Analyzing a Connection Pool Deadlock

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Overview

What is a deadlock?

Connection Pools (and Exhaustion)

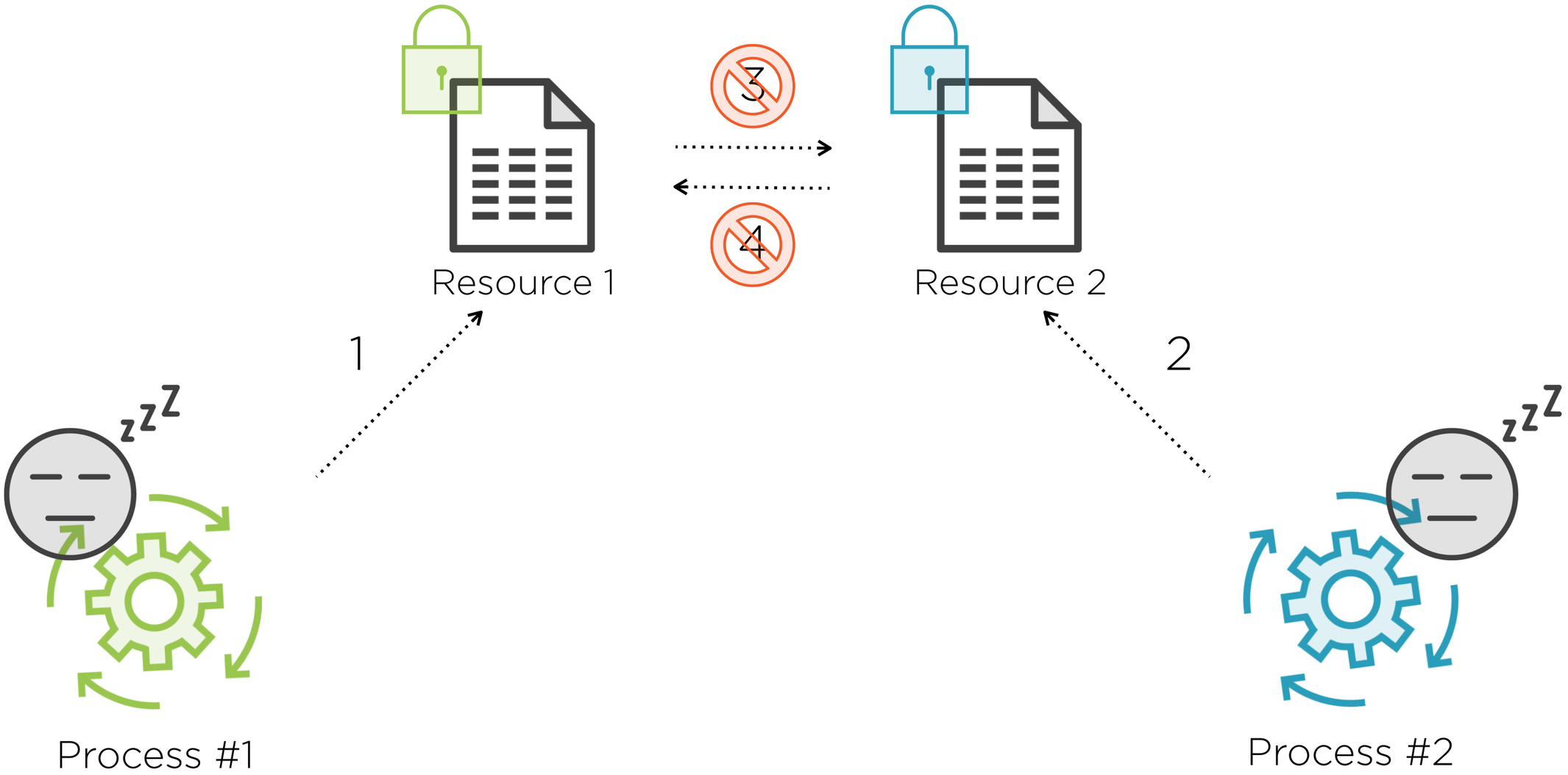
Intro to Demo: Bearer Authentication

Demo

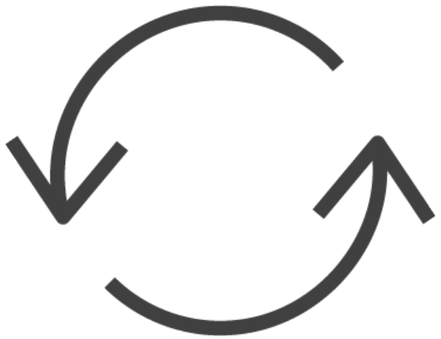
- The Code, and the Problem
- The Thread Dump
- More Code, and Root Cause Analysis

What Is a Deadlock?

A Deadlock Diagram



Baseline Prerequisites for a Deadlock



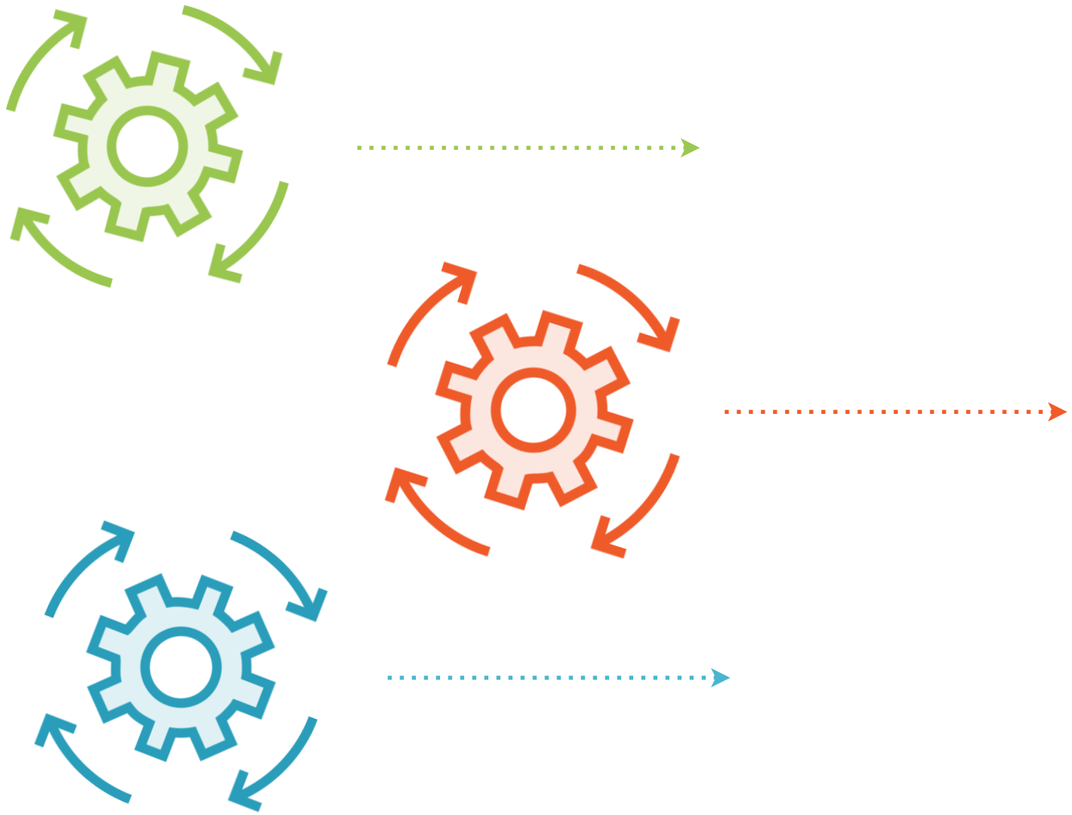
Block each other

Wait for each other

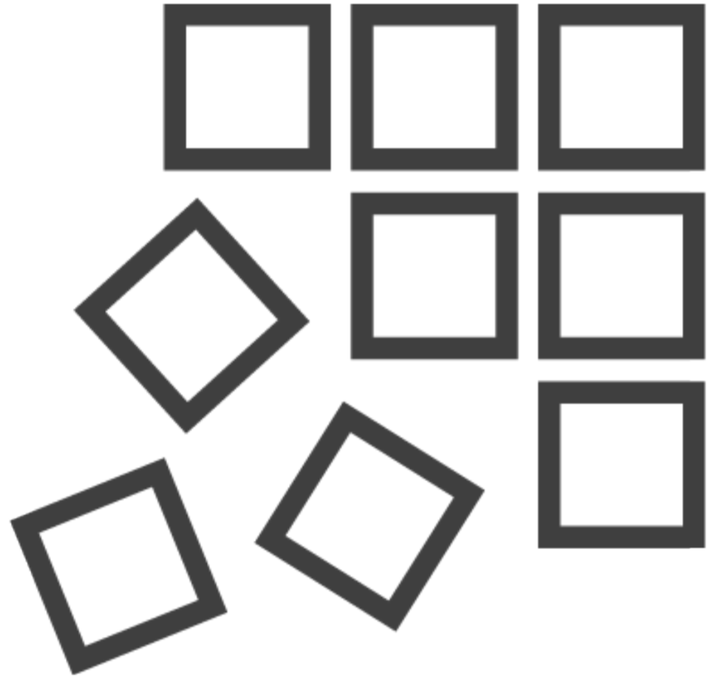
Connection Pools

Connection Pools

Threads



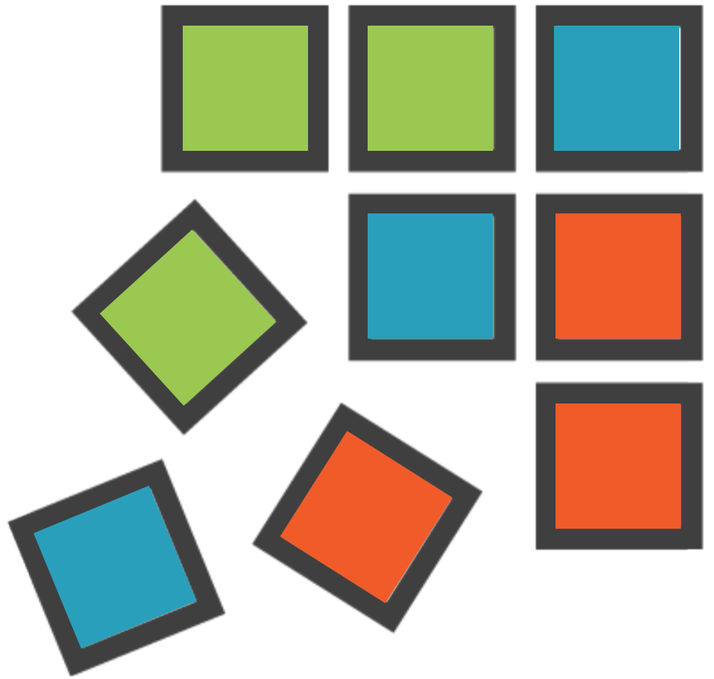
Connection Pool



Connection Pool Exhaustion

Threads

Connection Pool



*All connections taken!

OAuth

Bearer Authentication Scheme

Token-based Authentication

RFC6750

Bearer Auth Scheme Flow

Client sends request to protected resource

Server responds with HTTP 401

Client requests a token from an Auth server

Client receives token

Client re-attempts the protected resource

Server grants access to protected resource

Request to protected resource -> first connection

Request to token endpoint -> second connection

Authenticated request to protected resource -> third connection?

Thread #1

1. Protected Resource
2. Token endpoint

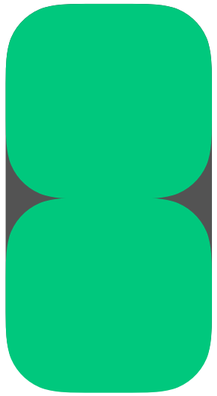
Thread #2

1. Protected Resource

2 + 1 = 3

Connection Pool and Cache State

Free Connections

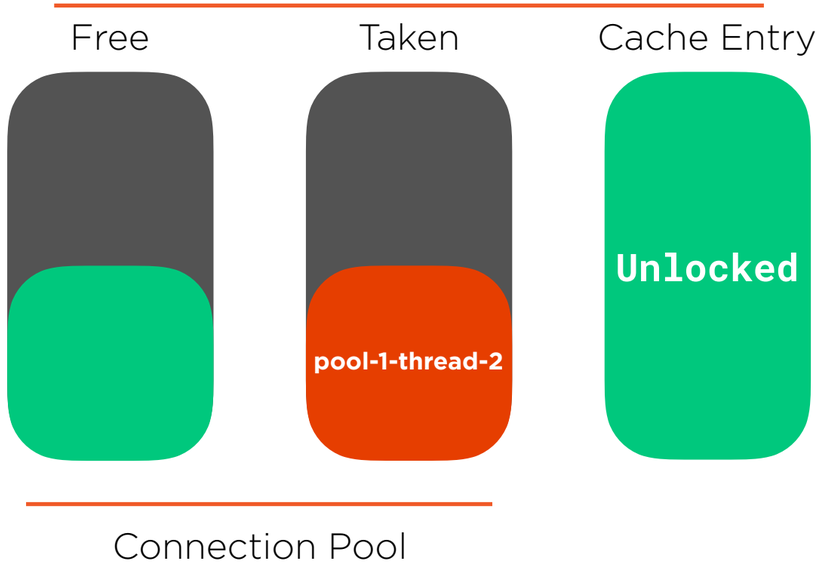


Taken Connections

Cache Entry

The Chain of Events

1

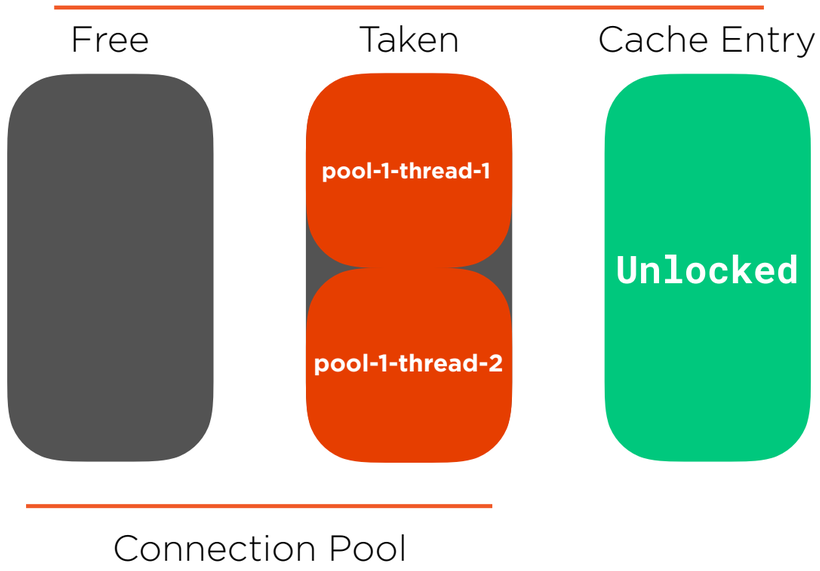


pool-1-thread-2 attempts protected resource

(acquires first connection)

The Chain of Events

2



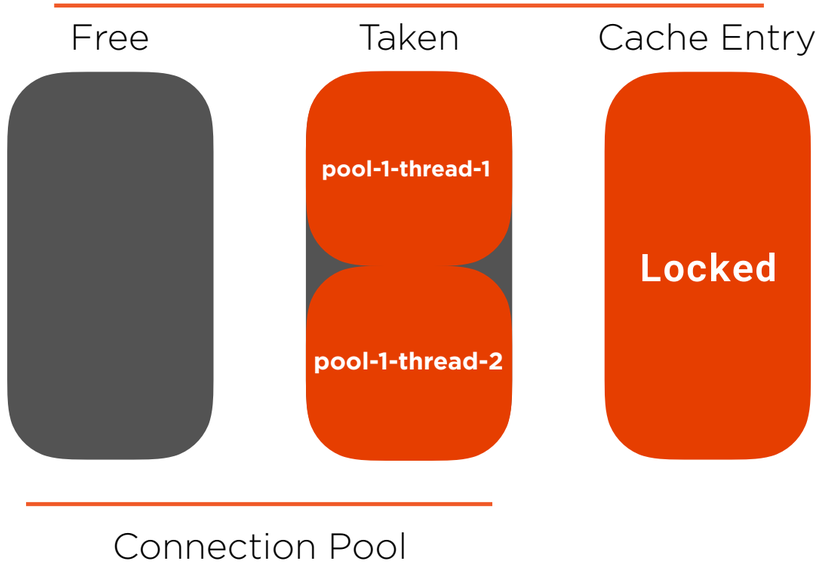
pool-1-thread-1 attempts protected resource

(acquires second connection)

***Connection Pool at max capacity**

The Chain of Events

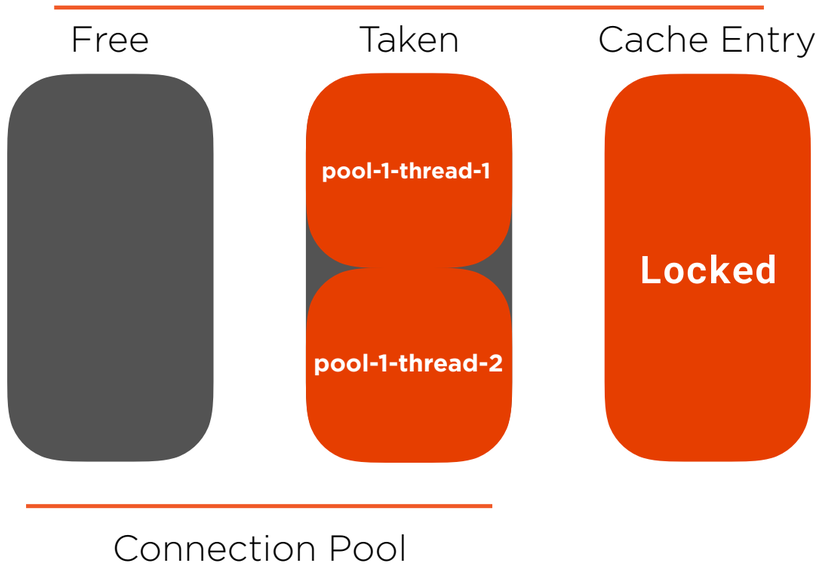
3



- **pool-1-thread-2 locks the cache entry for Jeff's token**
- **Wants to send an HTTP request to fetch a new token.**
- **No connections - wait for one to become available.**

The Chain of Events

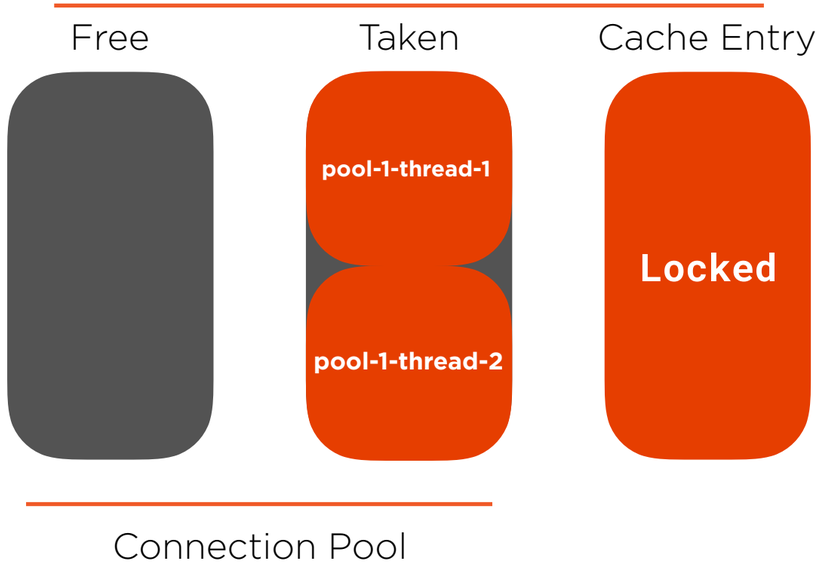
4



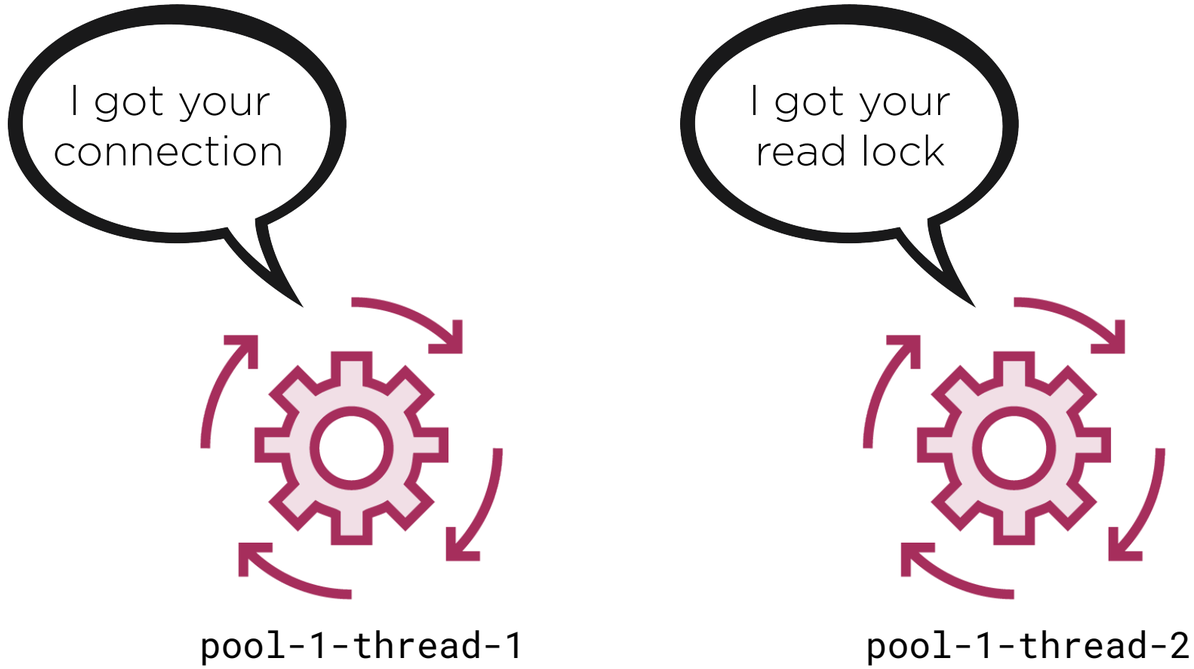
pool-1-thread-1 finds out the cache entry for Jeff's token is already locked by some other thread. It waits.

The Chain of Events

5



Both threads are now blocking each other and waiting for each other without even knowing.



I think we've got ourselves
a **Deadlock**