



Pivotal.

# Spring Cloud Netflix Hystrix - Bulkheads

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# Bulkhead Types - Isolation Strategies

Types of Bulkheads, known as “Isolation Strategies” in Hystrix:

- Thread Pool
- Semaphore

# Thread Pool

- Default
- Dedicated Thread Pool per Key (Command)
- Commands use Queues and Futures to handle command execution and timeout detection

# Thread Pool - Benefits and Trade-Offs

- Benefits:
  - Provides highest level of isolation
  - Can walk away from timed out requests (hard timeouts)
- At cost of:
  - Higher number of threads in a container
  - Performance penalty
  - Cannot store state on application threads (ThreadLocal)

# Thread Pool - Use When...

- Use when:
  - Netflix preferred default given their use cases and demonstrated suitable overhead with thread pools
  - Hard timeouts required (where no timeout facility exists within Command method)
  - Protected code is “untrusted”
    - Integration client APIs you cannot tune or control
    - Independently manage thread resources
    - Result in unbounded result sets

# Semaphore

- Must be configured
- Shares Thread Pool with application container
- Command runs on originating thread
- Logical isolation via Semaphores that track concurrent command requests

# Semaphore - Benefits and Tradeoffs

- Benefits:
  - Reduced Thread Resources
  - Thread State is preserved
- At cost of:
  - Thread Isolation
  - Cannot walk away from timed out requests (hard timeout)

# Semaphore - Use When...

- Use when:
  - Netflix recommendation for high throughput applications (number of executions at 100 per second or greater) or where thread creation may be expensive
  - Spring Cloud recommendation when running Spring Security, Spring Scope, or other dependencies on ThreadLocal
  - Protected code is “trusted”
    - You can control downstream HTTP or TCP calls handled gracefully with socket timeouts
    - Bound results sets or pagination



# Loadshedding

- Both Thread pool and Semaphore isolation strategies can shed load
- Both divert to fall back path (if configured)

# What Happens When Threads Get Stuck?

- Thread Pool (Default)
  - Hystrix will attempt to interrupt the command thread...
  - ... But command method must be equipped to handle interrupted exception
  - If command method is not equipped to handle interrupted exception, thread pool will deplete, and shed load to fallback. Container restart required to clear condition
- Semaphore Strategy
  - Nothing. The thread will be stuck until container restart.
  - Could result in container's thread pool being depleted, and liveness issues.