



Installing Galera Cluster with MariaDB

Codership Training

Introduction

Installing Galera Cluster with MariaDB



Introduction
Galera Cluster Overview
Installing Software

Configuring Nodes
Opening Ports

Starting Galera
Conclusion

Introductions

Codership Oy

Creators & Developers of Galera Cluster

Employees in Multiple Countries

Galera Cluster

Released Initially in May 2007

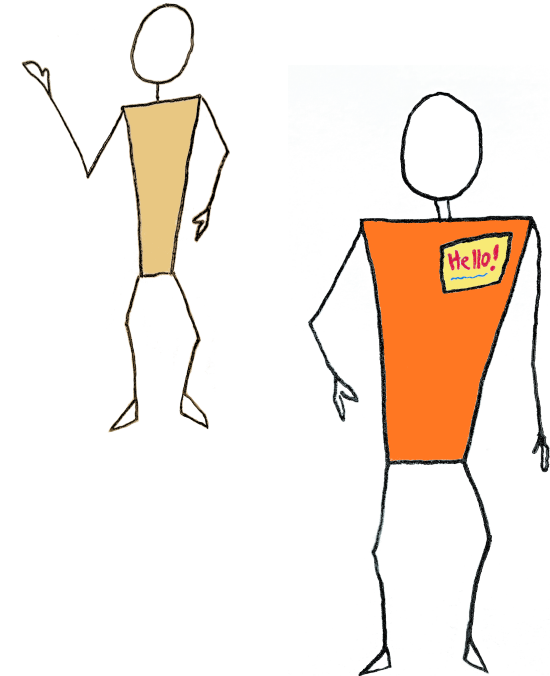
Over 1.5 Million Downloads

Russell Dyer, Presenter

KB Editor, Documentation, Instructor

(MySQL, MariaDB)

Writer (O'Reilly Books)



Tutorial Outline

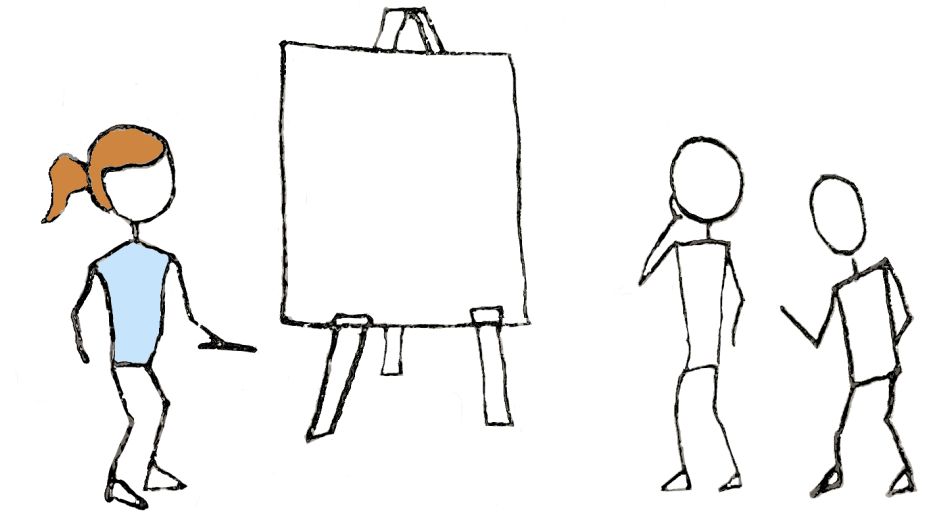
Galera Cluster Overview

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Galera Cluster Overview

Installing Galera Cluster with MariaDB



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Basic Replication Concepts

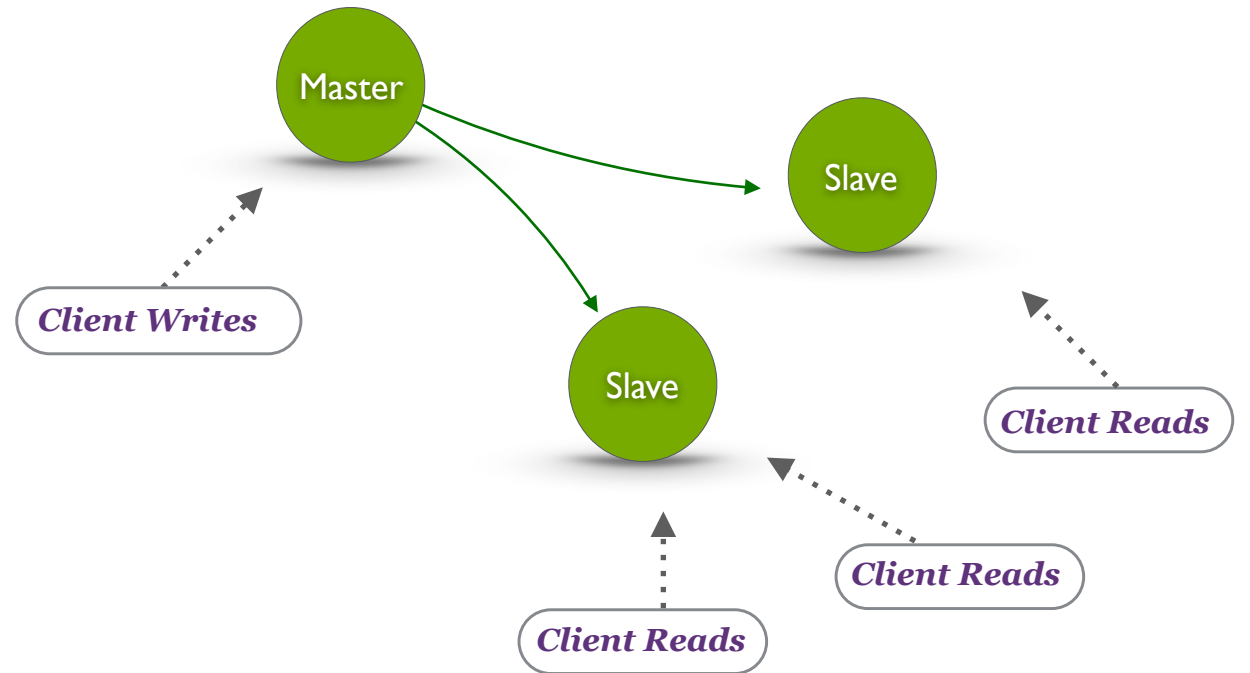
Node – Physical or Virtual Server

Database – MariaDB

Replication

High Availability

Load Balancing



Galera Cluster Concepts

Virtual Synchronous Replication

True Multi-Master Solution

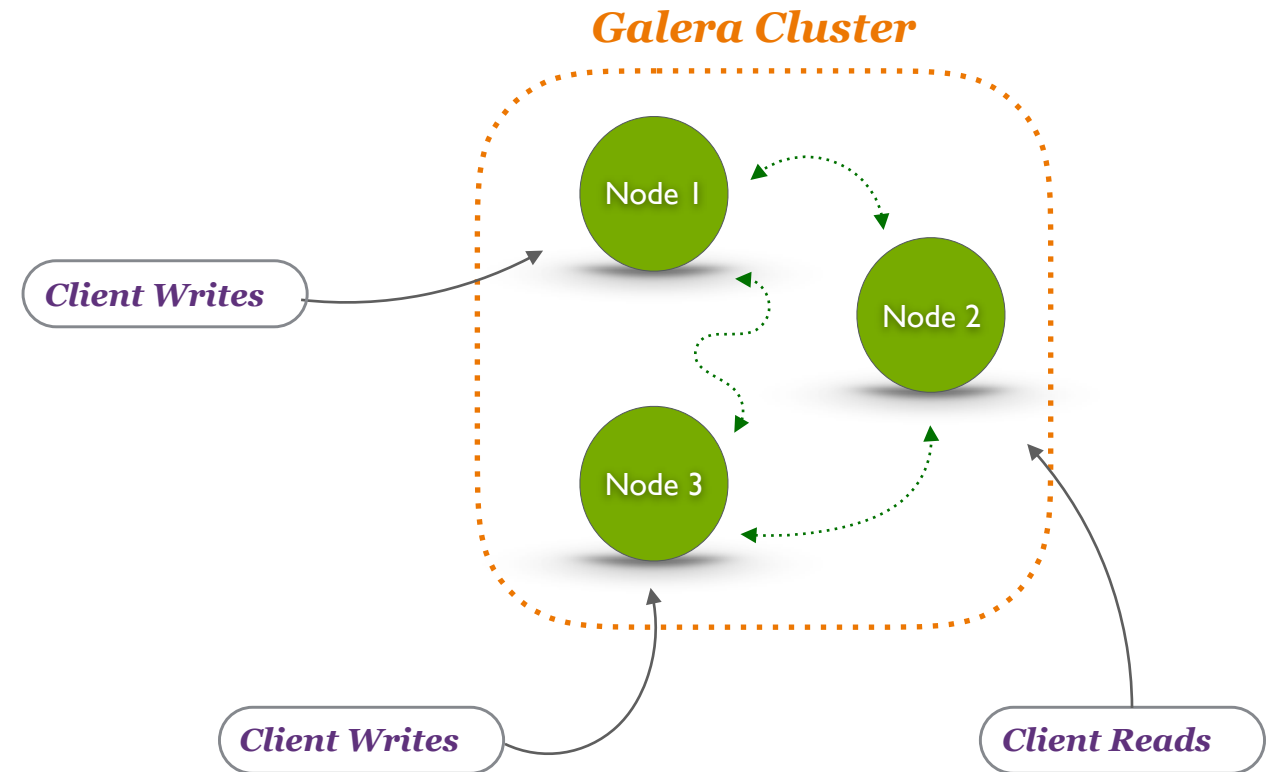
Conflict Detection & Resolution on Commit

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

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



Installing Software

Installing Galera Cluster with MariaDB



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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`

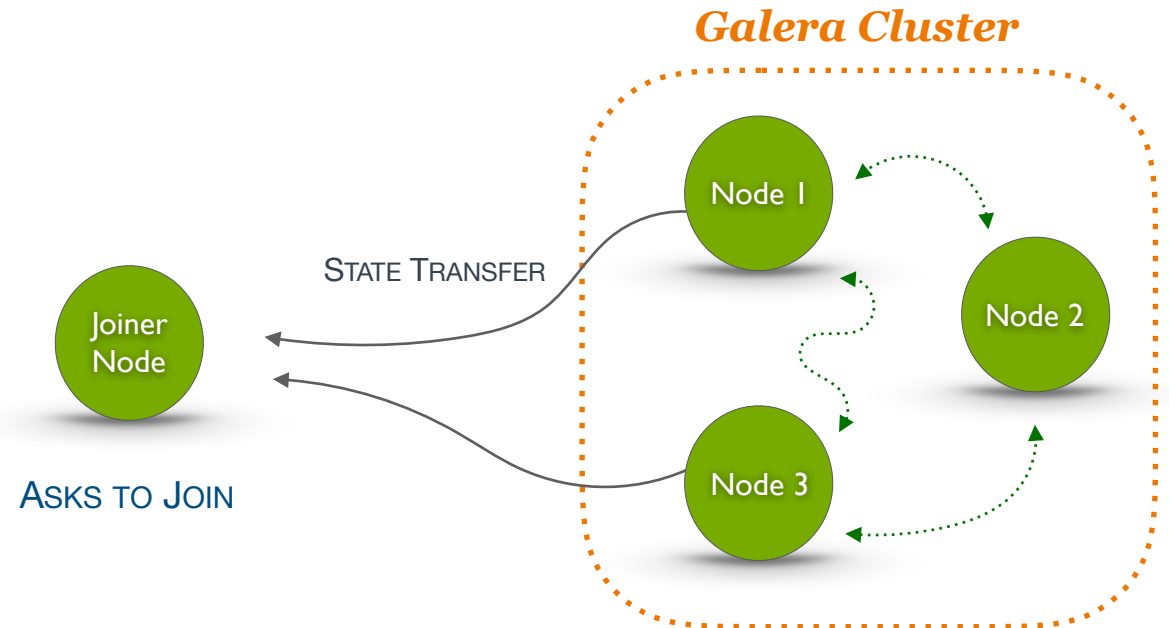
Physical – `rsync`

```
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



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Database Configuration

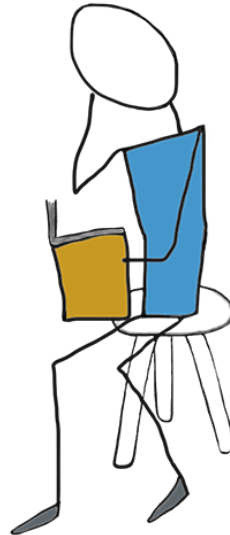
Edit MySQL Configuration File (`/etc/my.cnf.d/server.cnf`)

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] HEADER
ON MARIADB ONLY

```
[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>

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., 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

[GALERA] HEADER
ON MARIADB ONLY

```
[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"
```

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

```
[galera]
...
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

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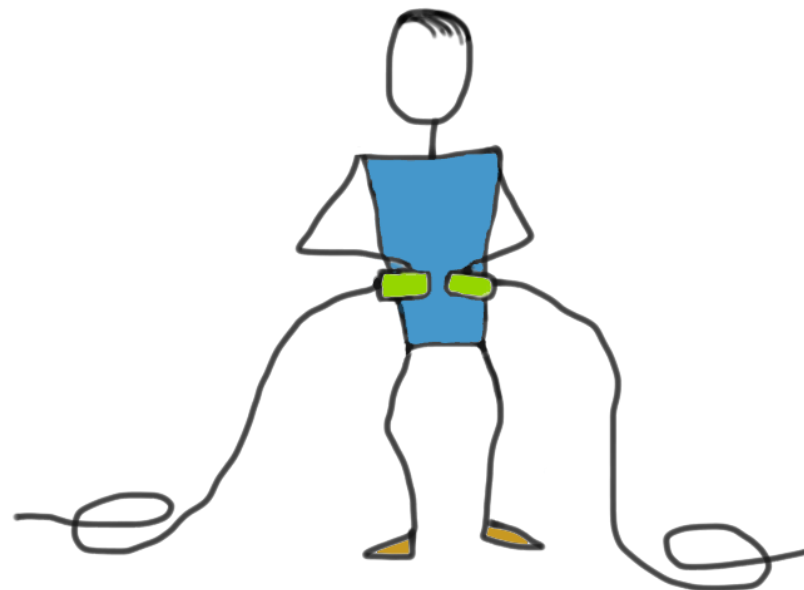
Galera Ports

MariaDB 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 MariaDB

Open Ports for Galera

Disables SELinux

```
setenforce 0
```

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
```

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

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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

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Additional Resources

Codership Library (galeracluster.com/library)

Documentation ([/library/documentation](https://galeracluster.com/library/documentation))

Knowledge Base ([/library/kb](https://galeracluster.com/library/kb))

FAQ ([/library/faq](https://galeracluster.com/library/faq))

Training ([/library/training](https://galeracluster.com/library/training))

Videos ([/library/training/videos](https://galeracluster.com/library/training/videos))

Tutorials ([/library/training/tutorials](https://galeracluster.com/library/training/tutorials))



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