Waltz: A Distributed Write-Ahead Log

By **Yasuhiro Matsuda** on Sep 9, 2019

We are happy to announce the open source release of Waltz. Waltz is a distributed write-ahead log. It was initially designed to be the ledger of money transactions on the WePay system and was generalized for broader use cases of distributed systems that require serializable consistency. Waltz is similar to existing log systems like Kafka in that it accepts/persists/propagates transaction data produced/consumed by many services. However, unlike other systems, Waltz provides a machinery that facilitates a serializable consistency in distributed applications. It detects conflicting transactions before they are committed to the log. Waltz is regarded as the single source of truth rather than the database, and it enables a highly reliable log-centric system architecture.

Background

Databases

The WePay system has been constantly growing to handle more traffic and more functionalities. We split a large service into smaller services to keep the system manageable when it makes sense. Each service typically has its own database. For better isolation it is not shared with other services.

It is not trivial to keep all databases consistent when there are faults such as network failures, process failures, and machine failures. Services interact with each other over the network. Interactions often result in database updates on both sides. Faults may cause inconsistencies between the databases. Most such inconsistencies are fixed by daemon threads that perform check-and-repair operations periodically. But not every repair can be automated. Sometimes manual operations are required.

On top of this, databases are replicated for fault tolerance. We use MySQL async replication. When the primary region goes down, a region failover will happen, and the backup region will take over the processing so that we can continue processing payments. Multi-region replication has its own issues. A database update in the master database will not appear in a slave