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Inside MySQL 5.7 Replication Features

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MySQL

Safe Harbour Statement

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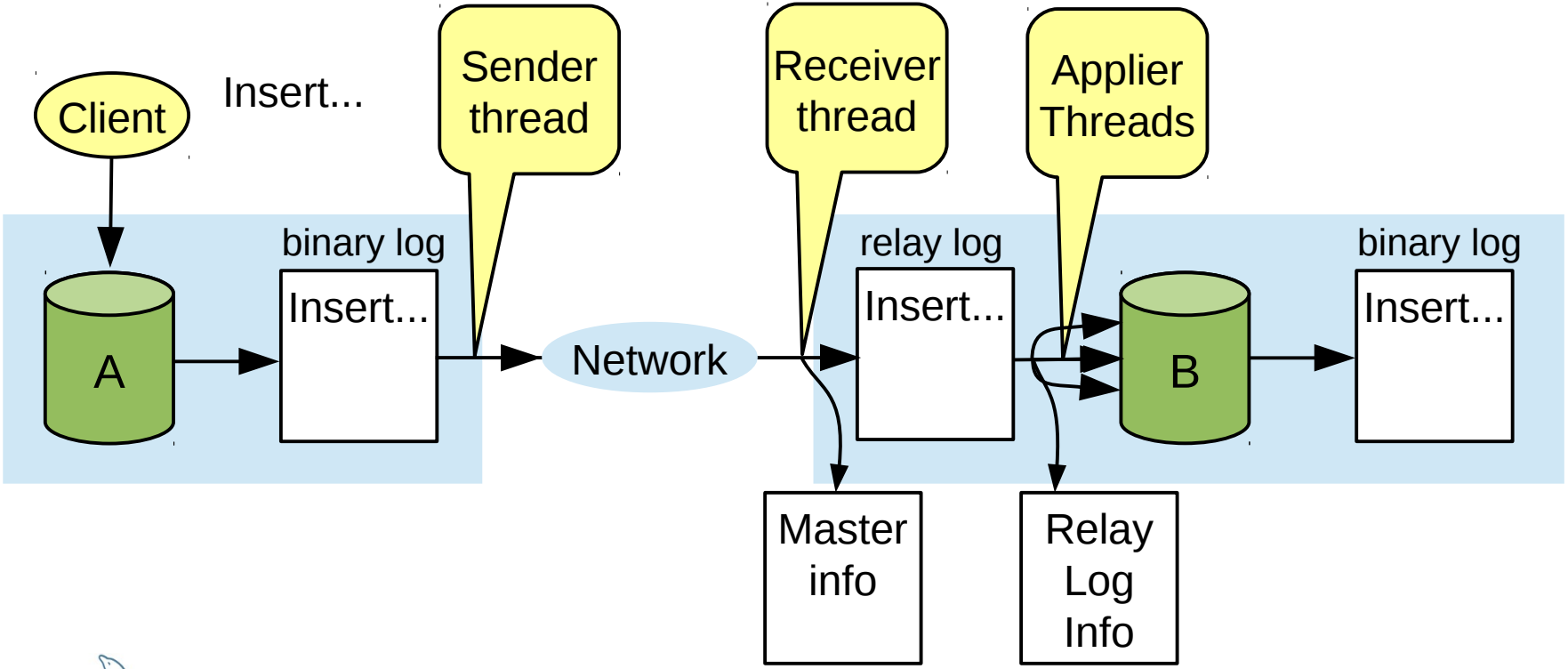
Agenda

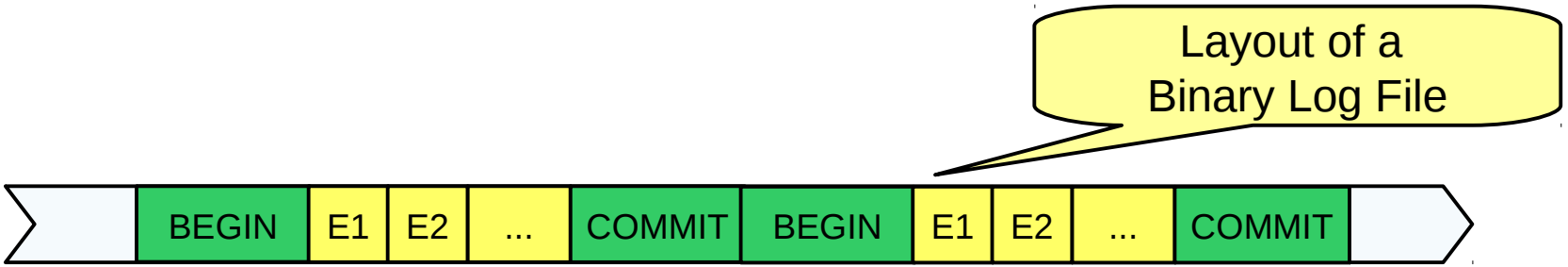
- **Background**
- **Next Generation Features in MySQL 5.7**
- **What is in the Lab?**
- **What is Next?**
- **Summary**

Background: Replication Components



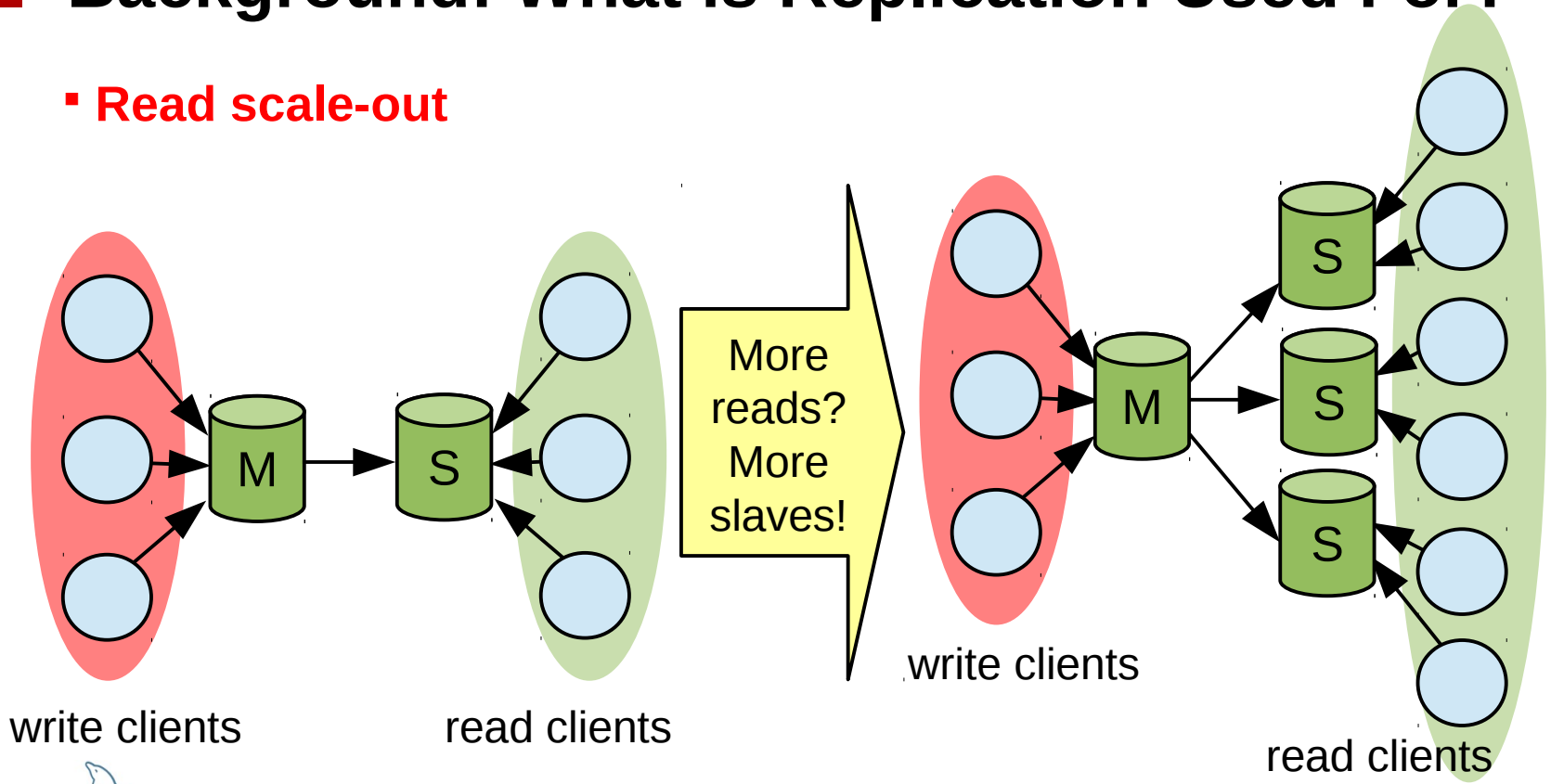
Background: Replication Components

- **Binary Log**
  - File based logical log that records the changes on the master.
  - Statement or Row based format (may be intermixed).
  - Transactions are split into groups of events.
  - Control events: Rotate, Format Description, Gtid, ...

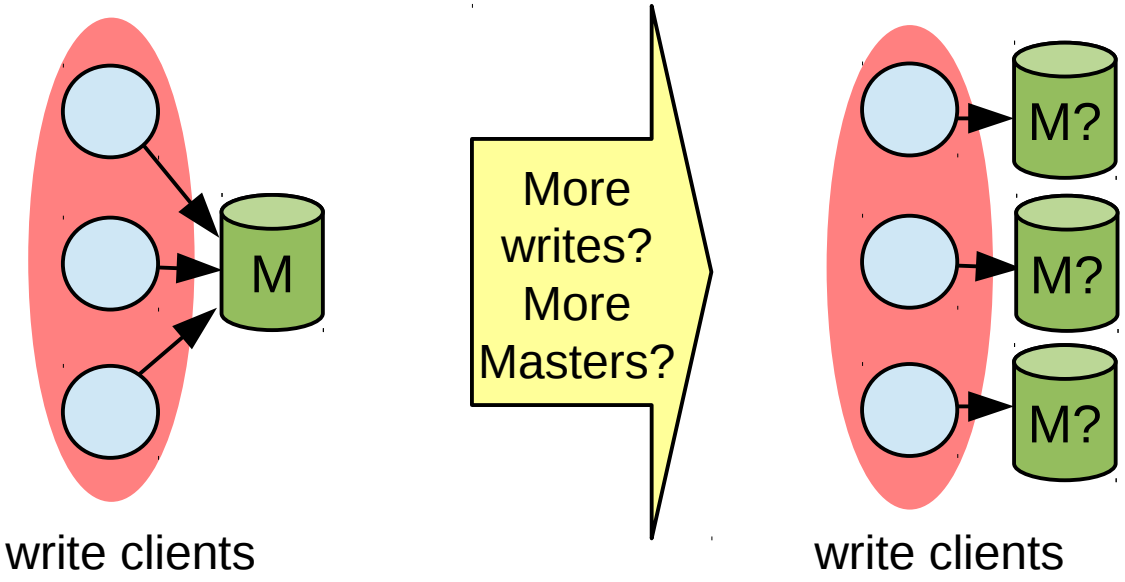


Background: What is Replication Used For?

- **Read scale-out**



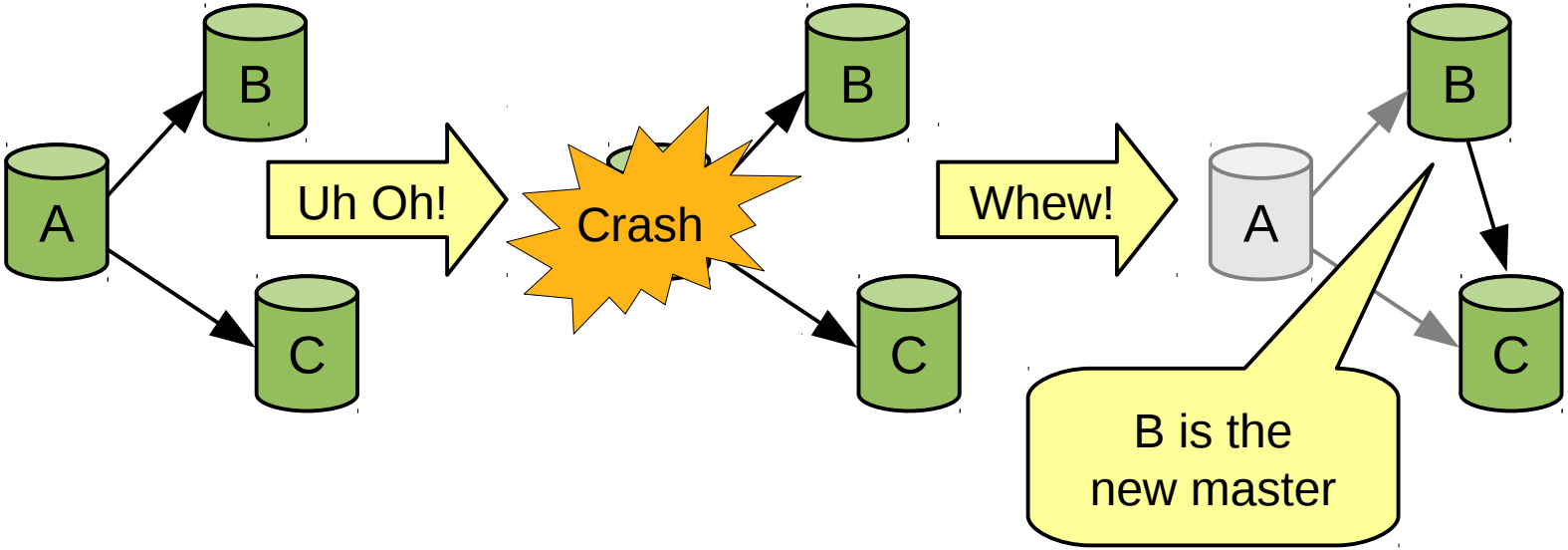
What about Write scale-out?



We will discuss MySQL Fabric later...

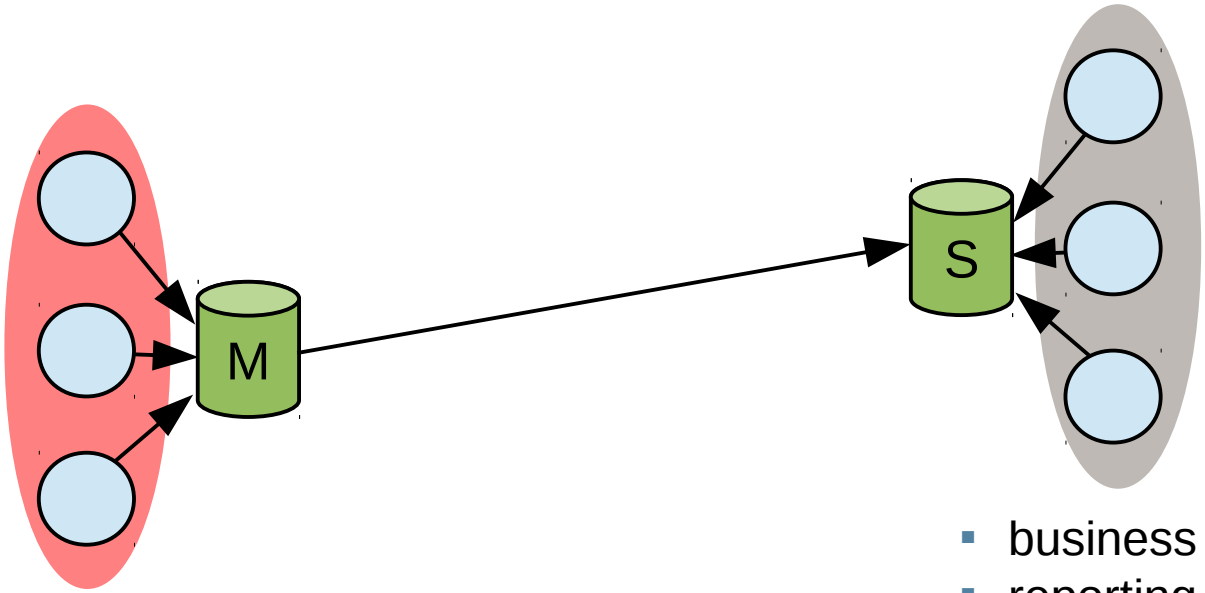
Background: What is Replication Used For?

- **Redundancy**: If master crashes, **promote** slave to master



Background: What is Replication Used For?

- **On-line Backup and Reporting**



- write clients

- business intelligent client apps
- reporting client apps
- big queries client apps

Background: What is Replication Used For?

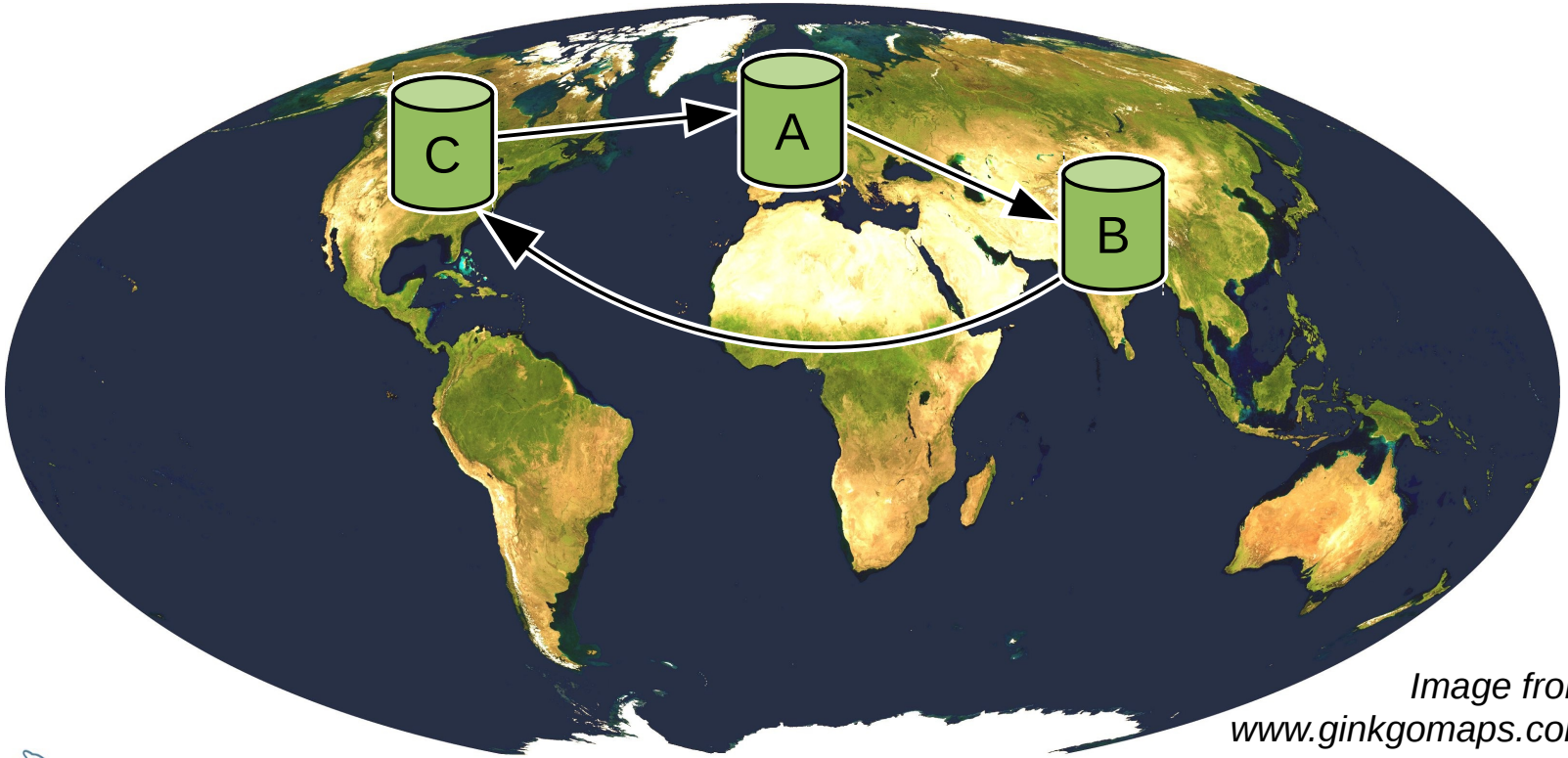


Image from www.ginkgomaps.com

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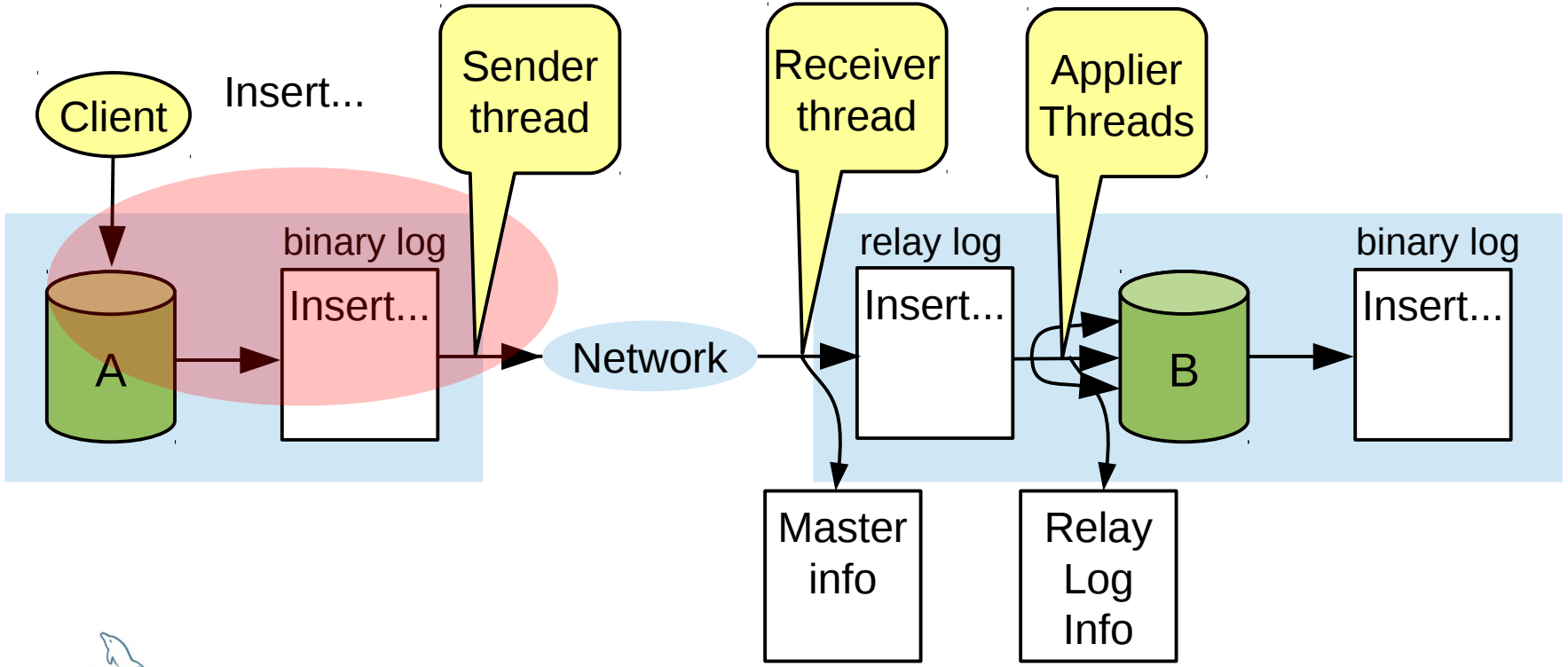
What is New? (2013 –)

- **MySQL 5.7.2** - **Development Milestone Release, September 2013**
  - Higher Master Throughput
    - Sender, aka Dump, Thread Does Not Take the Binary Log Lock.
  - Higher Slave Throughout
    - Multi-Threaded (Slave) Timestamp based Applier (MTS).
  - Better Monitoring of Replication
    - Instrumentation for getting replication status through performance schema.
  - Loss-less Semi-sync Replication.

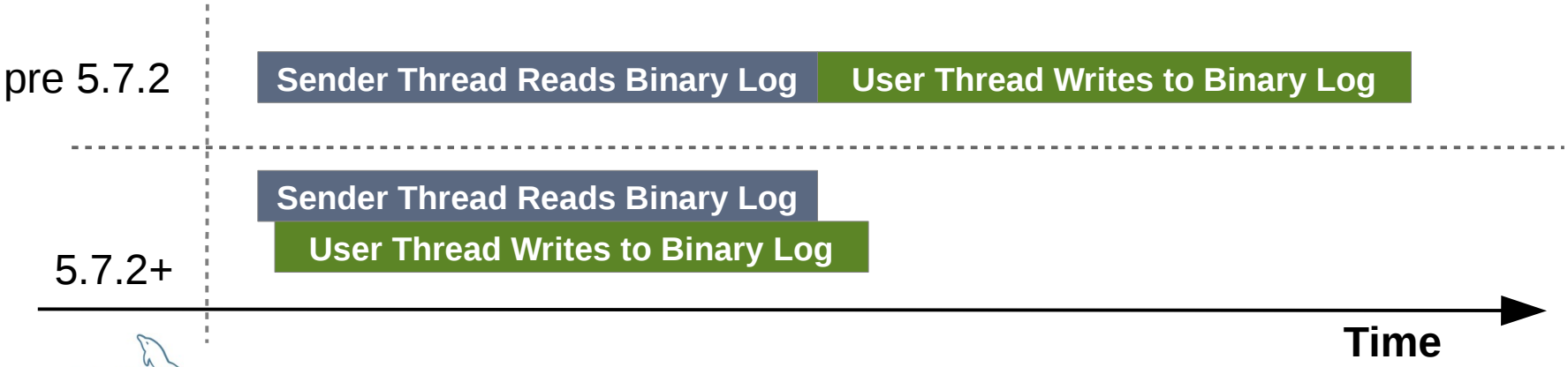
Higher Master Throughput: Sender, aka Dump, Thread Enhancement



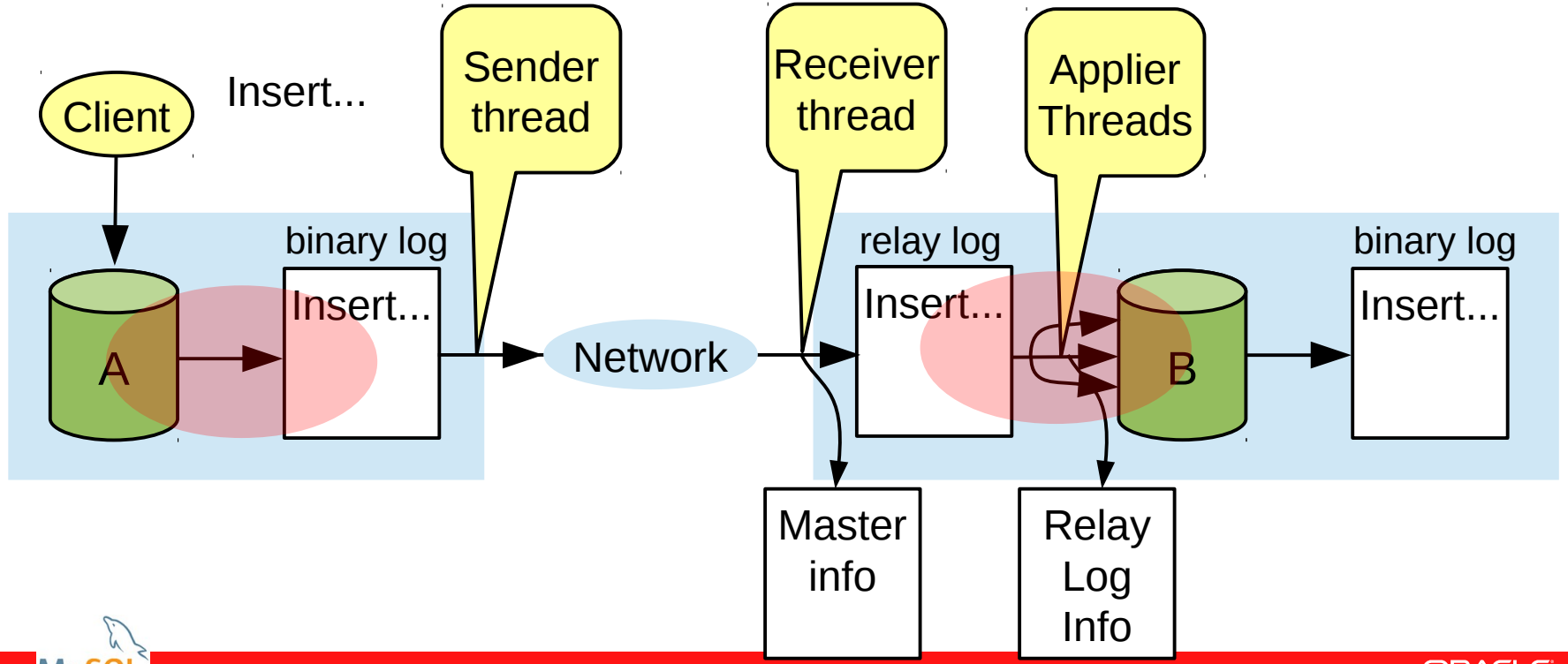
Higher Master Throughput: Sender, aka Dump, Thread Enhancement

Concurrent reads by the sender thread with ongoing writes from user threads.

- **Sender thread does not block user sessions more than necessary.**
- **Higher throughput for both sender threads and user sessions.**



Higher Slave Throughput: Timestamp based Multi-threaded Applier

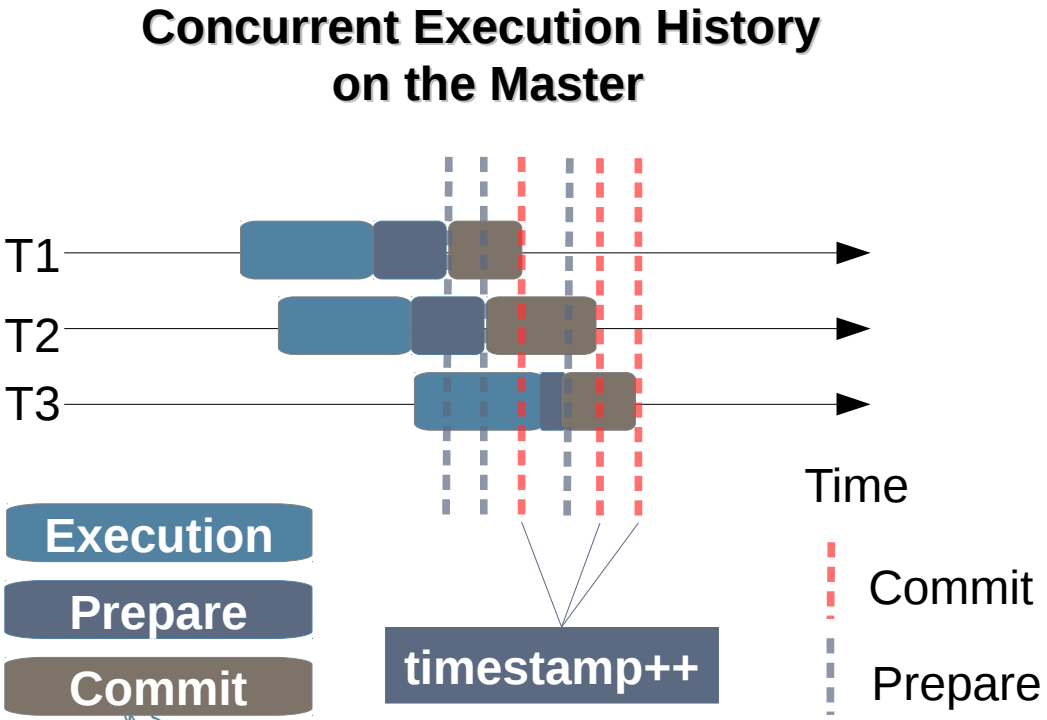


Higher Slave Throughput: Timestamp based Multi-threaded Applier

- Leverage parallelization information obtained from the execution on the master.
  - Transactions that prepare on the same "*version*" of the database, are assigned the same timestamp.

- Meanwhile, at the slave:
  - Transactions with the same timestamp can be executed in parallel;
  - Concurrent transactions commit independently, thus no waiting involved.

Higher Slave Throughput: Timestamp based Multi-threaded Applier



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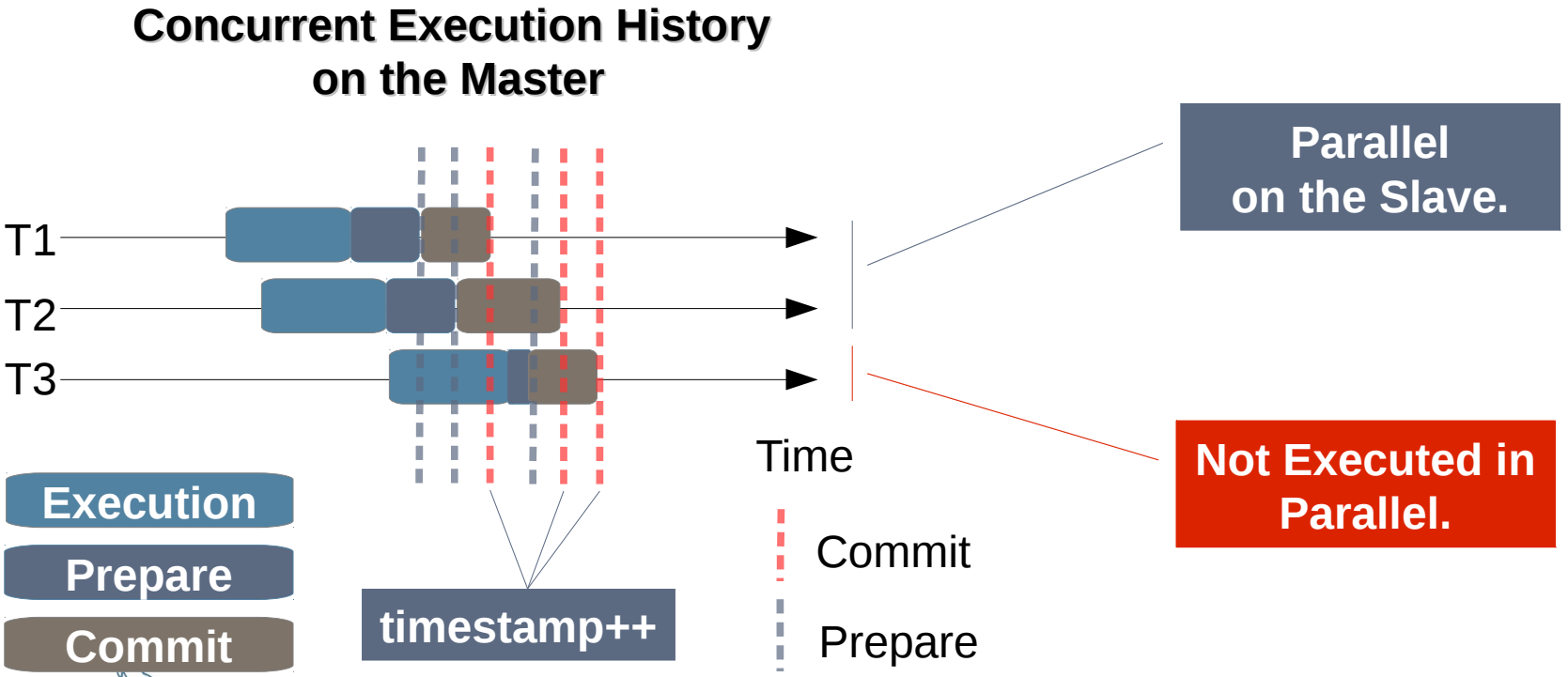


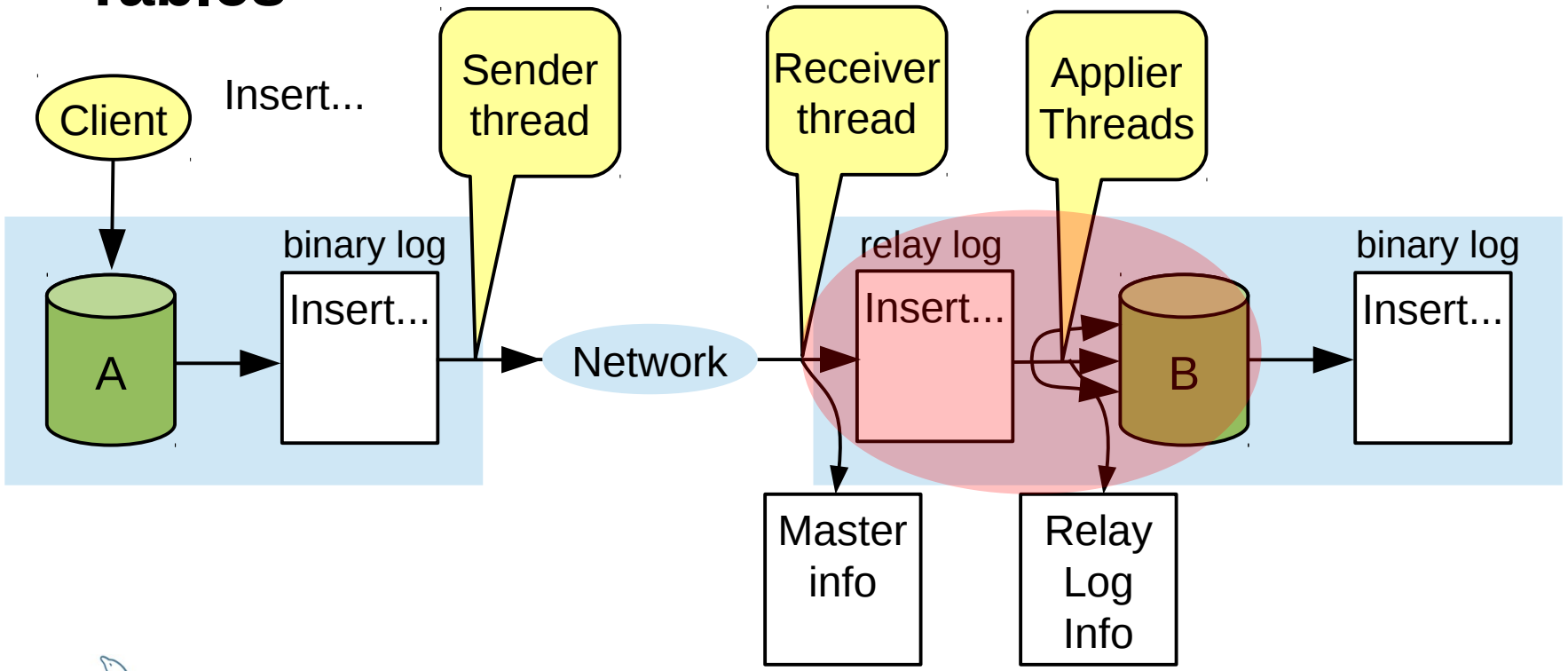
Higher Slave Throughput: Timestamp based Multi-threaded Applier

- Supports statement-based or row-based formats.
- Scheduling policy controlled through:

```
mysql> SET slave_parallel_type= [logical_clock|database]
```

  - *Logical_clock* - means schedule based on the prepare timestamp
  - *database* - the scheduling policy from 5.6 (concurrency control done per database).
- Work to improve slave scalability continues, does not stop here.

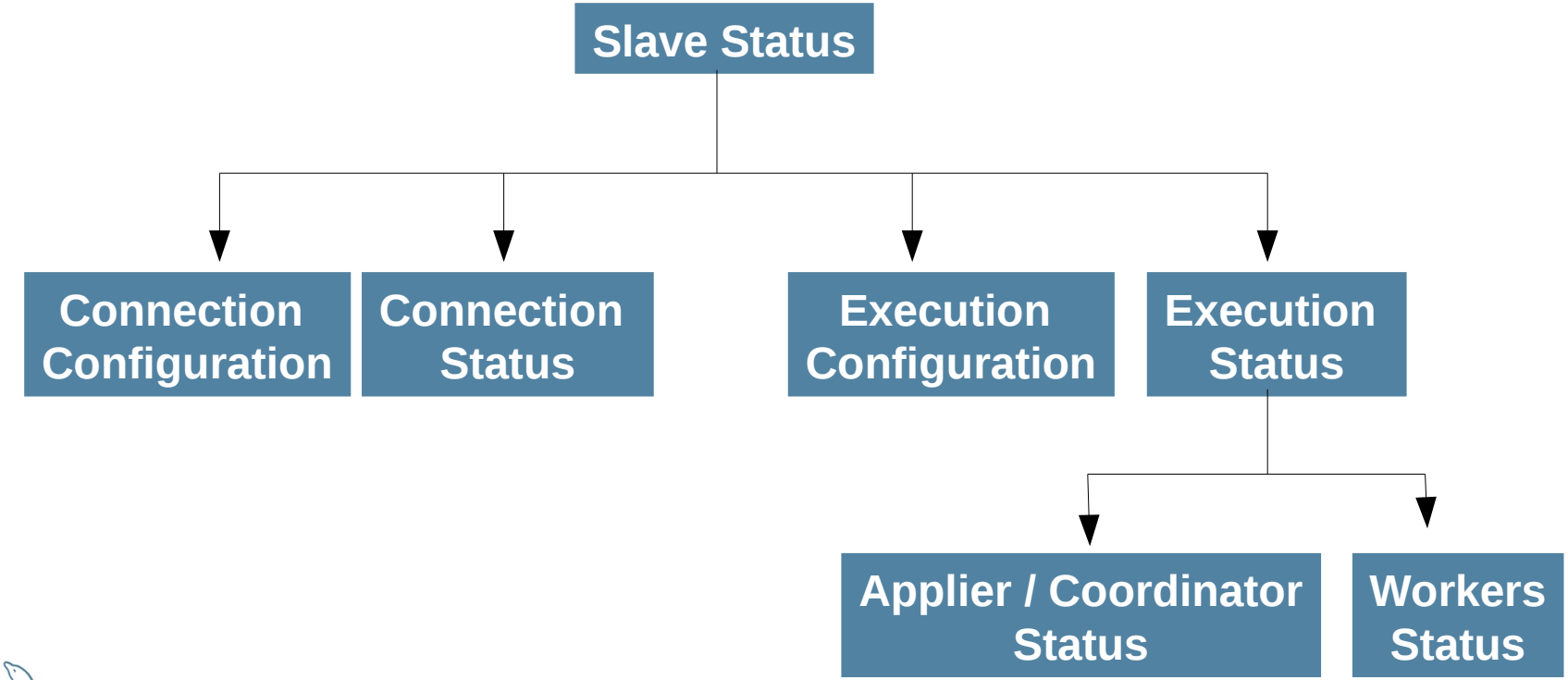
Better Replication Monitoring: P_S Replication Tables



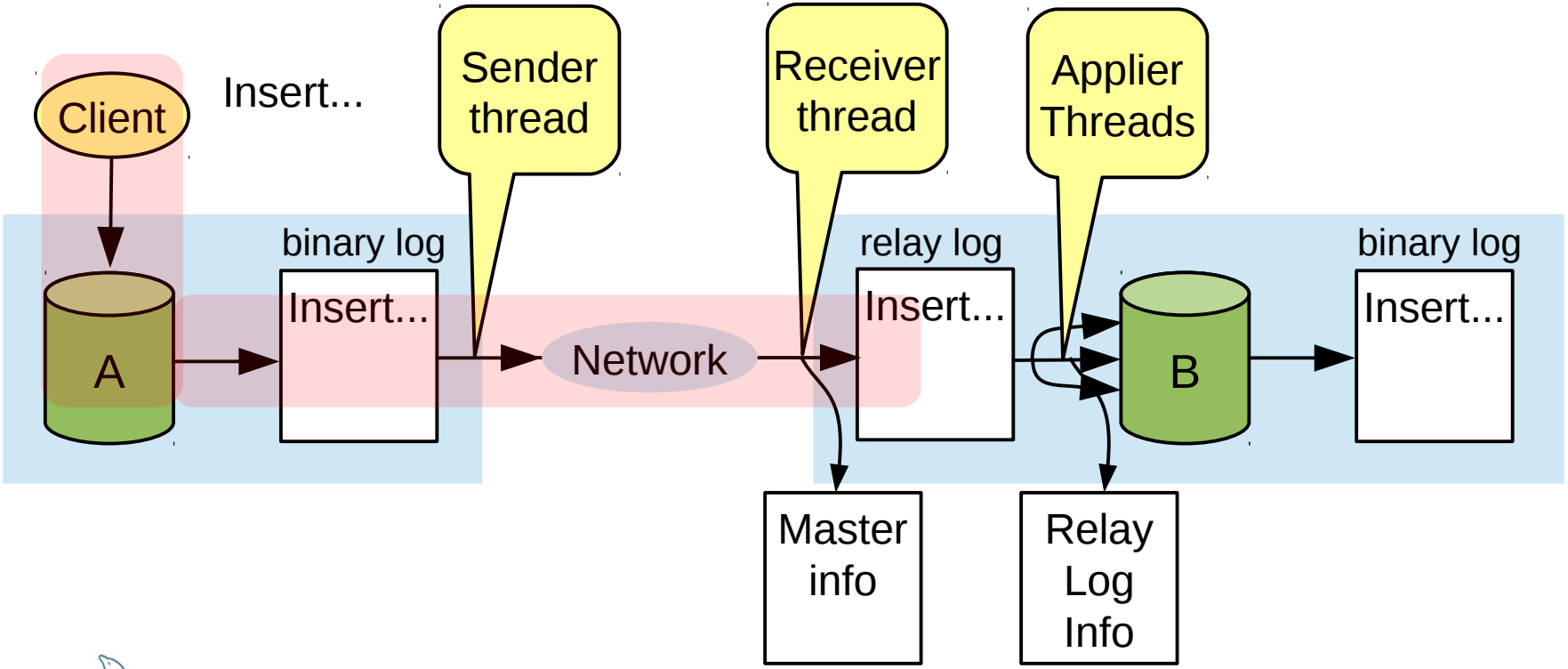
Better Replication Monitoring: P_S Replication Tables

- Access monitoring information through an SQL interface.
- Write stored functions or procedures with input from replication internals.
- Logically unrelated information into different places.
- Flexible and easier to extend and adapt as new feature get into the server.
- More user friendly names identifying the monitoring fields.

Better Replication Monitoring: P_S Replication Tables



Loss-less Semi-sync Replication

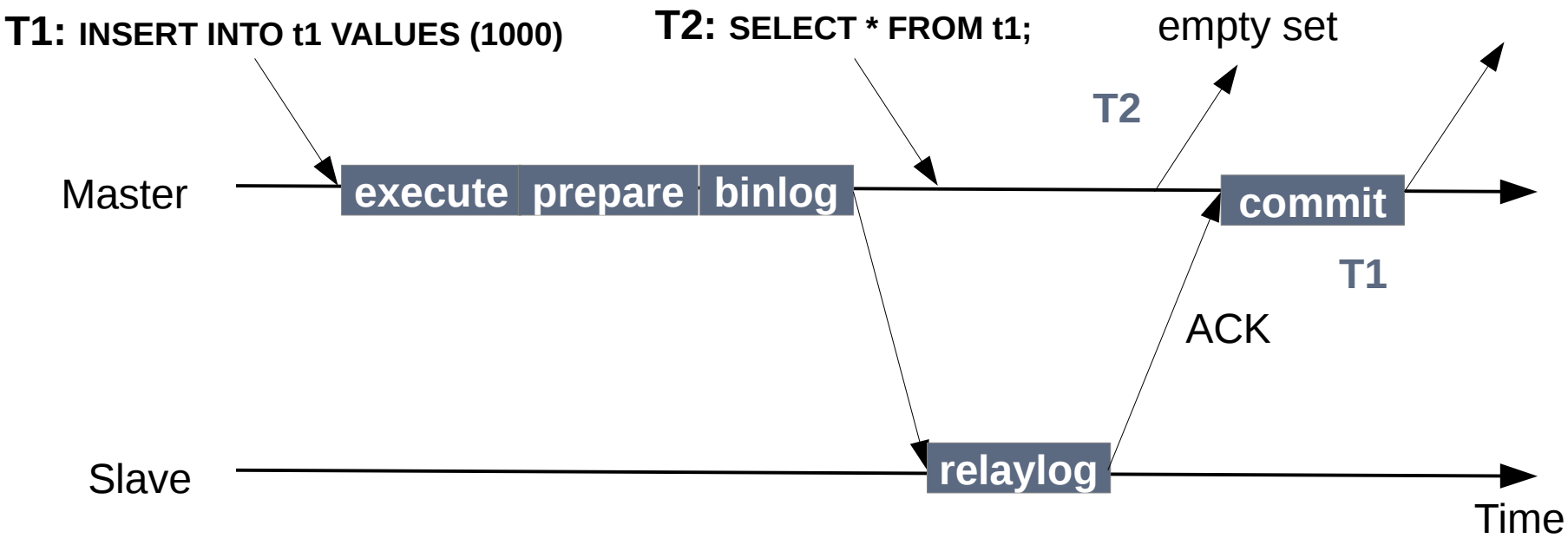


Loss-less Semi-sync Replication

- Master does not **commit** transaction until it receives and ACK from the slave.
  - (as opposed to: Master does not **release the session** until it receives and ACK from the slave.)
  - Therefore, concurrent transactions do not externalize changes while waiting for ACK.
- Should a master fail, then any transaction that it may have externalized is also persisted on a slave.
- User can choose between the original semisync behavior and the new one.

```
mysql> SET rpl_semi_sync_master_wait_point= [AFTER_SYNC|AFTER_COMMIT]
```

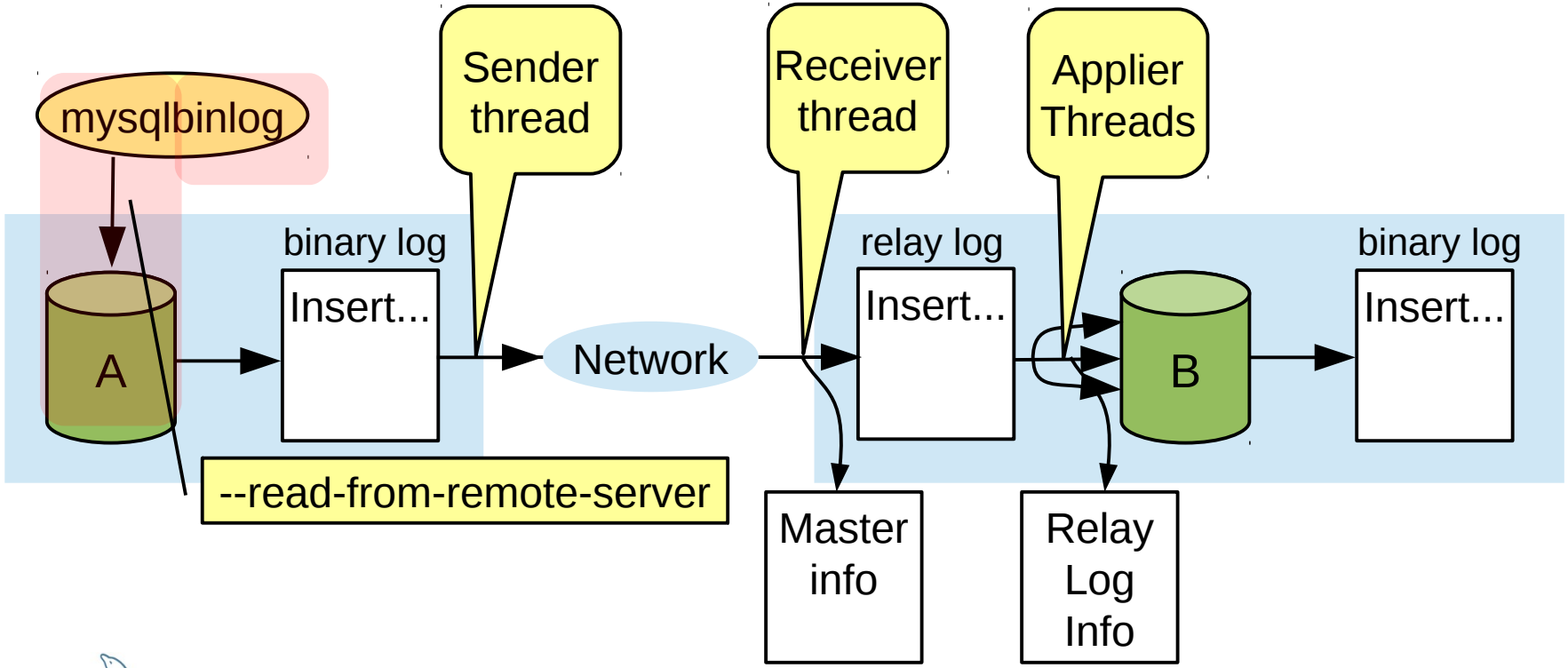
Loss-less Semi-sync Replication



What is New? (2013 –)

- **MySQL 5.7.3** - **Development Milestone Release, December 2013**
  - Improved Security
    - SSL options for mysqlbinlog
  - Flexible Semisync Durability
    - Configure master to wait for more than one semisync slave to ACK back.
  - More Production Friendly
    - Changing Replication Filters Dynamically.

SSL options for mysqlbinlog



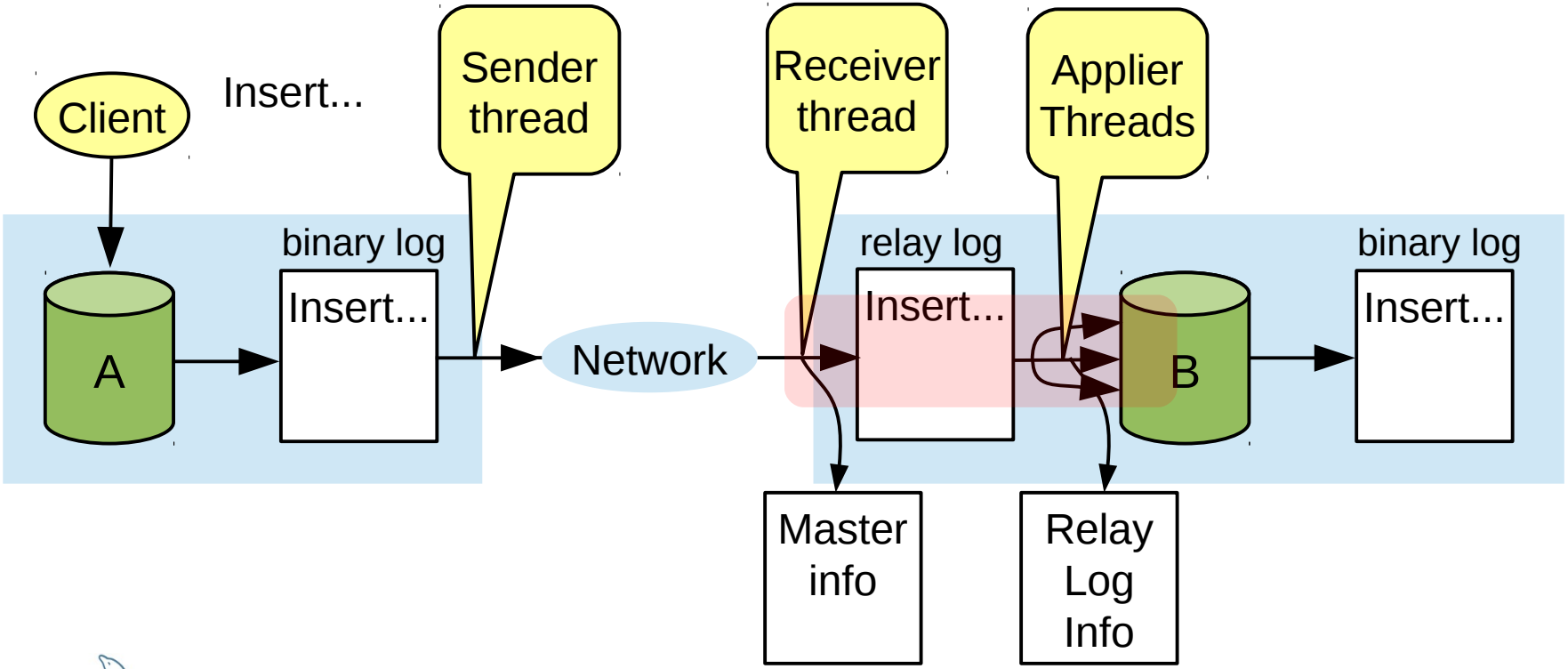
SSL options for mysqlbinlog

- --ssl* options to mysqlbinlog
  - Reading binary logs from remote servers through a secure channel.
  - Supports all SSL options that other client tools support.

```
mysql>  GRANT USAGE ON *.* TO 'rpluser'@'localhost' REQUIRE SSL;
```

```
shell>  mysqlbinlog --read-from-remote-server -ssl -u rpluser ...
```

Dynamic Slave Replication Filters

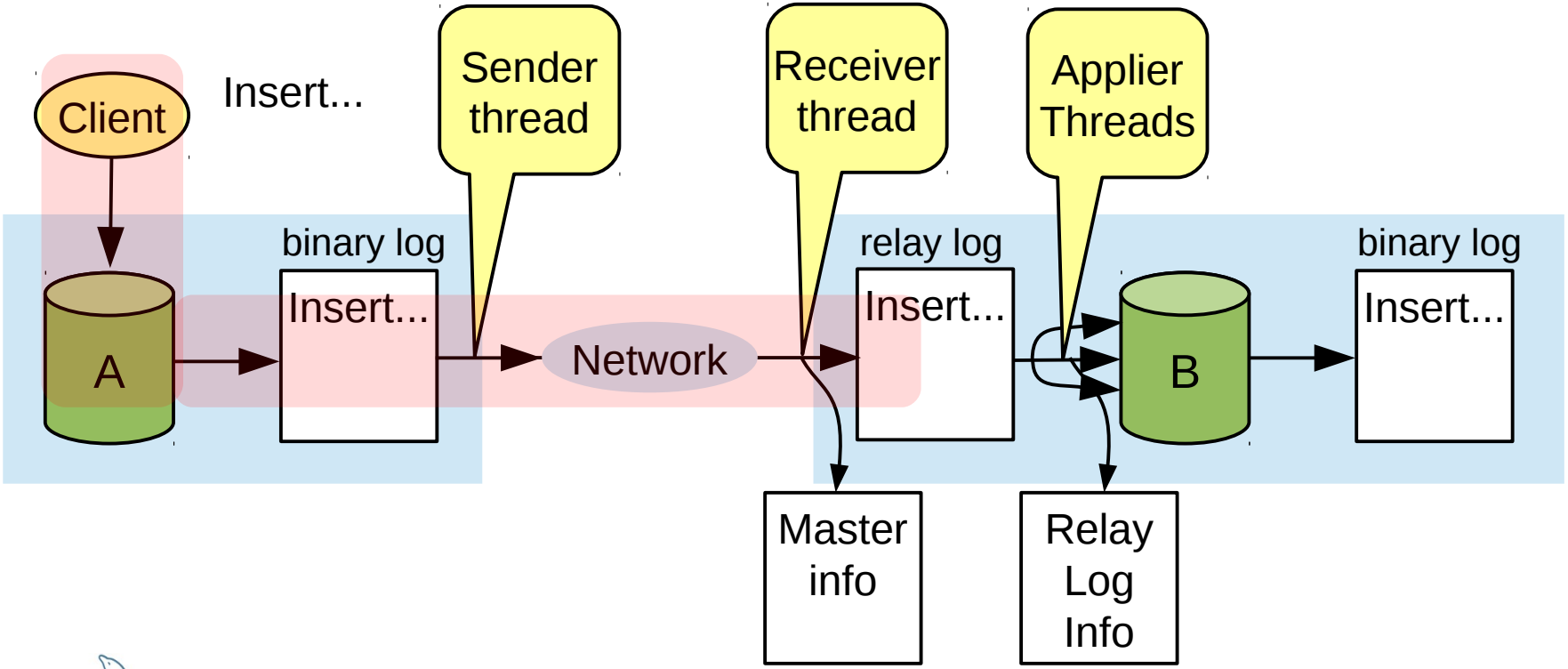


Dynamic Slave Replication Filters

- Change Slave's Replication Filters dynamically.
  - No need to stop and restart slave for establishing new replication filtering rules.
  - All slave filters are supported.
  - Values can be input in various character sets.

```
mysql> CHANGE REPLICATION FILTER REPLICATE_DO_DB= (db1, db2)
```

Semi-sync Replication – Wait for Multiple ACKs



Semi-sync Replication – Wait for Multiple ACKs

- Master does not **commit** transaction until it receives **N** ACKs from the slave.
- Dynamically settable:

```
mysql> SET GLOBAL rpl_semi_sync_master_wait_for_slave_count= N
```

Semi-sync Replication – Wait for Multiple ACKs

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```
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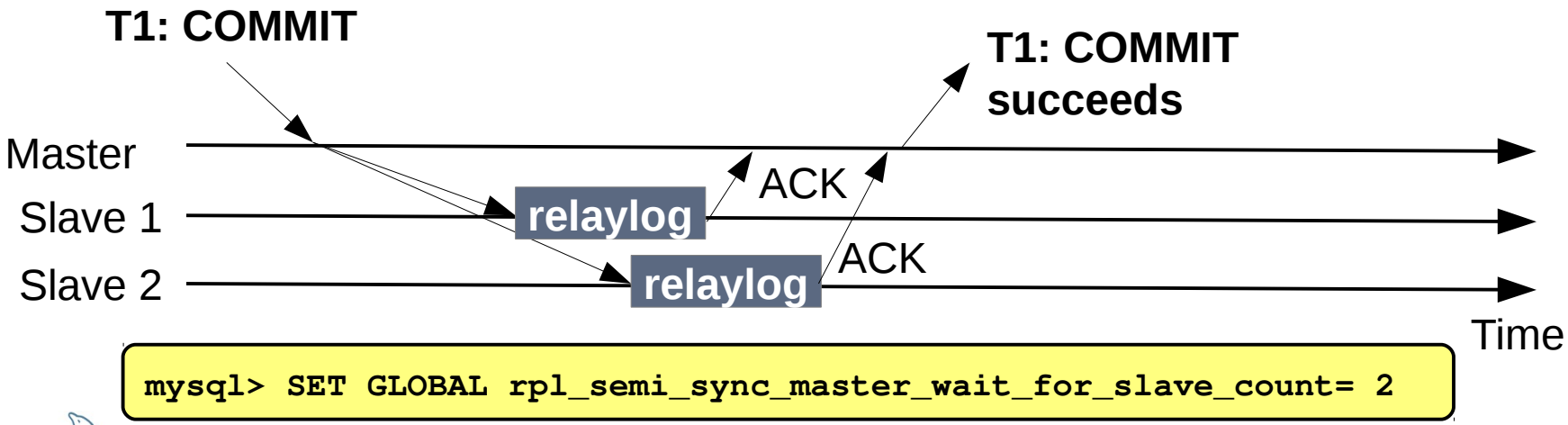

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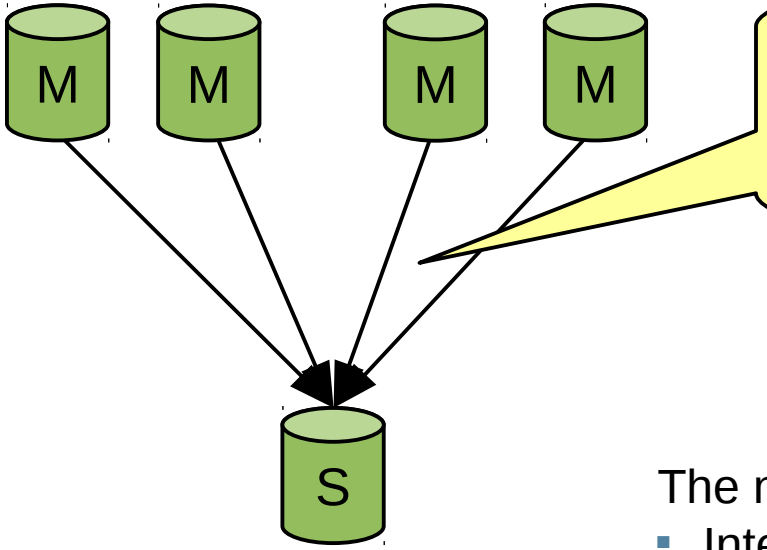
Multi-Source Replication

- A server (slave) can replicate from multiple sources (masters).
- Multiple channels (channel: connection thread, relay log, applier threads) that can be stopped started individually.
- Integrated with Multi-threaded Slave: each channel has its own multi-threaded applier set of threads.
- Integrated with the new P_S tables.
  - replication_execute_status_by_coordinator shows multiple entries, one per channel/source applier.
  - replication_connection_status shows multiple entries, one per connection to different sources.

Multi-Source Replication

- Integrated with GTIDs.
- Integrated with crash-safe tables.
  - Progress state is stored in these tables for recoverability purposes.
- Works with semisync replication.
  - Working on further improving the integration.
- No limit on the number of sources.
- Able to manage each source separately.

Multi-Source Replication



Slave **can** have more than **one master.**

Feature preview based on **5.7** is available on **labs.mysql.com .**

The need for gathering data in a central server:

- Integrated backup;
- Complex queries for analytics purposes;
- Data HUB for inter-cluster replication.

Write Scale-Out - Fabric

- Big workloads, Replication helps by offloading the master w.r.t. read queries (which are redirected to slaves).
- Huge workloads, Replication helps but eventually the requirement to write everywhere sets a limit on the scalability.
- **SOLUTION:** Split the database into chunks (shards) and distribute writes for groups of servers, instead of writing everywhere.
- **CHALLENGES:** routing queries, global tables, shard-aware connectors, shard migration, shart splitting, cross-shard joins, ...
- Enter **MySQL Fabric.** (Dr. Lars Thalmann will speak about that later today.)

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What is Next?

- MySQL Replication **Usability**
  - Instrument even more replication and extend replication P_S tables
  - Simpler administrative commands
  - Continue to build the GTIDs infrastructure
- MySQL Replication **Availability**
  - Continue to improve semi-sync
- MySQL Replication **Performance**
  - Continue to improve slave performance and improve multi-threaded slave
- MySQL **Fabric**
  - Extend High-Availability Support
  - Work with community on development

Our focus areas

- **Read Scale-out**: Increased performance
  - MySQL Replication
- **Usability**: Easier to use
  - MySQL Utilities
- **Loss-less replication**: Never loose information
  - MySQL Semi-synchronous Replication
- **Write Scale-out**: Increased performance
  - MySQL Fabric
- **High-Availability**: System always accessible
  - MySQL Fabric

Work on improvements

Work on improvements

Work to get to GA

Work on more features

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Summary

- MySQL 5.7.2 already shows features improving:
  - Performance, Availability and Usability.
- MySQL 5.7.3 continued down that path:
  - Tools got improved, HA enhancements, usability improvements.
- Lab releases provide a sneak peek at what is cooking: Multi-source, Fabric.

Next Steps: Read about the 5.7 DMRs Replication Features

- Read more about **P_S tables for replication** on Shiv's blog:

  http://shivjijha.blogspot.com/2013/09/Monitoring-Replication-with-the-NEW-performance-schema-tables.html

- Read more about **Intra-Schema Multi-threaded Slave** on Rohit's blog:

  http://geek.rohitkalhans.com/2013/09/enhancedMTS-deepdive.html

- Read more about **Semisync enhancements** on Libing's blog:

  http://my-replication-life.blogspot.com/2013/09/dump-thread-enhancement.html

  http://my-replication-life.blogspot.pt/2013/09/loss-less-semi-synchronous-replication.html

Next Steps: Read about the 5.7 DMRs Replication Features

- Read more about **mysqlbinlog idempotent mode** on Rohit's blog:

  http://binlogtorelaylog.blogspot.com/2013/05/mysqlbinlog-idemmpotent-mode.html

- Read more about **mysqlbinlog –rewrite-db option** on Manish's blog:

  http://manishthe.blogspot.com/2013/05/introduction-with-wonderful-and-best.html

Next Steps: Read about the 5.7 DMRs Replication Features

- Read more on **Dynamic Replication Filters** on Venkat's blog:

  http://my-s-q-l.blogspot.com/2013/12/Making-MySQL-Slave-Replication-Filters-Dynamic.html

- Read more on **Semi-sync Multiple ACKs** on Libing's blog:

  http://my-replication-life.blogspot.com/2013/12/enforced-semi-synchronous-replication.html

- Read more on **SSL options for mysqlbinlog** on João's blog:

  http://jmysqlrep.blogspot.com/2013/12/mysql-57-mysqlbinlog-now-supports-ssl.html

Next Steps: Read about the Replication Features on labs.mysql.com

- Read more about **Multi-source replication** on Rith's blog:

  http://on-mysql-replication.blogspot.com/2013/09/feature-preview-mysql-multi-source-replication.html

QUESTIONS?


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