Installing Galera Cluster with MySQL
Codership Training
Introduction

Installing Galera Cluster with MySQL
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 on Nodes
Configuring Nodes
Opening Ports
Starting Galera
Galera Cluster Overview

Installing Galera Cluster with MySQL
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

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 MySQL
Minimal Software

Operating System & Utilities
Synchronizing Tool
Firewall
Database Software
Galera Cluster

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

```
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`

```
sudo 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 MySQL with Galera

Repository File

(https://releases.galeracluster.com/)

Install MySQL & Galera

Secure Installation (e.g., Password)

[[galera]
name = Galera
baseurl = http://REPO-SUB-DOMAIN/VER/DIST/RELEASE/ARCH
gpgkey = http://REPO-SUB-DOMAIN/GPG-KEY-galeracluster.com
gpgcheck = 1

[mysql-wsrep]
name = MySQL-wsrep
baseurl = http://REPO-SUB-DOMAIN/mysql-wsrep-VER/DIST/RELEASE/ARCH
gpgkey = http://REPO-SUB-DOMAIN/GPG-KEY-galeracluster.com
gpgcheck = 1

Galera Repo File Format — /etc/yum.repos.d/galera.repo

yum -y install mysql-wsrep-5.7 galera-3
systemctl start mysqld
grep 'temporary password' /var/log/mysqld.log
mysql_secure_installation

Executed from Command-Line

Installation Doc: https://galeracluster.com/library/documentation/install.html
Galera Repository: https://releases.galeracluster.com/
Installing MySQL & Galera Software
Configuring Nodes

Installing Galera Cluster with MySQL
Database Configuration

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

bind-address — Not Local Host

default_storage_engine

binlog_format

log-error

Excerpt from MySQL Configuration File.

```
[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
```
Galera Configuration — Initializing

**wsrep_on** Enables Galera

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

May Need to Adjust File Path

Excerpt from Database Configuration File.

```
[mysqld]
...
wsrep_on=ON
wsrep_provider=/usr/lib64/galera-3/libgalera_smm.so
...
```

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., galera1, galera2)

Corresponds to AWS Instances

### wsrep_node_address

Node's IP Address

Use Internal IP Address for AWS

Excerpt from Database Configuration File.

```plaintext
[mysqld]
...
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

Excerpt from Database Configuration File.

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

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 MySQL
Galera Ports

MySQL Default Traffic – TCP 3306

Galera Cluster Communications – TCP & UDP 4567

Incremental State Transfers – TCP 4444

State Snapshot Transfers – TCP 4568

Firewall Settings: https://galeracluster.com/library/documentation/firewall-settings.html
SELinux

Kernel Module for Linux Security
Open Port for MySQL
Open Ports for Galera

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

```
setenforce 0

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
```
Firewall — firewalld

Firewall Daemon for Restricting Network Traffic & Services
Enable & Start Firewall
Open Port for MySQL
Open Ports for Galera
Reload Firewall

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

Installing Galera Cluster with MySQL
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

MySQL – `mysqld_bootstrap`

Start Database & Galera Normally on Additional Nodes

```
Seed Node
mysqld_bootstrap

Starting MySQL Nodes

Additional Nodes
```

```systemctl start mysql```
Starting & Testing Galera Cluster
Conclusion

Installing Galera Cluster with MySQL
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 with MySQL: https://galeracluster.com/library/training/tutorials/galera-mysql-installing.html