

**Alma Mater Studiorum ▪ Università di
Bologna
Campus di Cesena**

Caffeine Cache



**Publish-Subscribe Cache
Using Caffeine Cache and
Apache Pulsar**

Introduction

- **Objective:**

Design and implement a **Distributed Cache** system using **Apache Pulsar** and **Caffeine Cache**

- **Scope:**

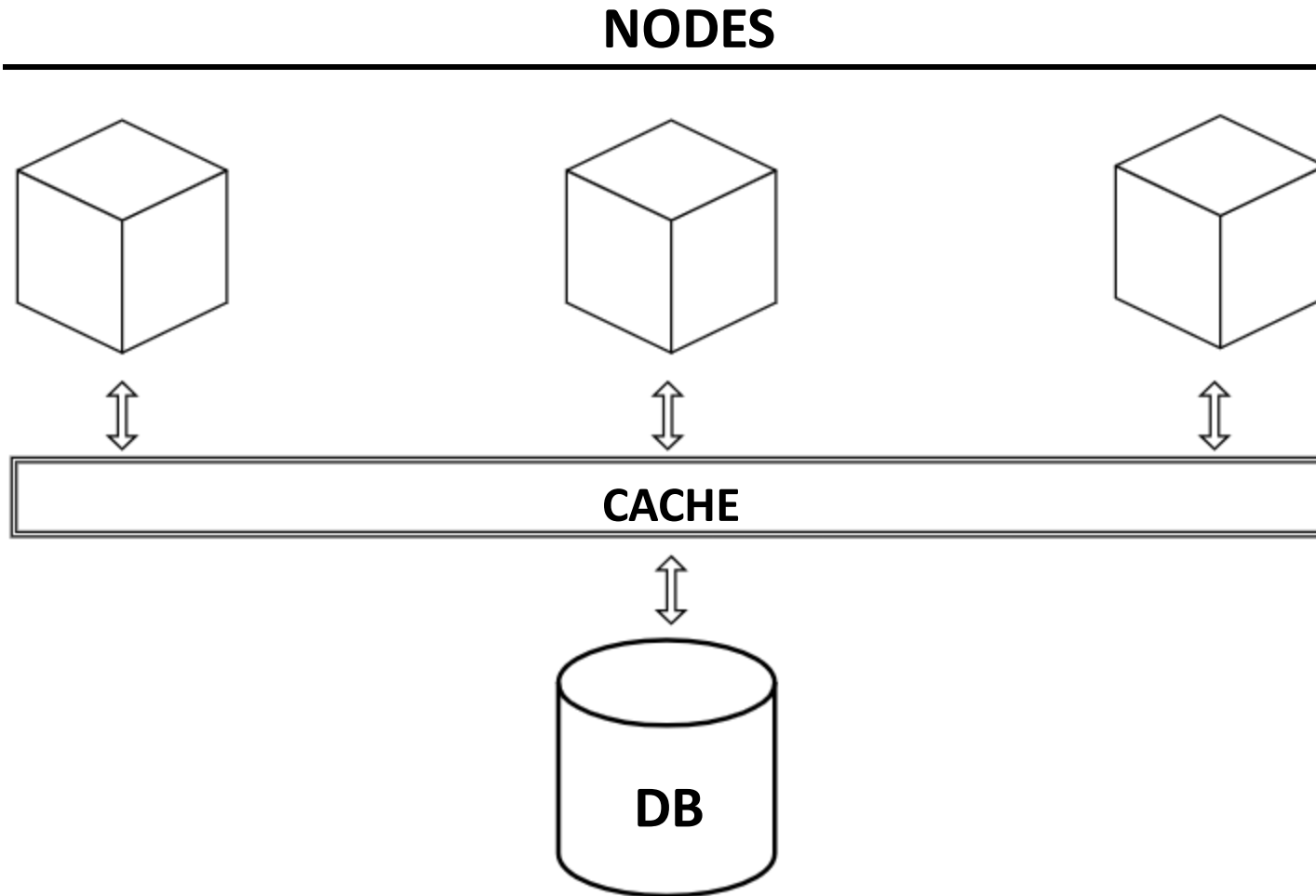
Distributed applications requiring high performance and low latency

- **Key Features:**

- **Asynchronous messaging** with **Apache Pulsar** (Scalable, Asynchronous, Reliable)

- **Advanced Caching** mechanism with **Caffeine** to reduce backend system load (Fast, Configurable, Concurrent)

Objectives



- ↓ Reduce DB Accesses
- ↑ Increase Resilience
- ↑ Improve Performance

Requirements

- Cache Management - CRUD
- Data Synchronization
- Information Exchange Between Nodes
- Message Publish/Subscribe



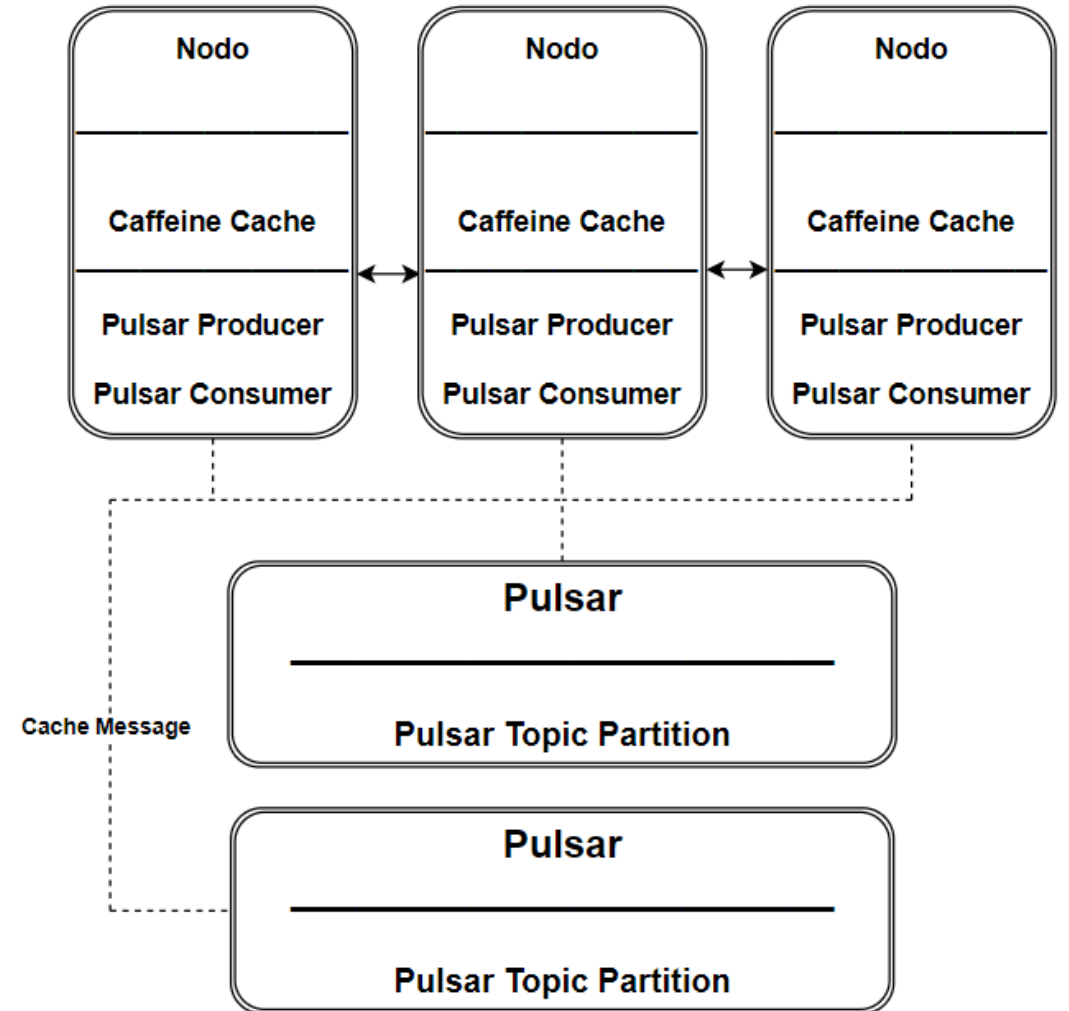
Pulsar



Caffeine Cache

System Architecture

- Nodes with Caffeine Cache and Pulsar
- Cache Message (Serialization)
- Pulsar Topic for Node Information
- Pulsar Topic for Cache Operations



Technologies

Pulsar

- Distributed and Multi-Tenant Messaging
- System Publish/Subscribe
- Paradigm Partitioning into Topics
- Heartbeat Mechanism - Retry with exponential backoff

Caffeine

- High performance
- Low latency
- RAM usage
- TTL support (Time-To-Live)
- Configurable

Workflow

- When a node registers, it sends a registration message to the monitoring topic *node registration*.
- Nodes perform operations related to data, such as: *put, get, fetch, invalidate* and information regarding the nodes themselves, such as: *node registration, node heartbeat, and node failure*.
- The bulk of the work is handled in the CacheService class
- APIs have been developed to test the service using Docker, allowing for easy deployment and testing

Conclusion

Aspects:

- Stimulating and highly educational project.
- Consolidation of skills in designing: distributed, resilient, and scalable systems.
- Approach focused on flexibility and design robustness.

Future Improvements:

- Integration of data encryption, authentication, and access control.

Thank you for your attention!