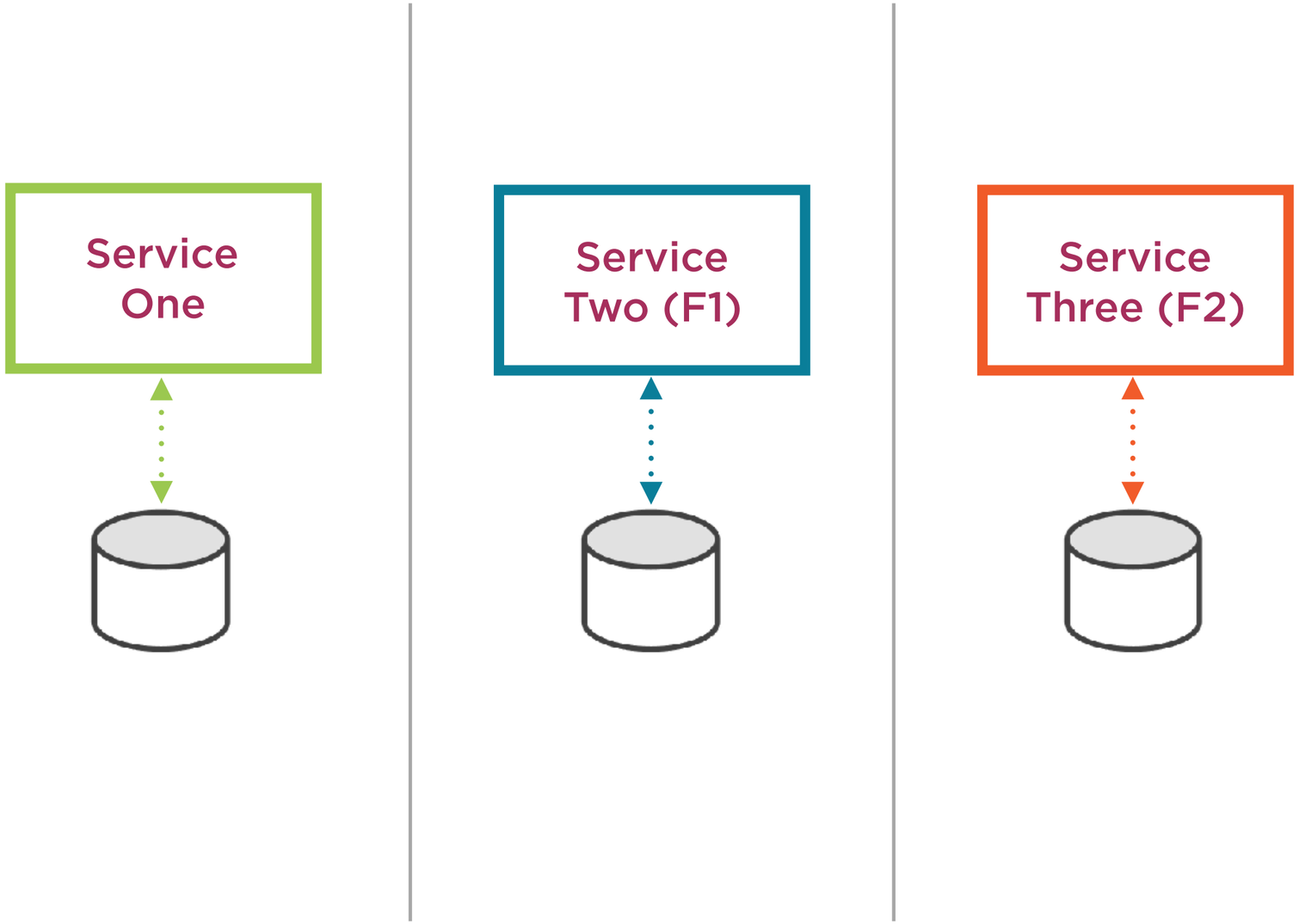
Bulkhead Pattern: Separation using Criticality



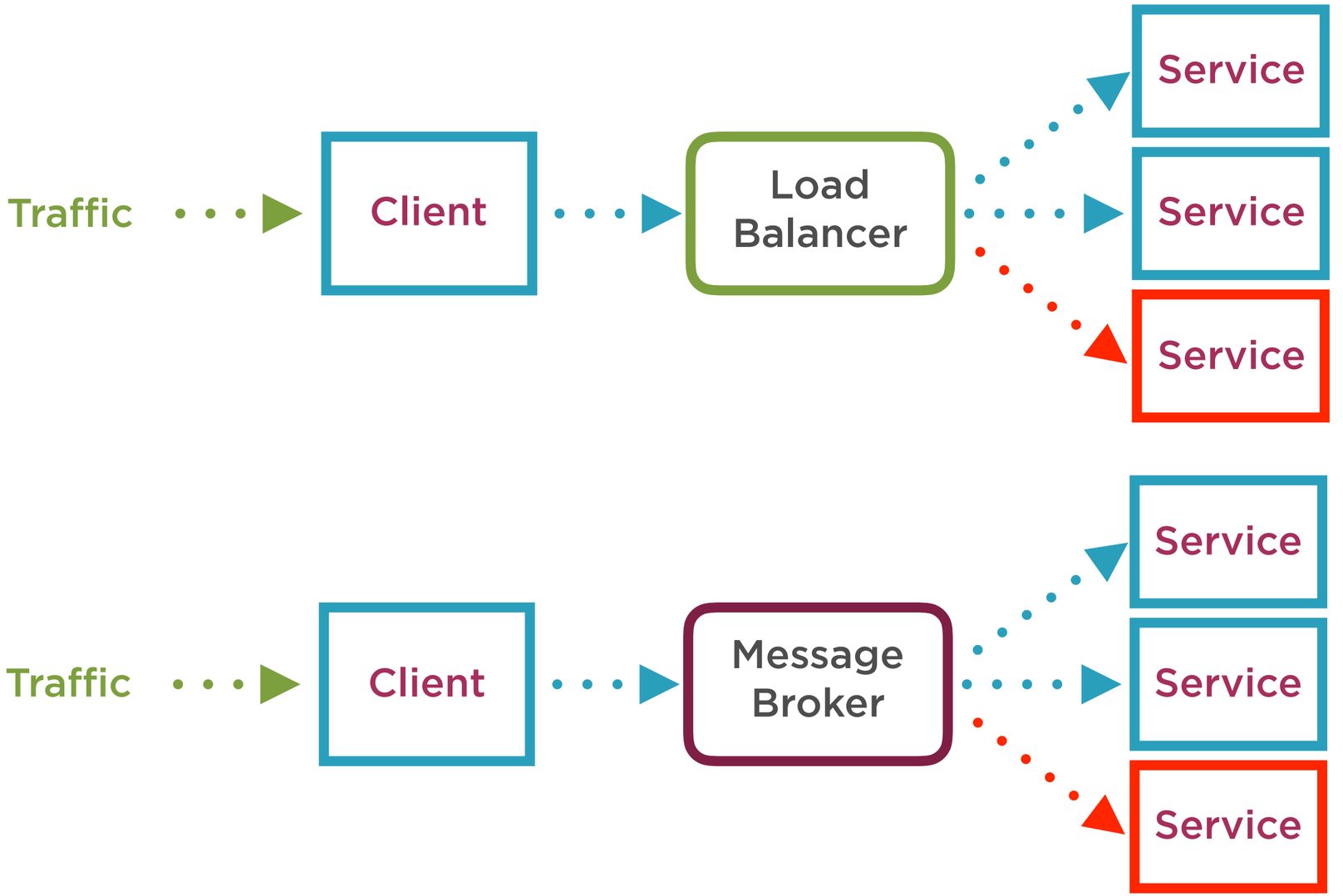
Bulkhead Pattern: Isolating Microservices



Bulkhead Pattern: Isolating Microservices

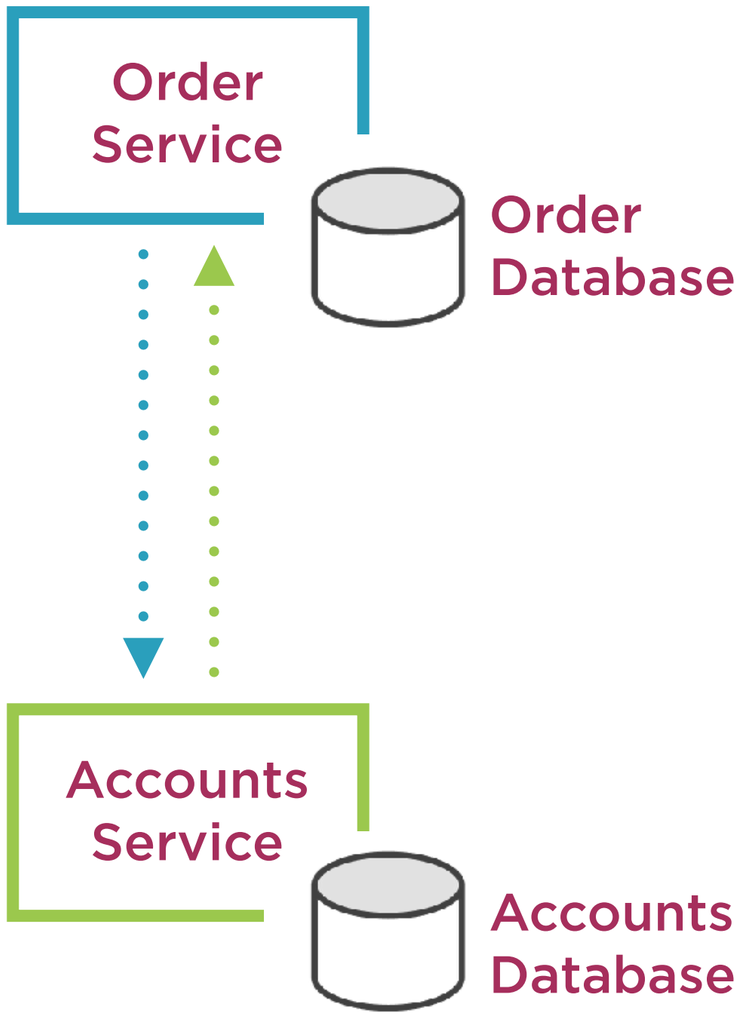


Bulkhead Pattern: Redundancy



Making a Resilient Microservices Architecture

Resiliency: How?



Design for known failures

- Look at previous failure causes
- Architect away single point of failures
- Use bulkhead pattern

Embrace failure

- Circuit breakers/retries with monitoring

Fail fast

- Using resiliency design patterns
- Fail fast for incoming request
  - Using timeouts on outbound calls

Degrade or default functionality

- Circuit breakers
- Use caches

Summary

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