Installing Galera Cluster with MySQL

Codership Training

Introduction

Installing Galera Cluster with MySQL

Introductions

Codership Oy

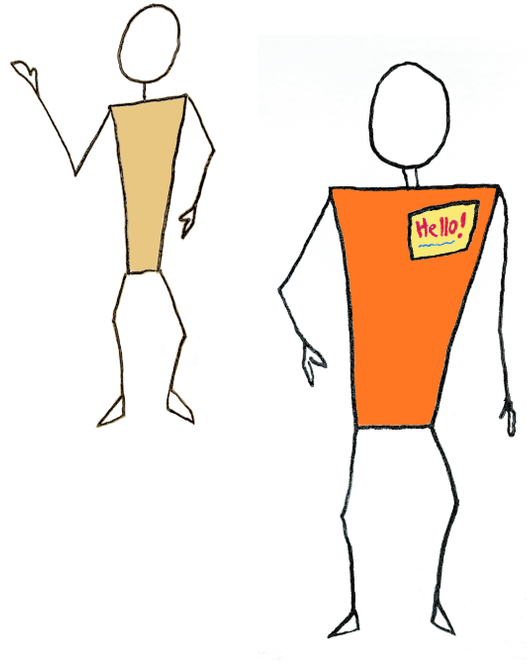
- Creators & Developers of Galera Cluster
- Employees in Multiple Countries

Galera Cluster

- Released Initially in May 2007
- Over 1.5 Million Downloads

Russell Dyer, Presenter

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



Tutorial Outline

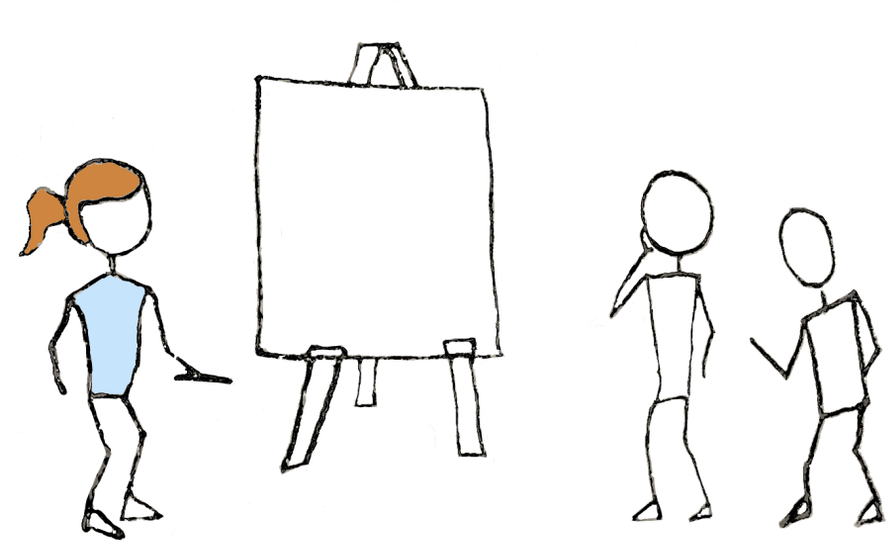
Galera Cluster Overview

Installing Software on Nodes

Configuring Nodes

Opening Ports

Starting Galera



Galera Cluster Overview

Installing Galera Cluster with MySQL

Basic Replication Concepts

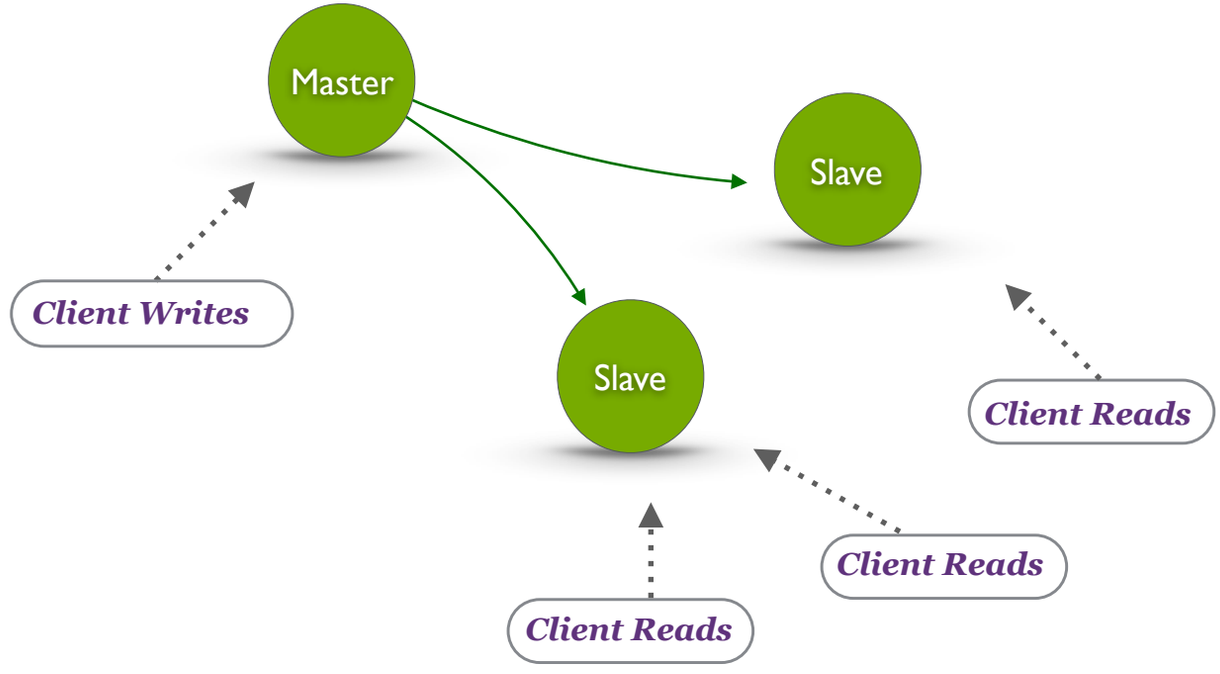
Nodes — Physical & Virtual Servers

Databases — MySQL, MariaDB, XtraDB

Replication

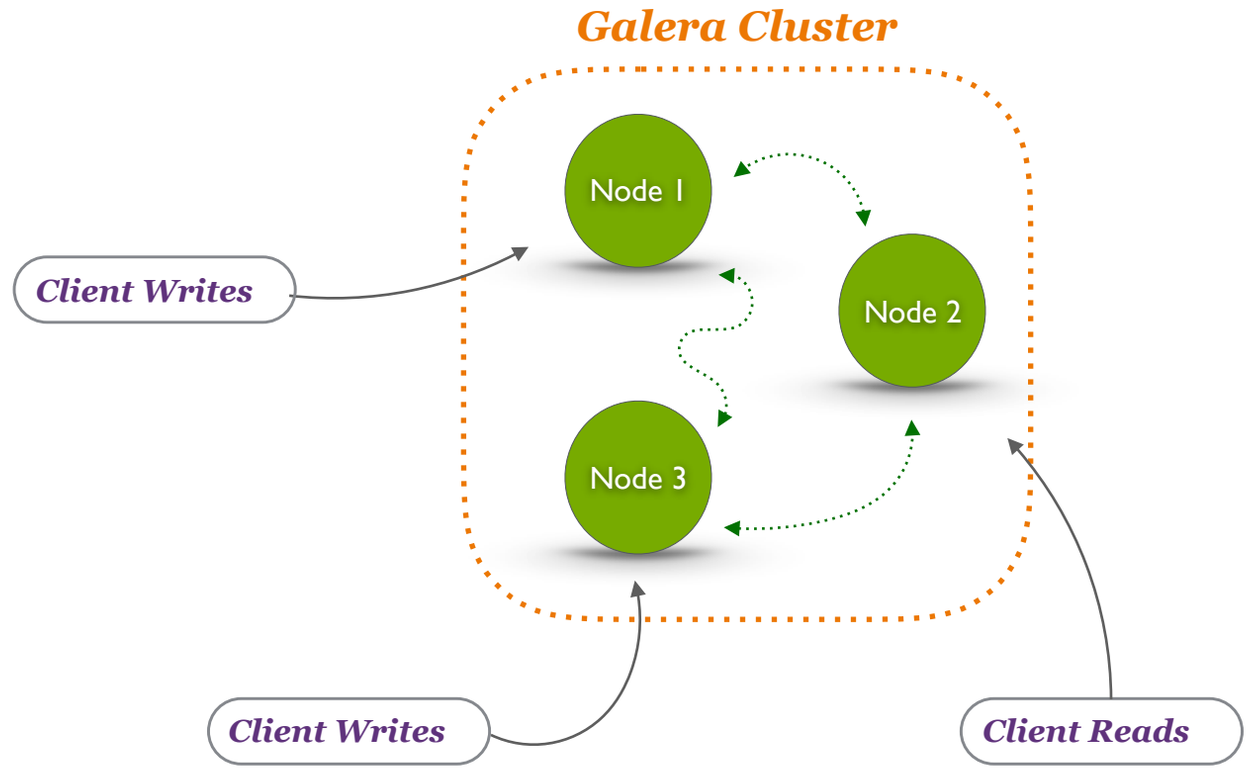
Load Balancing

High Availability



Galera Cluster Concepts

- Virtual Synchronous Replication
- True Multi-Master Solution
- Conflict Detection & Resolution on Commit
- Easy Maintenance
  - Automatic Provisioning
  - Node Isolatation
  - 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

Codership KB - Best Practices Articles: https://galeracluster.com/library/kb/best/index.html

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
```

```
ssh galera-1
```

Simpler with **config** File

LOGIN METHODS

```
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

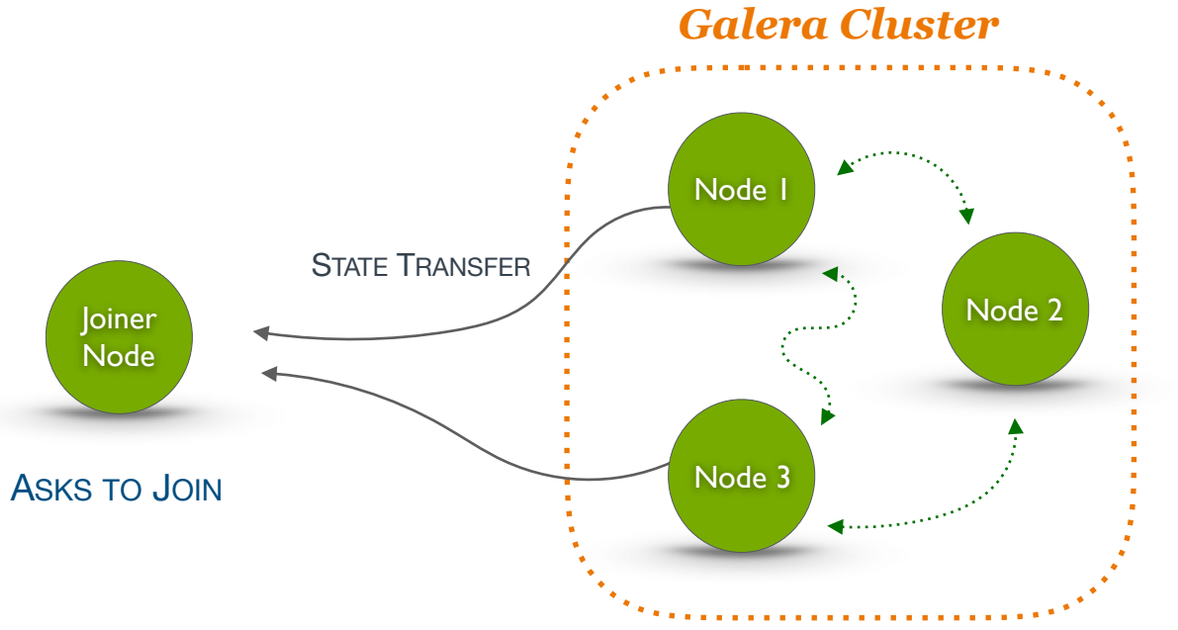
- State Snapshot Transfer (SST)
- Incremental State Transfers (IST)

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

(http://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

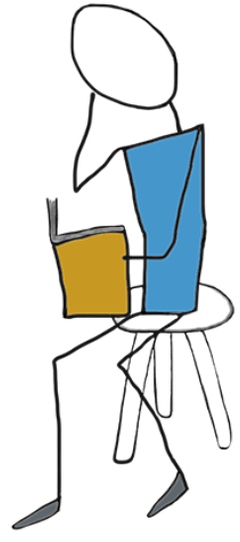
Configuring Nodes

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`**



```
[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

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

Excerpt from Database Configuration File.

MORE SETTINGS
UNDER THE [MYSQLD] HEADER

Documentation on **`wsrep_on`**: https://galeracluster.com/library/documentation/mysql-wsrep-options.html#wsrep-on
Documentation on **`wsrep_provider`**: https://galeracluster.com/library/documentation/mysql-wsrep-options.html#wsrep-provider

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

```
[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"
```

Excerpt from Database Configuration File.

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

```
[mysqld]
...
wsrep_provider_options="gcache.size=300M;
                        gcache.page_size=300M"
wsrep_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
Documentation on **`wsrep_sst_method`**: https://galeracluster.com/library/documentation/mysql-wsrep-options.html#wsrep-sst-method

Opening Ports

Installing Galera Cluster with MySQL

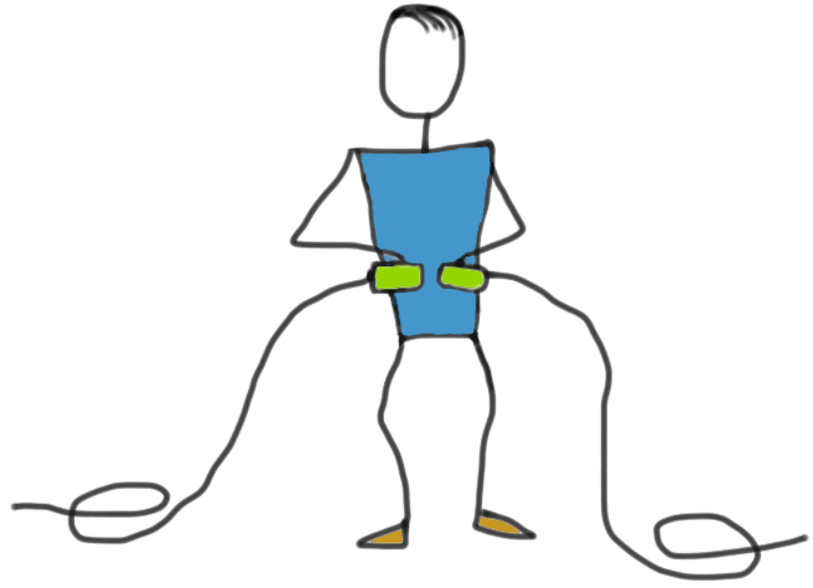
Galera Ports

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

Disables SELinux

```
setenforce 0
```

Open Ports on SELinux

```
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
```

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

Firewall — `firewalld`

- Firewall Daemon for
  - Restricting Network Traffic & Services
- Enable & Start Firewall
- Open Port for MySQL
- 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 MySQL

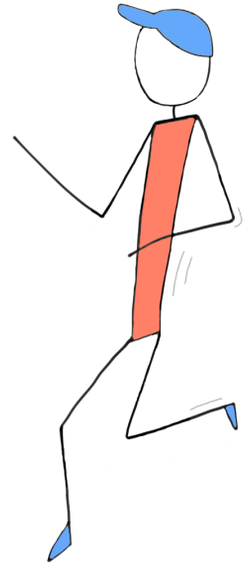
Caveats of Starting a Cluster

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

Starting MySQL Nodes

Seed Node

```
mysqld_bootstrap
```

Additional Nodes

```
systemctl start mysqld
```

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