☰   **MariaDB**   ⋯ ⌄   🔍   ⬧

Home   MariaDB Platform   Server   MaxScale   Analytics   **Galera Cluster**   Cor

⚙ **GALERA MANAGEMENT** > **CONFIGURATION**   ⬦ Ask ⌄

Configuring MariaDB Galera Cluster

A number of options need to be set in order for Galera Cluster to work when using MariaDB. These should be set in the MariaDB option file ↗.

Mandatory Options

Several options are mandatory, which means that they *must* be set in order for Galera Cluster to be enabled or to work properly with MariaDB. The mandatory options are:

- wsrep_provider — Path to the Galera library

- wsrep_cluster_address — See Galera Cluster address format and usage

- binlog_format=ROW ↗ — See Binary Log Formats

- wsrep_on=ON — Enable wsrep replication

- default_storage_engine=InnoDB ↗ — This is the default value, or alternately wsrep_replicate_myisam=1 (before MariaDB 10.6) or wsrep_mode=REPLICATE_ARIA,REPLICATE_MYISAM (MariaDB 10.6 and later).
  - innodb_doublewrite=1 ↗ — This is the default value, and should not be changed.

Performance-related Options

These are optional optimizations that can be made to improve performance.

- innodb_flush_log_at_trx_commit=0 ↗ — This is not usually recommended in the case of standard MariaDB. However, it is a safer, recommended option with Galera Cluster, since inconsistencies can always be fixed by recovering from another node.

- innodb_autoinc_lock_mode=2 ↗ — This tells InnoDB to use interleaved method. Interleaved is the fastest and most scalable lock mode, and should be used when BINLOG_FORMAT is set to ROW.
  Setting the auto-increment lock mode for InnoDB to interleaved, you're allowing slaves threads to operate in parallel.

- wsrep_slave_threads=4
  — This makes state transfers quicker for new nodes. You should start with four slave threads per CPU core.
  The logic here is that, in a balanced system, four slave threads can typically saturate a CPU core. However, I/O performance can increase this figure several times over. For example, a single-core ThinkPad R51 with a 4200 RPM drive can use thirty-two slave threads. The value should not be set higher than wsrep_cert_deps_distance.

Writing Replicated Write Sets to the Binary Log

Like with MariaDB replication, write sets that are received by a node with Galera Cluster's certification-based replication are not written to the binary log by default. If you would like a node to write its replicated write sets to the binary log, then you will have to set log_slave_updates=ON ↗. This is especially helpful if the node is a replication master. See Using MariaDB Replication with MariaDB Galera Cluster: Configuring a Cluster Node as a Replication Master.

Replication Filters

Like with MariaDB replication, replication filters can be used to filter write sets from being replicated by Galera Cluster's certification-based replication. However, they should be used with caution because they may not work as you'd expect.

The following replication filters are honored for InnoDB ↗ DML, but not DDL:

- binlog_do_db ↗
- binlog_ignore_db ↗
- replicate_wild_do_table ↗
- replicate_wild_ignore_table ↗

The following replication filters are honored for DML and DDL for tables that use both the InnoDB ↗ and MyISAM ↗ storage engines:

- replicate_do_table ↗
- replicate_ignore_table ↗

However, it should be kept in mind that if replication filters cause inconsistencies that lead to replication errors, then nodes may abort.

See also MDEV-421 ↗ and MDEV-6229 ↗.

Network Ports

Galera Cluster needs access to the following ports:

- Standard MariaDB Port (default: 3306) - For MySQL client connections and State Snapshot Transfers that use the `mysqldump` method. This can be changed by setting port ↗.
- Galera Replication Port (default: 4567) - For Galera Cluster replication traffic, multicast replication uses both UDP transport and TCP on this port. Can be changed by setting wsrep_node_address.
- Galera Replication Listening Interface (default: `0.0.0.0:4567`) needs to be set using gmcast.listen_addr, either
  - in wsrep_provider_options:
    ```
    wsrep_provider_options='gmcast.listen_addr=tcp://
    <IP_ADDR>:<PORT>;'
    ```
  - or in wsrep_cluster_address
- IST Port (default: 4568) - For Incremental State Transfers. Can be changed by setting ist.recv_addr ↗ in wsrep_provider_options.

- SST Port (default: 4444) - For all State Snapshot Transfer methods other than `mysqldump`. Can be changed by setting wsrep_sst_receive_address.

Mutiple Galera Cluster Instances on One Server

If you want to run multiple Galera Cluster instances on one server, then you can do so by starting each instance with mysqld_multi ↗, or if you are using systemd ↗, then you can use the relevant systemd method for interacting with multiple MariaDB instances ↗.

You need to ensure that each instance is configured with a different datadir ↗.

You also need to ensure that each instance is configured with different network ports ↗.

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