Introduction

Installing Galera Cluster with MariaDB
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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Tutorial Outline

Galera Cluster Overview
Installing Software
Configuring Nodes
Opening Ports
Starting Galera
Galera Cluster Overview

Installing Galera Cluster with MariaDB
Basic Replication Concepts

Node — Physical or Virtual Server

Database — MariaDB

Replication
  High Availability
  Load Balancing
Galera Cluster Concepts

Virtual Synchronous Replication
True Multi-Master Solution
Conflict Detection & Resolution on Commit
Easy Maintenance
  Automatic Provisioning
  Node Isolation
  Rolling Upgrades
Galera Factors & Best Practices

Servers

- Linux or Unix Operating System
- Dedicated Servers with Plenty of RAM

Multiple, Odd Number of Nodes

- Not a Stand-Alone
- Three Minimum

Equal Nodes

- Equipment & Software
- Configuration

Installing Software

Installing Galera Cluster with MariaDB
Minimal Software

Operating System & Utilities
Synchronizing Tool
Firewall
Database Software
Galera Cluster

```
ssh -i '.ssh/galera-key' centos@12.127.17.75
```

```
ssh galera-1
```

```
Host galera-1
    HostName 12.127.17.75
    User centos
    IdentityFile ~/.ssh/galera-key

Host galera-2
    HostName 12.127.17.89
    User centos
    IdentityFile ~/.ssh/galera-key

Host galera-3
    HostName 12.127.17.124
    User centos
    IdentityFile ~/.ssh/galera-key
```
Node Provisioning Tool

State Transfers for New Nodes

State Snapshot Transfer (SST)
Incremental State Transfers (IST)

Methods for State Transfers

Logical — `mysqldump`
Physical — `rsync`

```bash
yum -y install rsync
```

Executed from Command-Line on Each Node.

Documentation on Node Provisioning: https://galeracluster.com/library/documentation/node-provisioning.html
Documentation on State Transfers: https://galeracluster.com/library/documentation/state-transfer.html
Updating & Installing Software on Nodes
Installing MariaDB with Galera

MariaDB Repo File Generator
(https://downloads.mariadb.org/mariadb/repositories/)

Install MariaDB – Galera Included

Secure Installation (e.g., Password)

yum -y install MariaDB-server MariaDB-client
systemctl start mariadb
mysql_secure_installation

Executed from Command-Line

Installation Documentation: https://galeracluster.com/library/documentation/install.html
MariaDB Repo File Generator: https://downloads.mariadb.org/mariadb/repositories/
Installing MariaDB & Galera Software
Configuring Nodes

Installing Galera Cluster with MariaDB
Database Configuration

Edit MySQL Configuration File (/etc/my.cnf.d/server.cnf)

- **bind-address** — Not Local Host
- **default_storage_engine**
- **binlog_format**
- **log-error**

```
[mysqld]
datadir=/var/lib/mysql
socket=/var/lib/mysql/mysql.sock
bind-address=0.0.0.0
user=mysql

default_storage_engine=InnoDB
innodb_autoinc_lock_mode=2
innodb_flush_log_at_trx_commit=0
innodb_buffer_pool_size=128M

binlog_format=ROW
log-error=/var/log/mysqld.log
```

Excerpt from MySQL Configuration File.
Galera Configuration — Initializing

**wsrep_on** Enables Galera

**wsrep_provider** is Name & Path of Galera Libraries

May Need to Adjust File Path

```
[galera]
wsrep_on=ON
wsrep_provider=/usr/lib64/galera-4/libgalera_smm.so ...
```

Excerpt from Database Configuration File.

Documentation on `wsrep_on`: [https://galeracluster.com/library/documentation/mysql-wsrep-options.html#wsrep-on](https://galeracluster.com/library/documentation/mysql-wsrep-options.html#wsrep-on)

Galera Configuration — Node & Cluster

wsrep_node_name
Unique for Each Node (e.g., node1, node2)
Corresponds to AWS Instances

wsrep_node_address
Node’s IP Address
Use Internal IP Address for AWS

wsrep_cluster_name
Cluster Name — Same on All Nodes

wsrep_cluster_address
Comma-Separated List of All Nodes — Same on All Nodes

Excerpt from Database Configuration File.

[galera]

...  
wsrep_node_name='galera-1'
wsrep_node_address="172.31.19.208"

wsrep_cluster_name='galera-training'
wsrep_cluster_address="gcomm://172.31.19.208,
172.31.26.197,
172.31.15.54"

Documentation on wsrep_node_name: https://galeracluster.com/library/documentation/mysql-wsrep-options.html#wsrep-node-name
Documentation on wsrep_node_address: https://galeracluster.com/library/documentation/mysql-wsrep-options.html#wsrep-node-address
Documentation on wsrep_cluster_name: https://galeracluster.com/library/documentation/mysql-wsrep-options.html#wsrep-cluster-name
Documentation on wsrep_cluster_address: https://galeracluster.com/library/documentation/mysql-wsrep-options.html#wsrep-cluster-address
Galera Configuration — More Options

Set Galera Cache with

```
wsrep_provider_options
```

Set the Number of Threads for Galera with

```
wsrep_slave_threads
```

Set `wsrep_sst_method` to either `rsync` or `mysqldump` for Provisioning New Nodes

```
[galera]
...
wsrep_provider_options="gcache.size=300M; gcache.page_size=300M"
wrep_slave_threads=4
wsrep_sst_method=rsync
```

Excerpt from Database Configuration File.

Documentation on `wsrep_provider_options`: https://galeracluster.com/library/documentation/mysql-wsrep-options.html#wsrep-provider-options
Documentation on `wsrep_slave_threads`: https://galeracluster.com/library/documentation/mysql-wsrep-options.html#wsrep-slave-threads
Opening Ports

Installing Galera Cluster with MariaDB
Galera Ports

**MariaDB Default Traffic**  – TCP 3306

**Galera Cluster Communications**  – TCP & UDP 4567

**Incremental State Transfers**  – TCP 4444

**State Snapshot Transfers**  – TCP 4568

SELinux

Kernel Module for Linux Security

Open Port for MariaDB

Open Ports for Galera

Opens Ports for Galera

`semanage port -a -t mysqld_port_t -p tcp 3306`

`semanage port -a -t mysqld_port_t -p tcp 4444`

`semanage port -a -t mysqld_port_t -p tcp 4567`

`semanage port -a -t mysqld_port_t -p udp 4567`

`semanage port -a -t mysqld_port_t -p tcp 4568`

`semanage permissive -a mysqld_t`

Setenforce 0

Disables SELinux

Open Ports on SELinux

SELinux Configuration: https://galeracluster.com/library/documentation/selinux.html
Firewall

Firewall Daemon for Restricting Network Traffic & Services

Enable & Start Firewall

Open Port for MariaDB

Open Ports for Galera

Reload Firewall

```
systemctl enable firewalld
systemctl start firewalld
firewall-cmd --zone=public --add-service=mysql --permanent
firewall-cmd --zone=public --add-port=3306/tcp --permanent
firewall-cmd --zone=public --add-port=4444/tcp --permanent
firewall-cmd --zone=public --add-port=4567/tcp --permanent
firewall-cmd --zone=public --add-port=4567/udp --permanent
firewall-cmd --zone=public --add-port=4568/tcp --permanent
firewall-cmd --reload
```

Configuring firewalld: https://galeracluster.com/library/documentation/firewalld.html
Starting Galera

Installing Galera Cluster with MariaDB
Caveats of Starting a Cluster

A Cluster is made of Multiple Nodes
  — Not Stand-Alone

New Nodes Unassuming — Look for
  Primary Component

Tell First Node it’s the Primary
  Component
Starting Nodes

Bootstrap Database & Galera on Seed Node

MariaDB – galera_new_cluster

Start Database & Galera Normally on Additional Nodes

Starting MariaDB Nodes

Seed Node

galera_new_cluster

Additional Nodes

systemctl start mariadb
Starting & Testing Galera Cluster
Conclusion

Installing Galera Cluster with MariaDB
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)

Tutorial Article on Installing Galera with MariaDB: https://galeracluster.com/library/training/tutorials/galera-installing-mariadb.html