Programming Assignment 3 Report

CS 6381: Distributed Systems Principles, Spring 2025

This report summarizes the implementation status of Programming Assignment 3, covering Milestone 1, identified gaps for Milestones 2 and 3, and any extra work beyond the core requirement.

video: 6381 PA3 rebalancing

Milestone 1: Load-Balanced, Fault-Tolerant Groups

- **Achievement:** Introduced group-based partitioning for Discovery and Broker services:
  - ZooKeeper paths /discovery/leader/group_<id> and /brokers/leader/group_<id> created per group.
  - CLI parameter --group <id> allows clients (publishers, subscribers, brokers) to bind to a specific logical partition.
  - Independent leader election and registration within each group.
- **Verification:** Service logs confirm correct group-based leader election, registration, and transparent failover when a primary node is stopped.

Milestones 2 & 3: History QoS & Ownership Strength

- **Status:** Not implemented in this assignment.
  - **Milestone 2 (History QoS):** Sliding-window storage and offering/requested negotiation remain to be added.
  - **Milestone 3 (Ownership Strength):** Per-topic strength tracking and broker filtering logic not yet developed.

Incomplete Items

- **History QoS negotiation:** No matching logic to enforce offered vs. requested history depths.
- **Ownership Strength enforcement:** Publishers are not sequenced by strength; subscribers receive all sources.
- **Deadline QoS:** Deferred to the next assignment.

Extra Accomplishments (Milestone 1 Focus)

- **Automation Scripts:** Basic shell scripts under EXPERIMENTS/ automate starting one Discovery, two brokers/publishers, and multiple subscribers within a single group.

- **Test Coverage:** Verified direct and via-broker modes for a single group, covering core load-balancing behavior.

Conclusion

We have successfully completed Milestone 1, demonstrating group-based load balancing and fault tolerance using ZooKeeper. Core gaps remain for QoS features (History and Ownership Strength), which will be addressed in subsequent work.

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