Monitoring a Galera Cluster
Codership Training
Introduction

Monitoring a Galera Cluster
Introductions

Codership Oy
  Creators & Developers of Galera Cluster
  Employees in Multiple Countries

Galera Cluster
  Released Initially in May 2007
  Over 1.5 Million Downloads

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  KB Editor, Documentation, Instructor (MySQL, MariaDB)
  Writer (O'Reilly Books)
Tutorial Outline

Galera & Monitoring Overview
Galera Status Variables
Server Logs
Notification Command
Customized Scripts
Third-Party Software
Galera & Monitoring Overview

Monitoring a Galera Cluster
Basic Replication Concepts

Nodes – Physical & Virtual Servers

Databases – MySQL, MariaDB, XtraDB

Replication

Load Balancing

High Availability
Galera Cluster Concepts

Virtual Synchronous Replication
True Multi-Master Solution
Conflict Detection & Resolution on Commit
Multiple, Odd Number of Nodes
Easy Maintenance
  Automatic Provisioning
  Node Isolation
  Rolling Upgrades
Monitoring a Cluster

What to Monitor
- Nodes Down
- Partitioned Clusters
- Lagging Nodes

Resources Available
- Status Variables
- Log Files
- Scripts & Software
Galera Status Variables

Monitoring a Galera Cluster
Galera Status Variables

Cluster Integrity

Communication among Nodes

Node Status

Networking & Basic Requirements of Individual Nodes

Replication Health

Performance and Dependability of Schema and Data Changes

SHOW GLOBAL STATUS LIKE 'wsrep_%';

<table>
<thead>
<tr>
<th>Variable_name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>wsrep_local_state_uuid</td>
<td>bd5fe1c3-7d80-...</td>
</tr>
<tr>
<td>wsrep_protocol_version</td>
<td>10</td>
</tr>
<tr>
<td>wsrep_thread_count</td>
<td>6</td>
</tr>
</tbody>
</table>
Cluster Integrity

Compare UUIDs
  \[(\text{wsrep\_cluster\_state\_uuid})\]

Count the Nodes \[(\text{wsrep\_cluster\_size})\]

Do an Audit \[(\text{wsrep\_cluster\_conf\_id})\]

Ensure Primary Status
  \[(\text{wsrep\_cluster\_status})\]

```sql
SHOW GLOBAL STATUS
LIKE 'wsrep_local_state_comment';
```

<table>
<thead>
<tr>
<th>Variable_name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>wsrep_local_state_comment</td>
<td>Synced</td>
</tr>
</tbody>
</table>
Node Status

Ready & Connected (wsrep_ready, wsrep_connected)

Node State Comment

```
ERROR 1047 (08501) Unknown Command
SHOW GLOBAL STATUS LIKE 'wsrep_local_state_comment';
+---------------------------+--------+
| Variable_name             | Value  |
|---------------------------+--------|
| wsrep_local_state_comment | Synced |
+---------------------------+--------+
```
Replication Health

Bunching of Writes
\[(wsrep_local_recv_queue_avg)\]

Flow Control Paused
\[(wsrep_flow_control.paused)\]

Sequentially in Parallel
\[(wsrep_cert_deps_distance)\]

SHOW STATUS LIKE 'wsrep_local_send%';
+----------------------------+----------+
| Variable_name              | Value    |
|----------------------------+----------|
| wsrep_local_send_queue     | 0        |
| wsrep_local_send_queue_max | 1        |
| wsrep_local_send_queue_min | 0        |
| wsrep_local_send_queue_avg | 0.000000 |
+----------------------------+----------+

SHOW STATUS LIKE 'wsrep_local_recv%';
+----------------------------+----------+
| Variable_name              | Value    |
|----------------------------+----------|
| wsrep_local_recv_queue     | 0        |
| wsrep_local_recv_queue_max | 1        |
| wsrep_local_recv_queue_min | 0        |
| wsrep_local_recv_queue_avg | 0.145000 |
+----------------------------+----------+

Documentation on Replication Health: https://galeracluster.com/library/documentation/monitoring-cluster.html#check-replication-health
Server Logs

Monitoring a Galera Cluster
MySQL Server Logs

Error Log — Errors, Start-Up & Shutdown

Binary Log — Standard Replication and Point-in-Time Recovery

Slow Query Log

SQL Error Log — Govt. Compliance

Relevant Entries from my.cnf configuration file

- \[mysqld\]
  - slow_query_log = ON
  - slow_query_log_file='/var/log slow_query.log'
  - long_query_time = 0.5
  - log_queries_not_using_indexes
  - log_slow_admin_statements

Requires INSERT Privilege on mysql.plugin Table

log-error='/var/log/mysqld.log'
log-warnings = 1

log-bin
binlog-expire-logs-seconds=302400

INSTALL PLUGIN sql_error_log SONAME 'sql_errlog.so';
Recording More in Server Logs

Log Conflicts (wsrep_log_conflicts)

Certification Failures (cert.log_conflicts)

Debugging (wsrep_debug)

---

log-error
wsrep_log_conflicts=ON
wsrep_provider_options="cert.log_conflicts=ON"
wsrep_debug=ON

Relevant Entries from my.cnf configuration file
190720 3:25:31 [Note] WSREP: cluster conflict due to certification failure for threads:
190720 3:25:31 [Note] WSREP: Victim thread:
  THD: 241344, mode: local, state: executing, conflict: cert failure, seqno: 30399304
  SQL: UPDATE table1 SET col1 = 'some text' WHERE id = '100'

*** Priority TRANSACTION:
TRANSACTION 464359568, ACTIVE 0 sec starting index read
mysql tables in use 1, locked 1
1 lock struct(s), heap size 360, 0 row lock(s)
MySQL thread id 2, OS thread handle 0x7f1c0916c700, query id 8190690
  Update_rows_log_event::find_row(30399302)

*** Victim TRANSACTION:
TRANSACTION 845723193, ACTIVE 0 sec
mysql tables in use 1, locked 1
2 lock struct(s), heap size 360, 1 row lock(s), undo log entries 1
MySQL thread id 241344, OS thread handle 0x7f1c00091700,
  query id 947723 172.31.24.118 sam_angiz query end
UPDATE table1 SET col1 = 'some text' WHERE id = '100'

*** WAITING FOR THIS LOCK TO BE GRANTED:
RECORD LOCKS space id 254818 page no 3 n bits 72 index `PRIMARY` of table `db1`.`table1` trx
  table locks 1 total table locks 2 trx id 845723193 lock_mode X locks rec
  but not gap lock hold time 0 wait time before grant 0
190720 3:25:31 [Note] WSREP: cluster conflict due to high priority abort for threads:
190720 3:25:31 [Note] WSREP: Winning thread:
  THD: 4, mode: applier, state: executing, conflict: no conflict, seqno: 30399302
  SQL: (null)
190720 3:25:31 [Note] WSREP: Victim thread:
  THD: 241344, mode: local, state: committing, conflict: no conflict, seqno: -1
  SQL: UPDATE table1 SET col1 = 'some text' WHERE id = '100'
Notification Command

Monitoring a Galera Cluster
Notifying

Notification Script on Each Node

Node Status Changes (e.g., Disconnects)

Notification Command Triggered
# Node Status String

**Starting Node**
- Undefined — Not Part of PC
- Joiner — Receiving SST

**Existing Nodes**
- Donor — Sending SST
- Joined — Processing Updates
- Synced — Synchronized

**Error** — Problems Occurred

Documentation on Node Status Values: https://galeracluster.com/library/documentation/notification-cmd.html#node-status
## Members List

<table>
<thead>
<tr>
<th>Node UUID</th>
<th>Node Name (wsrep_node_name)</th>
<th>Incoming Address (wsrep_node_incoming_address)</th>
</tr>
</thead>
<tbody>
<tr>
<td>09fd7887-a84d-11e9-bdaa-1718db36144e</td>
<td>galera2/AUTO</td>
<td>09fd7887-a84d-11e9-bdaa-1718db36144e/\textit{galera2}/AUTO</td>
</tr>
<tr>
<td>0a1e9504-a871-11e9-944c-13bde588c4e3</td>
<td>galera3/AUTO</td>
<td>0a1e9504-a871-11e9-944c-13bde588c4e3/\textit{galera3}/AUTO</td>
</tr>
<tr>
<td>38807f55-a7d2-11e9-aa9b-7674d700b955</td>
<td>galera1/AUTO</td>
<td>38807f55-a7d2-11e9-aa9b-7674d700b955/\textit{galera1}/AUTO</td>
</tr>
</tbody>
</table>

Documentation on Members List: [https://galeracluster.com/library/documentation/notification-cmd.html#member-list-format](https://galeracluster.com/library/documentation/notification-cmd.html#member-list-format)
Customized Scripts

Monitoring a Galera Cluster
Simple Notification Script
Setting a Notification Command

Locate Script in Protected Directory
Touch Log File
Change Permissions & Ownership
Set `wsrep_notify_cmd` in Configuration File

**PREPARING**
**EMPTY LOG FILE**

```
cd /var/log
touch galera-node-monitor.log
chown mysql:mysql galera-node-monitor.log
chmod 755 galera-node-monitor.log
```

Executed from Command-Line

**TELLING GALERA ABOUT NOTIFICATION COMMAND**

```
wsrep_notify_cmd="/commands/note-cmd.bash"
```

Excerpt from MySQL Configuration File (e.g., `my.cnf`)
Testing a Notification Script
Notifications Logged in MySQL

Logging to MySQL will Replicate to All Nodes

Generating Reports is Easier

Patterns may Emerge

Detect Problems Early
MySQL Database Log
Notification Script
Interfacing with MySQL
Creating an Alert

Conditional Statements for Alert Worthiness

Email Alert

- mail
- sendmail

SMS Telephone Message

- Subscription to Text Messaging Service
- Determine DBA On-Call
- Assemble Alert Message

```
curl -X POST https://textbelt.com/text
--data-urlencode phone='$admin_nbr'
--data-urlencode message='$alert'
-d key=textbelt
```
Third-Party Software

Monitoring a Galera Cluster
Monitoring & Trending Software

Monitors

- Cluster Status
- Node States
- Cluster Size
- Flow Control
- Send & Receive Queue
- Slow Nodes

Trends

- Record Stats for Reports & Graphs
- Host Metrics — Repetition & Patterns
- Spot Physical Server & Network Problems
- InnoDB Status (e.g., Spikes)
Popular Software

Monitoring

Nagios Plugin
Galera Monitor (MariaDB MaxScale)
  Load Balancing, Designating Master & Slaves
Monyog
  Individual Nodes

Trending

SCUMM (Several Nines)
Percona Monitoring & Management

Conclusion

Monitoring a Galera Cluster
A Monitoring & Reaction Plan

Inventory of Nodes & Cluster

Notes on Location, Logins, Etc.
Minimum Nodes Needed for Traffic
Spare Nodes – Notes on Deploying Them

Practice

Removing a Node for Maintenance
Adding a Node for Increased Traffic
Restarting a Cluster

Monitoring Plans

List of Relevant Status Variables
Log Files – Path and Names
Method or Software for Monitoring
Additional Resources

Codership Library (galeracluster.com/library)
Documentation (/library/documentation)
Knowledge Base (/library/kb)
FAQ (/library/faq)

Training (/library/training)
Videos (/library/training/videos)
Tutorials (/library/training/tutorials)

Thanks for Listening

Monitoring a Galera Cluster