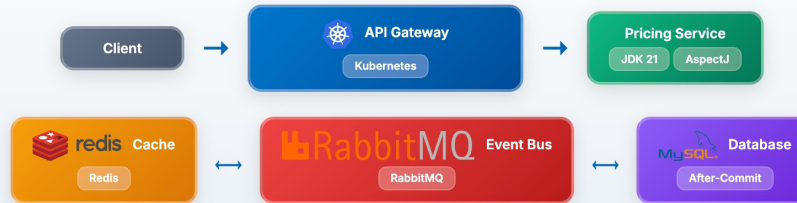


# Develop and Implement New Function Features on OOCL's Smart Pricing Platform

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## SYSTEM ARCHITECTURE



## OVERVIEW & OBJECTIVES

FreightSmart is OOCL's logistics platform for **COSCO Shipping** (world's 4th largest). The **Smart Pricing System** delivers real-time quotes for 80+ vessels, processing inland rates, surcharges, and tariffs across **80+ microservices** on **Kubernetes**.

- High Availability**
- High Performance**
- Low Latency**
- High Consistency**

## KEY METHODS & TECHNOLOGIES

### Virtual Threads (JDK 21)

Lightweight user-space threads managed by JVM scheduler. Unmount from carrier threads during I/O to prevent thread pool exhaustion

### AspectJ (AOP)

Compile-time bytecode weaving for cross-cutting concerns. Zero runtime overhead vs Spring AOP's proxy-based approach

### Redis Streams + Caffeine

Event-driven cache invalidation with durable message persistence & consumer groups for eventual consistency

### After-Commit Publishing

Publish events only after successful DB commit to eliminate rollback-related phantom events

## RESULTS

- 10x throughput improvement** for 50,000 concurrent API calls using virtual threads with semaphore-based backpressure control
- Zero runtime overhead** for cross-cutting concerns via AspectJ compile-time weaving vs Spring AOP proxies
- Microsecond-level cache access** with bounded staleness via TTL + event-driven invalidation using Redis Streams
- Eliminated phantom events** ensuring database-event consistency through after-commit publication patterns

## CONCLUSION

Successfully enhanced OOCL's production FreightSmart platform serving COSCO Shipping's global logistics operations. Achieved improved **scalability** through modern Java concurrency, enhanced **maintainability** via AOP patterns, and strengthened **consistency** using event-driven architectures - critical for high-stakes shipping environments where pricing inaccuracies could cause significant financial losses.

**Future: Distributed tracing, metrics for cache lag & reusable after-commit framework**