MySQL Group Replication

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Developers' mDay #3

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Industry Leaders Rely on MySQL

MySQL Powers The Web

Over 50 million Tweets/day. 143,200 Tweets/sec in Aug 2013

facebook

”Many petabytes” of data. 11.2 Million Row changes & 2.5 billion rows read /sec handled in MySQL

YouTube

6 billion hours of video watched each month

PayPal

Globally-distributed database with 100 terabytes of user-related data based on MySQL Cluster

The #1 Database in the Cloud

Best Choice for Next Generation Web & Cloud Applications

Strong MySQL Momentum

World's Most Popular open Source Database

Leading Database for Web Applications

#1 Database in the Cloud

#2 Most Popular DBMS *

Integrated with Hadoop in Big Data Platforms

#1 Linux Career IT skill **

* Based on the DB Engine Ranking in Aug 2014 ** Source: Linux Career IT Skills Watch update July 2014

MySQL Group Replication

- Synchronous
- Multi master
- Auto everything
- Modern
- Conflict detection/handling
- Consistency guarantees

Group Replication is a plugin for the standard MySQL 5.7 Server. This plugin provides virtually synchronous replication, with built-in conflict detection/handling and consistency guarantees, all of which supports multi-master write anywhere usage. It allows you to move from a stand-alone instance of MySQL, which is a single point of failure, to a natively distributed highly available MySQL service (the Group Replication set) that's made up of N MySQL instances (the group members). Then individual machines and/or MySQL instances can fail or be taken offline for maintenance while the distributed MySQL service continues to operate and handle application traffic.

MySQL Group Replication

- High Availability – high available replica sets with write being duplicated on each member of the group.
- NOT automatic “scale out” solution on it’s own
- Can be a perfect part of a “scale out” solution in combination with **FABRIC** framework creating “**sharded cluster**”

Why MySQL Group Replication

- High Availability

Distributed Databases (general goals)

- Availability
  - Cluster as a whole unaffected by loss of nodes
- Scalability
  - Geographics
  - Data size
  - Number of queries
  - R/W load
- Transparency
  - Acces, migration, scale, redesign on-line
  - Consistency
  - Concurrency
  - Failure recovery

MySQL Group Replication Goals

- Availability
- Scalability
- Distribution Transparency

Before MySQL Group Replication

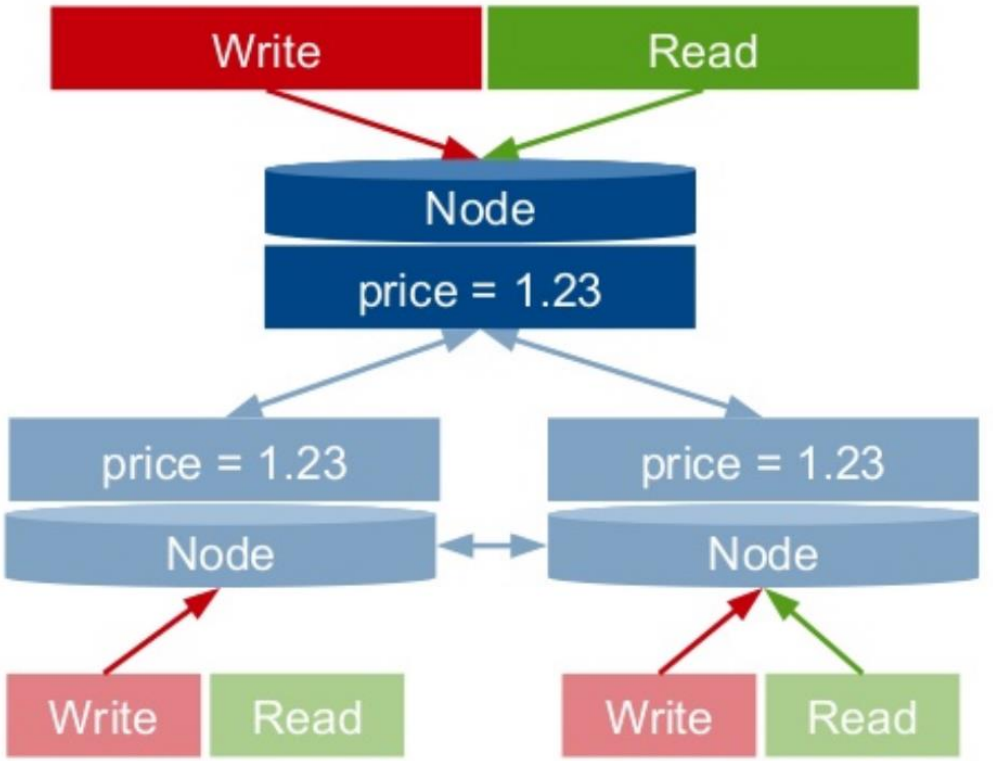
	MySQL Replication	MySQL Cluster	MySQL Fabric
Availability	SPOF	FULL	SPOF + failover
Scalability	READS only	Partial	Partial
Scale on WAN	Asynchronous	Synchronous	Asynchronous
Distribution Transparency	R/W splitting	SQL: full, ndb-api: partial	NO

MySQL Group Replication

	MySQL Replication	MySQL Cluster	MySQL Fabric	MySQL Group Replication	MySQL Group Repliation + Fabric
Availability	SPOF	FULL	SPOF + failover	FULL	FULL
Scalability	READS only	Partial	Partial	PARTIAL	FULL
Scale on WAN	Asynchronous	Synchronous	Asynchronous	PARTIAL	FULL
Distribution Transparency	R/W splitting	SQL: full, ndb-api: partial	NO	YES	FULL

MySQL Group Replication – eager update everywhere

- An eager update everywhere system (cause “lazy write” and “primary copy” cause additional work, more latency, more issues, don’t properly scale)



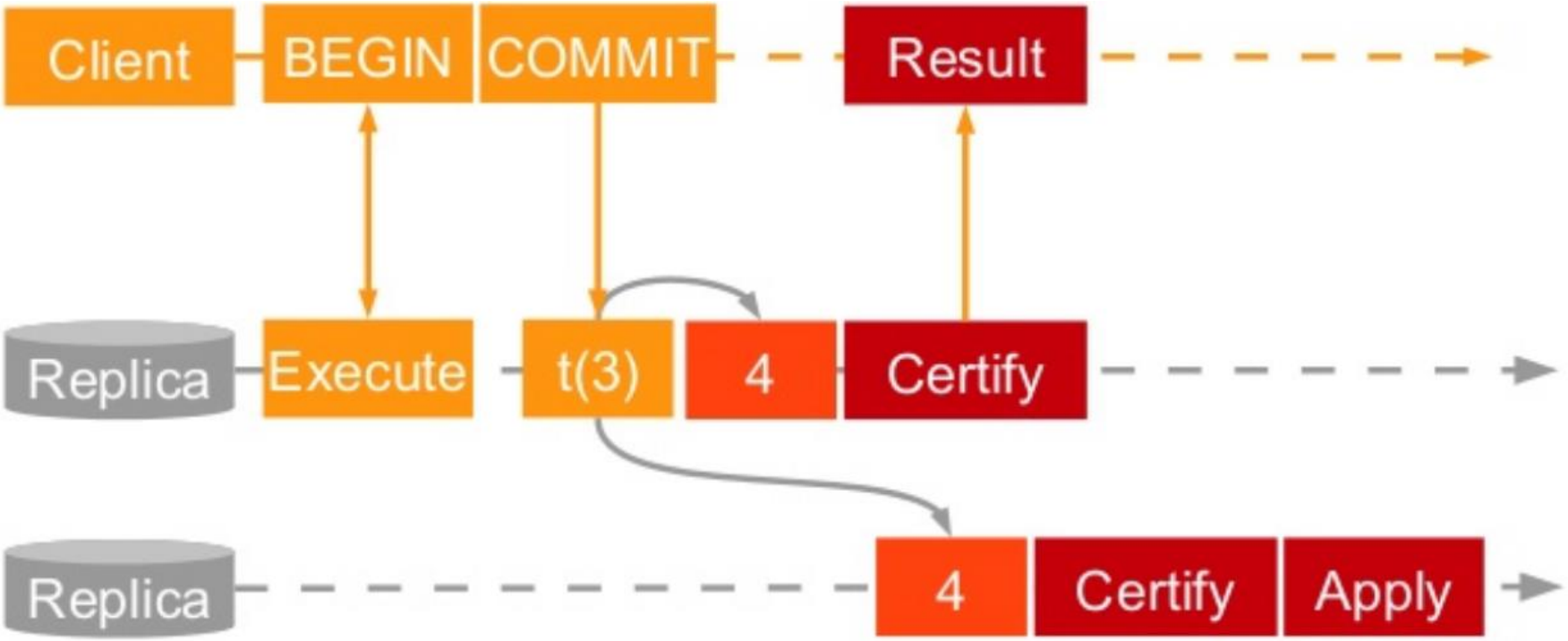
Eager update anywhere

- Indistinguishable from “single node”
- Only extra work is load balancing (that you have to do with any cluster)
- Improves distribution transparency
- Removes the risk of reading stale data
- Better fault tolerance then “primary copy”
- No single point of failure

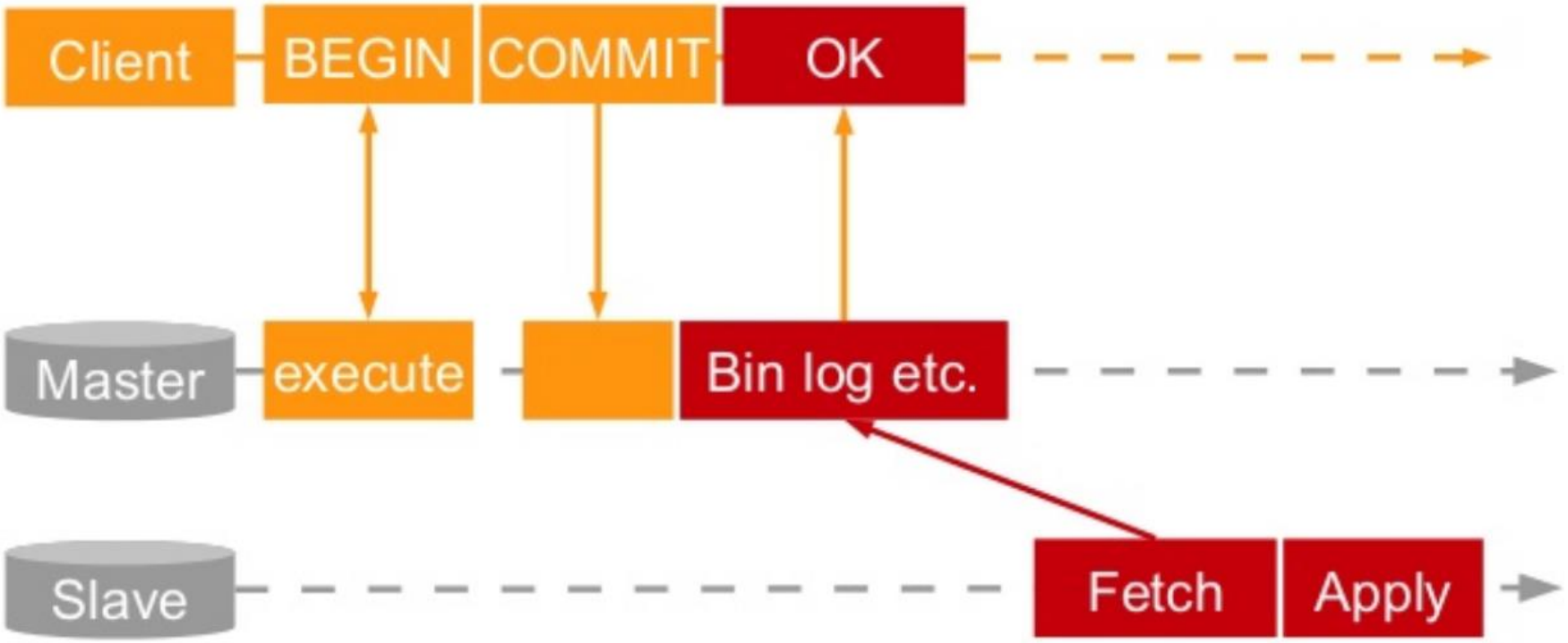
Building blocks

- State machine replication
- Atomic Broadcast
  - Message abstraction
  - Agreement
  - Order
  - Termination
- Deferred Update Database Replication
  - Reads execute locally, updates get certified
  - Certification ensures transaction serializability
  - Replicas decide independently about certification result

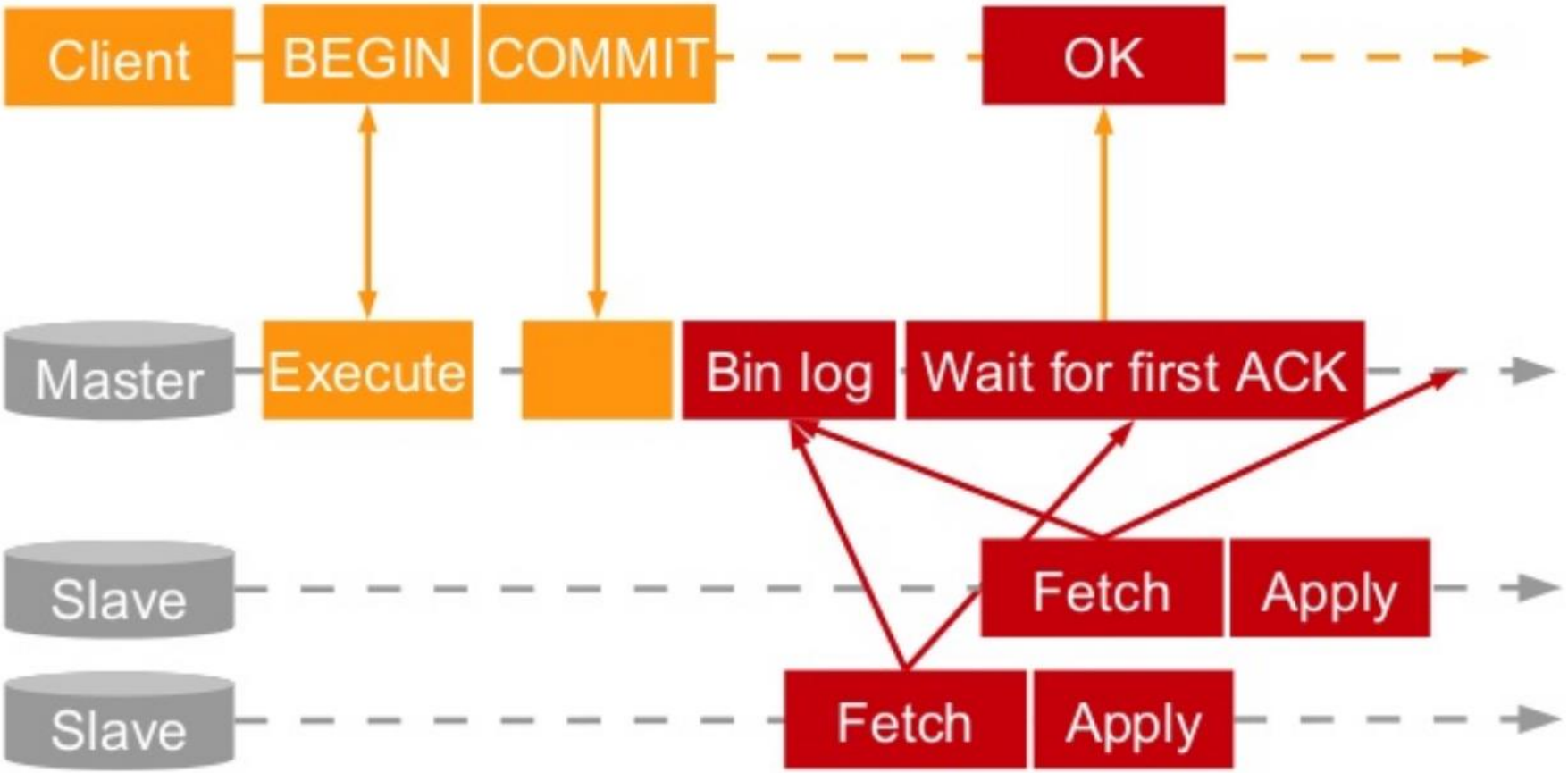
A developers view on commit



MySQL Replication



MySQL Semi-sync Replication



MySQL Group Replication – Group Communication System

- MySQL Group Replication has a pluggable GCS API
  - handles splig brain situation
  - Originally Corosync (complex to install for noobs, additional library..)
  - Xcom is a new default (included by default in plugin, no additional libraries required)
  - MySQL Group Replication can use **any** GCS that can be accessed from C and that implementes Virtual Synchrony. Split brain handling is GCS dependent.

MySQL Group Replication – configuration

- You want “real hw” for a node
- You want 3 or more nodes
- You want odd number of nodes (majority consensus)
- You need to setup mysql accound that node can use when requesting GTID’s from members of the group

MySQL Group Replication – configuration sample

```
[mysqld]
…
log-bin
binlog-row-image = MINIMAL
binlog-rows-query-log-events = ON
log-bin-trust-function-creators = TRUE
expire-logs-days = 90
max-binlog-size = 1G
relay-log-recovery = ON
slave-parallel-type = LOGICAL_CLOCK
slave-preserve-commit-order = ON
slave-rows-search-algorithms = 'INDEX_SCAN,HASH_SCAN‘
slave-type-conversions = ALL_NON_LOSSY
sync-master-info = 1000
sync-relay-log = 1000
binlog-format = ROW
gtid-mode = ON
enforce-gtid-consistency = ON
log-slave-updates = ON
master-info-repository = TABLE
relay-log-info-repository = TABLE
binlog-checksum = NONEslave-parallel-workers = 0
disabled_storage_engines="MyISAM,BLACKHOLE,FEDERATED,ARCHIVE“
plugin-load = group_replication.so
group_replication = FORCE_PLUS_PERMANENT
transaction-write-set-extraction = XXHASH64
group_replication_start_on_boot = ON
group_replication_bootstrap_group = OFF
group_replication_group_name = 550fa9ee-a1f8-4b6d-9bfe-c03c12cd1c72
group_replication_local_address = '192.168.0.1:6606‘
group_replication_group_seeds = '192.168.0.2:6606,192.168.0.3:6606'
```

MySQL Group Replication - config

- Setup account for GTID collection

```
SET sql_log_bin=0;
CHANGE MASTER TO
   MASTER_USER=‘someuser',
   MASTER_PASSWORD=‘somepass'
   FOR CHANNEL 'group_replication_recovery';
SET sql_log_bin=1;
```

- Allow tcp port 6606 between all nodes

MySQL Group Replication – bootstrap

- Only once – first start
- Select one node to bootstrap the group
  - group_replication_bootstrap_group=ON
- It will not try and participate in any group communication when starting but will instead configure the group as consisting only of itself.
- Any subsequent member that attempts to join the group will sync itself up with the state of this instance
- After the node is up, turn the group_replication_bootstrap_group OFF!

MySQL Group Replication – add new members

- Take a backup from one of the current members of the group
- Restore that backup onto the node that we want to add to the group, thus applying a snapshot of the state (tables, rows, and other SQL objects, along with the GTID metadata) from that current member of the group.
- Set up the configuration file so that this new node can participate in group replication, and become a member of this group
- Specify valid MySQL credentials that this node will use when requesting GTIDs from existing members of the group
- Have the new node join to become a member with: STOP GROUP_REPLICATION; START GROUP_REPLICATION; (STOP is necessary because we have start_on_boot enabled).

MySQL Group Replication – monitoring

- select * from performance_schema.replication_group_members;
- select * from performance_schema.replication_group_member_stats;
- Mysqld error log, everything related to group replication is prepended with “Plugin group_replication” tag

MySQL Group Replication – debugging

- Mysqld error logs on each node
- performance_schema on running nodes

MySQL Group Replication – routing and failover

- HAProxy
- SYS schema

Thank You!

Questions?

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