MySQL always-up with Galera Cluster

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by oli.sennhauser@fromdual.com

www.fromdual.com

About FromDual GmbH

- FromDual provides neutral and independent:
  - Consulting for MySQL, Galera Cluster, MariaDB and Percona Server
  - Support for all MySQL and Galera Cluster
  - Remote-DBA Services for all MySQL
  - MySQL Training
- Open Source Business Alliance (OSBA)
- Member of SOUG, DOAG, /ch/open

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Always-up? :-(

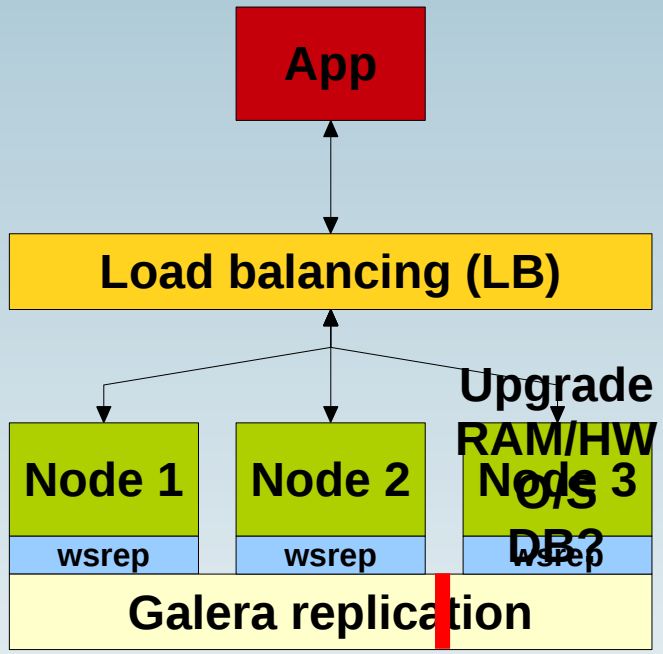
- Its also about maintenance...

- Who loves night-shifts?
- Who loves weekend-work?
- Who does regular upgrade (DB, kernel, etc.)?
- Who does regular reboots (after kernel upgrade)?

- Why are you not doing it in your office hours?

The Galera Cluster for MySQL

Maintenance time...



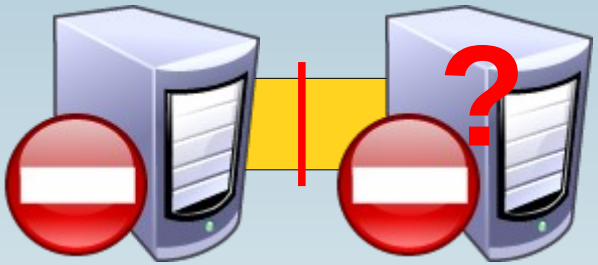
Advantages / Disadvantages

- Based on InnoDB SE
- Synchronous replication → No lost transaction
- Active-active multi-master Cluster

  → Read and write to any cluster node (no r/w split any more!)
- Read scalability and higher write throughput (Flash-Cache?)
- Automatic node membership control
- Rolling Restart (Upgrade of Hardware, O/S, DB release, etc.)
- True parallel replication, on row level → No slave lag
- A bit more complicated than normal MySQL, but similar complexity as M/S Replication!
- No original MySQL binaries → Codership MySQL binaries
- Be aware of Hot Spots on rows: Higher probability of deadlocks

Quorum and Split-brain

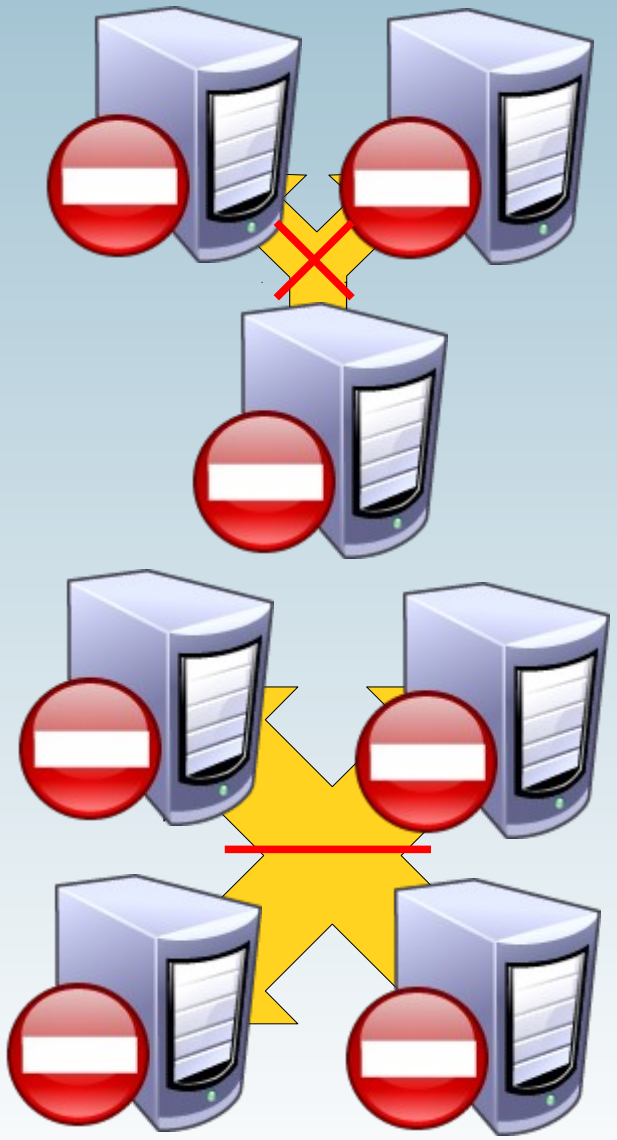
- What is the problem?
- Split-brain → bad!



- Galera is a pessimistic Cluster → good!
- Quorum: `FLOOR(n/2+1)`

  → more than half! → 3-node Cluster (or 2+1)

Quorum



Installation and Configuration

Installation

- Galera Cluster consists of:
  - A patched Codership MySQL (`mysqld`)
    - Or MariaDB Galera Cluster
    - Or Percona XtraDB Cluster
  - The Galera Plugin (`libgalera_smm.so`)
- Ways of installation
  - Packets (RPM, DEB)
  - Binary tar-ball
  - Patch MySQL source and compile both
- Download http://galeracluster.com/downloads/

MySQL Configuration

my.cnf

```
[mysqld]

default_storage_engine          = InnoDB
binlog_format                   = row

innodb_autoinc_lock_mode        = 2   # parallel applying

innodb_flush_log_at_trx_commit = 0   # performance only!

query_cache_size                = 0   # Galera 3 → experimental
query_cache_type                = 0   # Mutex! Consistency!
```

Galera Configuration

my.cnf (conf.d/wsrep.cnf)

```
[mysqld]

# wsrep_provider                  = none
wsrep_provider                  = …/lib/plugin/libgalera_smm.so

# wsrep_cluster_address           = "gcomm://"
wsrep_cluster_address           = "gcomm://ip_node2,ip_node3"

wsrep_cluster_name              = 'Galera Cluster'
wsrep_node_name                 = 'Node A'

wsrep_sst_method                = mysqldump
wsrep_sst_auth                  = sst:secret
```

Operations

Initial Cluster start

- Start very 1st node with:

```
wsrep_cluster_address = "gcomm://"
```

or

```
mysqld_safe --wsrep-cluster-address="gcomm://"
```

  - → this tells the node to be the first one!
- All other nodes normal:

```
service mysqld start
```

Rolling Restart

- Scenario:
  - Hardware-, O/S-, DB- and Galera-Upgrade
  - MySQL configuration change
  - During full operation!!! (99.999% HA, 5x9 HA)

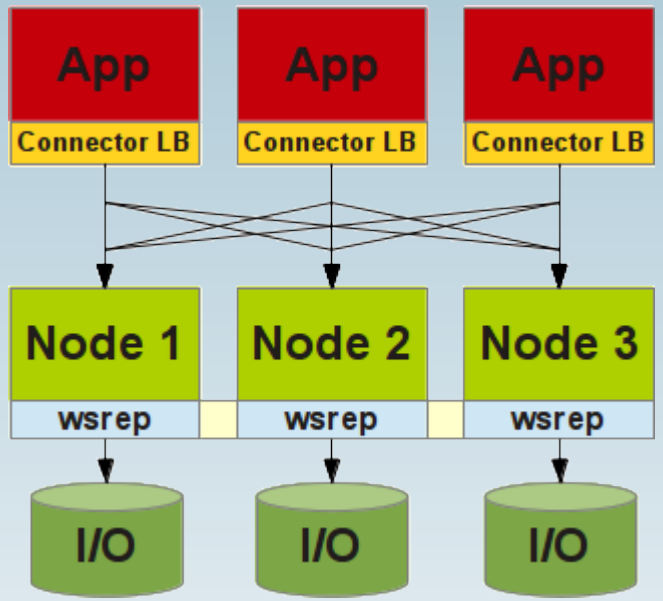
- → Rolling Restart
  - Start one node after the other in a cycle
  - New features or settings are used after Rolling Restart is completed

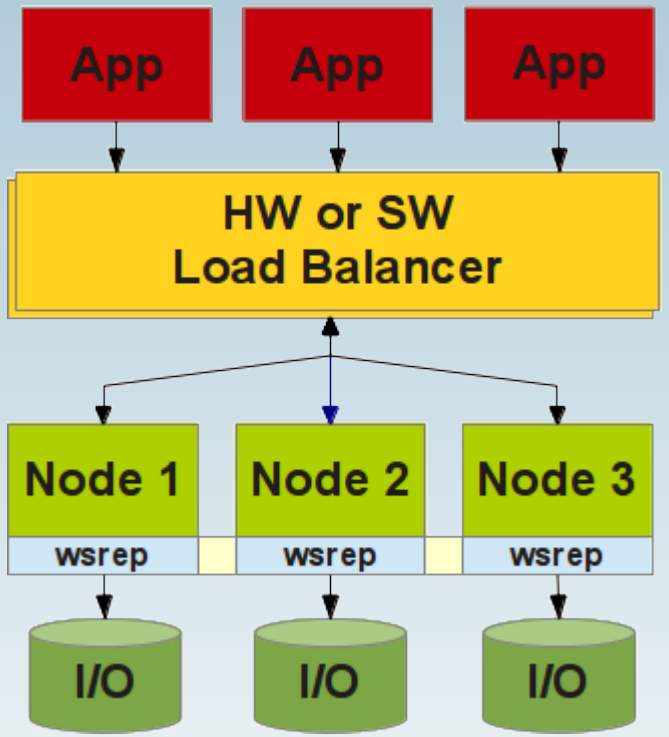
Demo?

Load Balancing

- Connectors
  - Connector/J
  - PHP: MySQLnd replication and load balancing plug-in
- SW Load Balancer
  - GLB, LVS/IPVS/Ldirector, HAProxy
- HW Load Balancer

Location of Load Balancing





Demo?

Catch Node State Change

- Node State Change
  - Initialized (0), Joining (1), Donor/Desynced (2), Synced (4), ...
- Galera node acts as follows;
  - `ERROR 2013 (HY000): Lost connection to MySQL server at 'reading initial communication packet', system error: 2`
  - `ERROR 1047 (08S01) at line 1: Unknown command`

  → this is ugly!
- Catch the state change with:
  - `wsrep_notify_cmd`
  - To start Firewall Rules (REJECT)
  - To take node out of Load Balancer

Demo?

Online Schema Upgrade (OSU)

- Schema Upgrade = DDL run against the DB
  - Change DB structure
  - Non transactional
- 2 Methods:
  - Total Order Isolation (TOI) (default)
  - Rolling Schema Upgrade (RSU)
- `wsrep_osu_method = {TOI|RSU}`

Total Order Isolation (TOI)

- Default
- Part of the database is locked for the duration of the DDL.

  + Simple, predictable and guaranteed data consistency.

  - Locking operation
- Good for fast DDL operations

Rolling Schema Upgrade (RSU)

- DDL will be only processed locally at the node.
  - Node is desynchronized
  - After DDL, delayed write sets are applied
- DDL should be manually executed at each node.

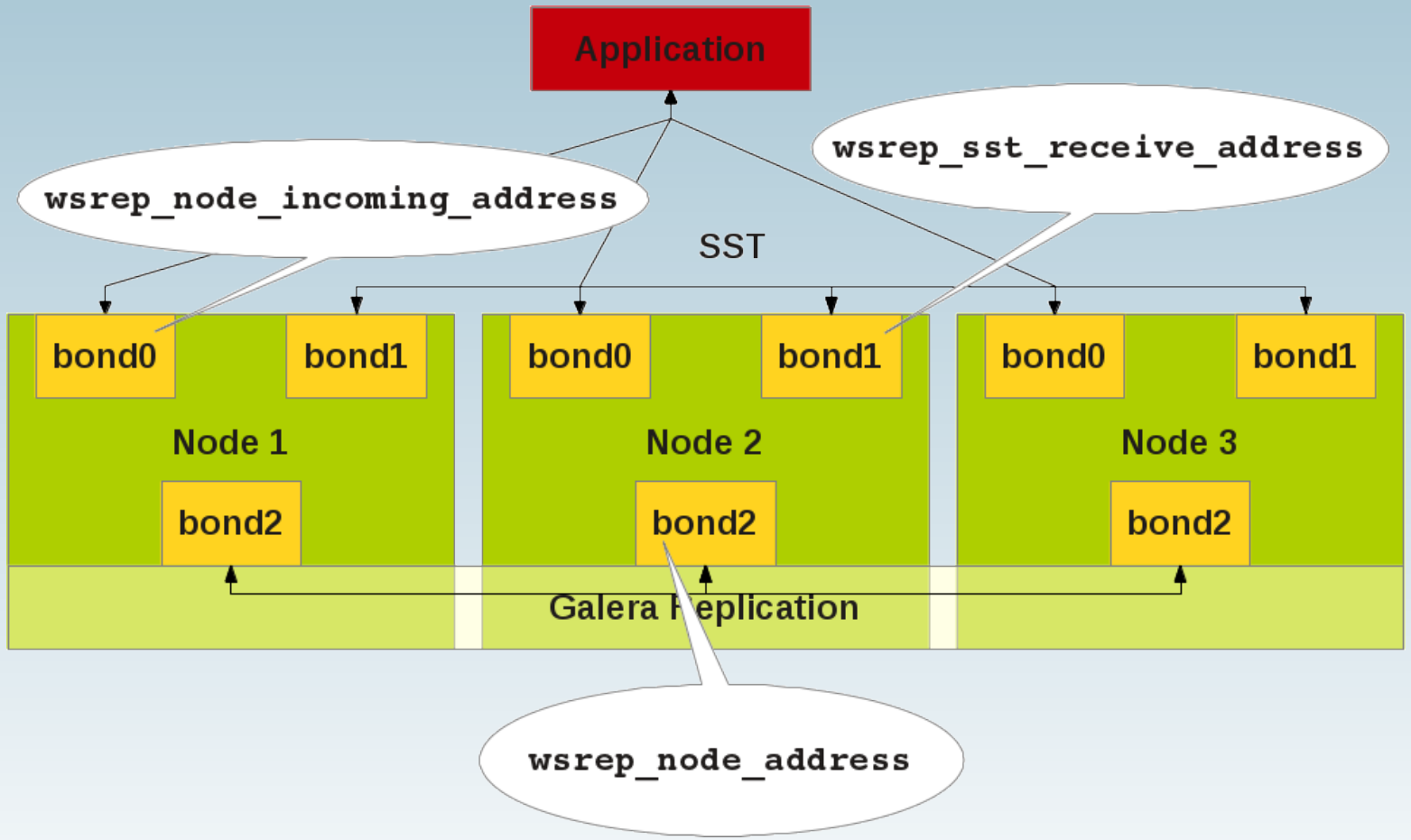
  + only blocking one node at a time

  - potentially unsafe and may fail if new and old schema are incompatible
- Good for slow DDL operations

Other security related stuff

Caution!

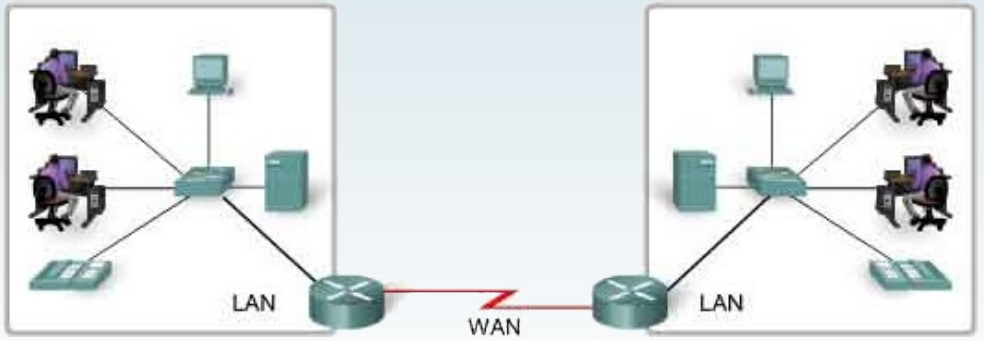
Galera Network Configuration



WAN – Cluster

- WAN = Wide Area Network
  - Connect 2 or more locations over a public or private Network

- What are the problems?
  - Round Trip Time (RTT)
  - Throughput
  - Network Stability
  - Wrong set-ups



Communication encryption

- 2 Possibilities:
  1.) Make Network secure (V-LAN, VPN with SSL, `stunnel`)
  2.) Encrypt Galera communication with SSL
- Caution: only Galera replication is affected!
  - NOT State Snapshot Transfer (SST, `mysqldump | mysql`, `rsync`)
  - NOT Client connection (`mysql`), use MySQL SSL encryption!
  - But Incremental State Transfer (IST) IS affected (= Galera Protocol)!
- We recommend for ease of use: Do it on Network level!

Wir suchen noch:

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- **Datenbank Enthusiast/in für Support / remote-DBA / Beratung**

Q & A

Questions ?

Discussion?

We have time for some face-to-face talks...

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