MySQL Galera Cluster Setup Guide

Release 04

ROSS

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Our mission is to:

1. Provide a Superior Customer Experience
   - offer the best product quality and support
2. Make Cool Practical Technology
   - develop great products that customers love

Ross has become well known for the Ross Video Code of Ethics. It guides our interactions and empowers our employees. I hope you enjoy reading it below.

If anything at all with your Ross experience does not live up to your expectations be sure to reach out to us at *solutions@rossvideo.com*.

David Ross
CEO, Ross Video
dross@rossvideo.com

Ross Video Code of Ethics

Any company is the sum total of the people that make things happen. At Ross, our employees are a special group. Our employees truly care about doing a great job and delivering a high quality customer experience every day. This code of ethics hangs on the wall of all Ross Video locations to guide our behavior:

1. We will always act in our customers' best interest.
2. We will do our best to understand our customers' requirements.
3. We will not ship crap.
4. We will be great to work with.
5. We will do something extra for our customers, as an apology, when something big goes wrong and it's our fault.
6. We will keep our promises.
7. We will treat the competition with respect.
8. We will cooperate with and help other friendly companies.
9. We will go above and beyond in times of crisis. *If there's no one to authorize the required action in times of company or customer crisis - do what you know in your heart is right. (You may rent helicopters if necessary.)*

Inception/Streamline · MySQL Galera Cluster Setup Guide

- Ross Part Number: **4950DR-008-04**
- Release Date: December 8, 2020. Printed in Canada.
- Software Issue: **04**

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Patents

Patent numbers 4,205,346; 5,115,314; 5,280,346; 5,561,404; 7,034,886; 7,508,455; 7,602,446; 7,834,886; 7,914,332; 8307284, 2039277; 1237518; 1127289 and other patents pending.

Warranty and Repair Policy

Ross Video Limited (Ross) warrants its Inception and Streamline Server systems to be free from defects under normal use and service a time period of 15 months from the date of shipment:

If an item becomes defective within the warranty period Ross will repair or replace the defective item, as determined solely by Ross.

Warranty repairs will be conducted at Ross, with all shipping FOB Ross dock. If repairs are conducted at the customer site, reasonable out-of-pocket charges will apply. At the discretion of Ross, and on a temporary loan basis, plug in circuit boards or other replacement parts may be supplied free of charge while defective items undergo repair. Return packing, shipping, and special handling costs are the responsibility of the customer.

This warranty is void if products are subjected to misuse, neglect, accident, improper installation or application, or unauthorized modification.

In no event shall Ross Video Limited be liable for direct, indirect, special, incidental, or consequential damages (including loss of profit). Implied warranties, including that of merchantability and fitness for a particular purpose, are expressly limited to the duration of this warranty.

This warranty is TRANSFERABLE to subsequent owners, subject to Ross' notification of change of ownership.

Extended Warranty

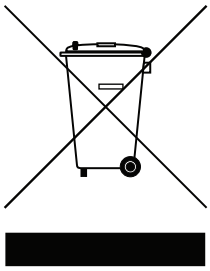
For customers that require a longer warranty period, Ross offers an extended warranty plan to extend the standard warranty period by one year increments. For more information about an extended warranty for your Inception or Streamline Server system, contact your regional sales manager.

Environmental Information

The equipment that you purchased required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment.

To avoid the potential release of those substances into the environment and to diminish the need for the extraction of natural resources, Ross Video encourages you to use the appropriate take-back systems. These systems will reuse or recycle most of the materials from your end-of-life equipment in an environmentally friendly and health conscious manner.

The crossed-out wheeled bin symbol invites you to use these systems.



If you need more information on the collection, reuse, and recycling systems, please contact your local or regional waste administration.

You can also contact Ross Video for more information on the environmental performances of our products.

Use of Hazardous Substances in Electrical and Electronic Products (China RoHS)

Ross Video Limited has reviewed all components and processes for compliance to:

“Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products” also known as China RoHS.

The “Environmentally Friendly Use Period” (EFUP) and Hazardous Substance Tables have been established for all products. We are currently updating all of our Product Manuals.

The Hazardous substances tables are available on our website at:

http://www.rossvideo.com/about-ross/company-profile/green-practices/china-rohs.html

电器电子产品中有害物质的使用

Ross Video Limited 按照以下的标准对所有组件和流程进行了审查：

“电器电子产品有害物质限制使用管理办法”也被称为中国RoHS。

所有产品都具有“环保使用期限”（EFUP）和有害物质表。目前，我们正在更新我们所有的产品手册。

有害物质表在我们的网站：

http://www.rossvideo.com/about-ross/company-profile/green-practices/china-rohs.html

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Introduction

A Word of Thanks

Thank you for choosing Ross Video Inception as your newsroom and social media management solution, or Ross Video Streamline as your media asset management solution.

We are committed to providing you with the highest level of customer satisfaction possible. If, for any reason, you have questions or comments, please call Ross Video at +1-613-652-4886 or send us an e-mail at techsupport@rossvideo.com.

We hope that you visit our website www.rossvideo.com to stay up to date with ongoing software releases, join our customer forum and learn more about the complete range of Ross Video products.

Note that software maintenance and extended warranties are available for your system to protect and extend the life of your investment. Our sales team are more than happy to provide further information on the plans available. Members of our sales team promptly respond to e-mails sent to: solutions@rossvideo.com.

Again, thank you for your purchase of an Inception or Streamline Server system from Ross Video. We are confident of your future pleasure with your choice.

Yours Sincerely,

Jenn Jarvis
Marketing Product Manager – Editorial
jjarvis@rossvideo.com

About This Guide

This guide contains the following chapters that cover the installation and configuration of MySQL Galera database software for an Inception or Streamline Server database:

- Chapter 1, "**Introduction**" summarizes the guide and provides important terms, conventions, and features.
- Chapter 2, "**System Requirements**" provides the recommended minimum hardware and software requirements to ensure that your Inception or Streamline Server database software functions correctly.
- Chapter 3, "**Software Installation**" provides instructions for installing MySQL Galera database software for your Inception or Streamline Server.
- Chapter 4, "**Database Cluster Setup**" provides instructions for setting up a MySQL Galera database cluster for your Inception or Streamline Server.

If you have questions pertaining to the operation of the Ross Video product, please contact us at the numbers listed in the section "**Contacting Technical Support**" on page 1–3. Our technical staff is always available for consultation, training, or service.

Documentation Conventions

This guide uses special text formats to identify parts of the user interface, text that a user must enter, or a sequence of menus and submenus that a user must follow to reach a particular command.

Interface Elements

Bold text identifies a user interface element such as a dialog box, a menu item, or a button. For example:

In the **Media Manager Client**, click **Channel 1** the **Channels** section.

User Entered Text

Courier text identifies text that a user must enter. For example:

In the **File Name** box, enter `Channel01.property`.

Referenced Guides

Italic text identifies the titles of referenced guides, manuals, or documents. For example:

For more information, refer to the section "**Twitter Configuration**" on page 3–6 in the ***Inception User Guide***.

Menu Sequences

Menu arrows identify a sequence of menu items that a user must follow to reach a particular command. For example: if a procedure step contains "**Server** > **Save As**," a user should click the **Server** menu and then click **Save As**.

Important Instructions

Star icons identify important instructions or features. For example:

✶ After installing Inception Server software, you must obtain Inception feature licenses from Ross Video Technical Support before users can access Inception features.

Getting Help

To access the Inception or Streamline Server Online Help system, click the **Help** icon in the main toolbar. For help about the currently open panel, click he **Help** button in a panel title bar to view a help topic about the panel.

The Online Help system contains the following navigation tabs to locate and access Online Help topics:

- **Contents** — table of contents
- **Search** — full text search
- **Favorites** — preferred information storage and access

Ross Video product guides are also supplied as print-ready PDF files in the **Printing and Guides Download** section of the Online Help system.

The Inception and Streamline Online Help systems contain information about how to configure and use the application. There are two separate Online Help systems; one for the Configuration interface, and one for the User interface.

Contacting Technical Support

Technical Support is staffed by a team of experienced specialists ready to assist you with any question or technical issue.

Ross Video has technical support specialists strategically located around the globe to ensure a prompt response to technical inquiries. Our primary technical support center is located in Ottawa, Ontario, Canada. In addition, we have offices in The United Kingdom (London), Australia (Sydney), and Singapore with satellite locations in New York City, The Netherlands, and China. As we expand our presence globally, we are constantly evaluating other key locations to have a local technical support specialist in order to better service our customers.

North America

Our North America center located in Ottawa, Ontario, Canada and is open Monday to Friday 8:30 a.m. to 6:00 p.m. EST, with 24/7/365 on-call service after hours.

Our telephone number is: +1-613-652-4886

Toll free within North America: +1 844-652-0645

EMEA

Our EMEA center is located in Buckinghamshire, England, United Kingdom and is open Monday to Friday 8:30 a.m. to 5:00 p.m. GMT. After hours support is provided by our North America location.

Our telephone number is: +44 (0)1189502446

International toll free: +800 1005 0100

Emergency After-hours Support

Our telephone number is: +1-613-349-0006

Toll free within North America: +1 844-652-0645

International toll free: +800 1005 0100

Online

E-mail: techsupport@rossvideo.com

Website: use the link http://www.rossvideo.com/support/tech-support.html to open a support request.

System Requirements

Ross Video bases Inception and Streamline products on mainstream PC hardware that use the Windows® or Linux based operating systems. To ensure that Inception or Streamline database software functions correctly, verify that the computer selected to run Inception or Streamline database software meets the recommended minimum requirements described in the following sections:

Hardware

Ross Video recommends the following minimum computer hardware configuration to run Inception or Streamline database software:

- **CPU** — quad-core Intel® Xeon® E3 with Hyper-Threading
- **RAM** — 32GB
- **Hard Drive** — Minimum 2 GB free
- **LAN** — 1 GB/s

Software

Ross Video recommends the following minimum computer software configuration to run Inception or Streamline database software:

- CentOS 7
- Red Hat Enterprise Linux (RHEL)

Ports

As part of the Inception and Streamline Server software installation process, the installer automatically creates the required firewall exceptions locally for the ports that Inception or Streamline uses the to communicate with clients and MOS devices.

✶ If an external firewall separates your Inception or Streamline Server from your clients and MOS devices, you may need to update the port exceptions on your external firewall to enable communication with the Inception or Streamline Server.

The following table lists the ports on the Inception or Streamline Server computer that Inception or Streamline uses to communicate with clients and MOS devices:

Table 2.1 Inception and Streamline Server Ports

Port	Type	Description
3306	TCP	MySQL port between the database and Inception or Streamline.
4567	TCP and UDP	Inter cluster replication.
4568	TCP	Incremental Sate Transfers.
4444	TCP	All other State Snapshot Transfers.

Software Installation

This chapter provides instructions for installing MySQL Galera database software for your Inception or Streamline Server.

This chapter discusses the following topics:

- Before a Software Install
- Installing Database Software
- Tuning the Database Software for Performance
- Database Time Zone Information Maintenance

Before a Software Install

Before you install database software on an Inception or Streamline Server database computer, perform the following tasks:

- Have a qualified Ross Video technician perform any required maintenance or repairs on the Inception or Streamline Server database computer.
- Exit all other programs currently running on the Inception or Streamline Server database computer.
- Temporarily disable anti-virus software running on the Inception or Streamline Server database computer. Some heuristic-based intrusion detection systems prevent the installation of database software. Re-enable anti-virus software after installing database software.

For More Information on...

- contacting Ross Video Technical Support, refer to the section "**Contacting Technical Support**" on page 1–3.

Installing Database Software

Inception and Streamline use the MySQL Galera Cluster database to store and manage application data. Only an initial installation or a recovery installation require that you install database software on your Inception or Streamline Server computer.

✶ You must install and configure MySQL Galera Cluster database software on the Inception or Streamline Server database computer before installing Inception or Streamline Server software on the Inception or Streamline Server computer.

For the upgrade procedure, refer to the ***Inception Server Installation Guide*** or ***Streamline Installation Guide***.

To install MySQL Galera Cluster database software for an initial install of Inception or Streamline software

1. Log into the Inception or Streamline Server database computer.
2. Use a text editor to create or edit the following configuration file:

   `/etc/yum.repos.d/galera.repo`

3. In the open configuration file, enter the settings for your Inception or Streamline Server database computer operating system.

   - **CentOS 7 Operating System**

     ```
     [galera]
     name = Galera
     baseurl = http://releases.galeracluster.com/galera-3/centos/7/x86_64
     gpgkey = http://releases.galeracluster.com/GPG-KEY-galeracluster.com
     gpgcheck = 1

     [mysql-wsrep]
     name = MySQL-wsrep
     baseurl =  http://releases.galeracluster.com/mysql-wsrep-5.7/centos/7/x86_64
     gpgkey = http://releases.galeracluster.com/GPG-KEY-galeracluster.com
     gpgcheck = 1
     ```

   - **Red Hat Enterprise Linux (RHEL) Operating System**

     ```
     [galera]
     name = Galera
     baseurl = http://releases.galeracluster.com/galera-3/redhat/7/x86_64
     gpgkey = http://releases.galeracluster.com/GPG-KEY-galeracluster.com
     gpgcheck = 1

     [mysql-wsrep]
     name = MySQL-wsrep
     baseurl =  http://releases.galeracluster.com/mysql-wsrep-5.7/redhat/7/x86_64
     gpgkey = http://releases.galeracluster.com/GPG-KEY-galeracluster.com
     gpgcheck = 1
     ```

4. Save the `galera.repo` configuration file.
5. Open a **Terminal** window.
6. At the prompt in the **Terminal** window, enter the following command to install **Galera** and **MySQL** software:

   ```
   sudo yum install galera-3 mysql-wsrep-5.7 rsync
   ```

7. Use a text editor to edit the following configuration file:

   ```
   /etc/sysconfig/selinux
   ```

8. Add the following information to the configuration file to disable **Selinux** for **MySQL**:

   ```
   SELINUX=permissive
   ```

9. Save the configuration file.
10. Reboot the Inception or Streamline Server database computer.

Tuning the Database Software for Performance

The installation of Inception or Streamline Server database software configures the database to manage work efficiently. You greatly improve performance by tuning the values of a few key Inception or Streamline Server database software settings.

To tune database settings

1. On the Inception or Streamline Server database computer, stop the MySQL Galera database service.
2. Use a text editor to create or edit the following configuration file:

   ```
   /etc/my.cnf.d/galera.cnf
   ```

3. Add the following settings to the new configuration file:

```
[mysqld]
# Galera Provider Configuration
wsrep_on=ON
wsrep_provider=/usr/lib64/galera-3/libgalera_smm.so
wsrep_provider_options="gcs.limit=<wst*5>; gcs.fc_limit=<wst*5>; gcache.size=300M;
gcache.page_size=300M"
   # Where <wst*5> = wsrep_slave_threads * 5
# Galera Cluster Configuration
wsrep_cluster_name="inception_cluster" or "streamline_cluster"
wsrep_cluster_address="gcomm://<ip1>, <ip2>, <ip3>, <ipN>"
   # Where <ip1> = IP address of node 1, <ip2> = IP address of node 2, and so on
wsrep_sync_wait=1
wsrep_slave_threads=<CPU*4>
   # Where <CPU*4> = The nuber of Core CPUs * 4
# Galera Synchronization Configuration
wsrep_sst_method=rsync
# Galera Node Configuration
wsrep_node_name="node name"
wsrep_node_address="local node IP"
# InnoDB Configuration
innodb_autoinc_lock_mode=2
# Flush logs approx every sec
innodb_flush_log_at_trx_commit=2
# Flush directly to disk (avoids double buffering)
innodb_flush_method=O_DIRECT
```

4. Add the following settings to the configuration file using the associated formula to calculate the setting value:

Setting	Formula
innodb_buffer_pool_size=	50% of RAM on dedicated server.
innodb_buffer_pool_instances=	Buffer pool sized divided by instances equals at least 1. Maximum value of 64.
innodb_log_file_size=	25% of buffer pool.
join_buffer_size=	Set to 256K.
tmp_table_size=	Set to 64M.
max_heap_table_size=	Set to 64M.

5. Add the following settings to the configuration file:

```
key_buffer_size=<0.0625*MySQL RAM>
   # Where <0.0625*MySQL RAM> = 0.0625 * MySQL allocated RAM
table_open_cache=6000
sort_buffer_size=2M
read_buffer_size=256Kdefault-storage-engine=innodb
bind-address=0.0.0.0
# Free RAM from the unused query cache
query_cache_size=0
user=mysql
max_allowed_packet=16M
skip-name-resolve
lower_case_table_names=1
max_connections=<0.5*MySQL RAM/10>
   # Where <0.5*MySQL RAM/10> = 0.5 * MySQL RAM in MB / 10
# For Example: 32GB system with 8GB for MySQL would have 409 connections
               0.5 * 8192 = 4096, then 4096 / 10 = 409.6
validate_password_policy=0
```

6. Save the configuration file.
7. Restart the MySQL Galera database service.

Database Time Zone Information Maintenance

The system schema of a MySQL Galera Cluster database contains several tables that store time zone information. Time zone rules and daylight savings time transitions can occasionally change on a regional basis. To perform accurate time zone date conversions you must ensure that your MySQL Galera Cluster database is loaded with up-to-date time zone information.

To load up-to-date time zone information into the database

1. Log into the Inception or Streamline Server database computer.
2. Open a **Terminal** window.
3. At the prompt in the **Terminal** window, enter the following command to load up-to-date time zone information into the MySQL Community Edition Server database:

```
mysql_tzinfo_to_sql --leap /usr/share/zoneinfo | mysql -u root -p<db-password>
mysql
```

4. Restart the MySQL Galera database service.

5. If replication is enabled on your system this procedure is complete. Replication automatically loads up-to-date time zone information into the other nodes in your system.
6. If replication is not enabled on your system, repeat steps **2** to **4** on the other nodes in your system to load up-to-date time zone information into the MySQL Community Edition Server databases.

Database Cluster Setup

This chapter provides instructions for setting up a MySQL Galera database cluster for your Inception or Streamline Server.

This chapter discusses the following topics:

- Node Configuration
- Cluster Startup

Node Configuration

Before you can start the MySQL Galera database cluster, you must configure each database node computer in the cluster.

To configure a database node

1. Log into a database node computer.
2. Use a text editor to create or edit the following configuration file:

   ```
   /etc/my.cnf
   ```

3. Add the following setting to the configuration file:

   ```
   !includedir /etc/my.cnf.d/
   ```

4. Save the configuration file.
5. Open a **Terminal** window.
6. Enter the following commands at the **Terminal** window prompt to open the required ports through the firewall on the node:

   ```
   firewall-cmd --zone=public --add-port=3306/tcp --permanent
   firewall-cmd --zone=public --add-port=4567/tcp --permanent
   firewall-cmd --zone=public --add-port=4568/tcp --permanent
   firewall-cmd --zone=public --add-port=4444/tcp --permanent
   firewall-cmd --zone=public --add-port=4567/udp --permanent
   firewall-cmd --reload
   ```

7. Complete this procedure on each node in your MySQL Galera database cluster.

Cluster Startup

After you configure all the nodes in your MySQL Galera database cluster, you are ready to start up the cluster.

To startup your MySQL Galera database cluster

1. Log into the first database node computer in your MySQL Galera database cluster.
2. Open a **Terminal** window.
3. At the prompt in the **Terminal** window, enter the following command to stop MySQL on the node:

   ```
   systemctl stop mysqld
   ```

4. Enter the following command to delete the MySQL data folder:

   ```
   rm -rf /var/lib/mysql
   ```

5. Enter the following command to start the first node:

   ```
   sudo /usr/bin/mysqld_bootstrap
   ```

6. On each node in the cluster, enter the following command to start the node:

   ```
   sudo systemctl restart mysqld
   ```

7. On each node in the cluster, enter the following command to find each node's temporary root password:

   ```
   grep 'temporary password' /var/log/mysqld.log
   ```

   You might have to replace `mysqld.log` with `mysql.log` or `messages`.

8. Record the temporary root password for each node.

9. On one database node computer in your MySQL Galera database cluster, run the **mysql_secure_installation** command and do the following:

   - Allow root to connect remotely.
   - Accept all other defaults.
   - Set a strong password.

10. Confirm cluster communication by entering the following command on a database node computer in your MySQL Galera database cluster:

    ```
    mysql -u root -p -e "SHOW STATUS LIKE 'wsrep_cluster_size'"
    ```

    This command requires the **password** set in step **7**. The command should return a value equal to the number of nodes in the cluster.

11. Verify that the MySQL root user has cluster access by completing the following steps on one database node computer in your MySQL Galera database cluster:

    a. Enter the following command to log into the MySQL terminal:

       ```
       mysql -u root -p
       ```

       This command requires the **password** set in step **7**. If your password does not work, you can reset the root password by completing the "**To grant all privileges to the MySQL root user**" on page 4–4.

    b. In the MySQL terminal, enter the following command to verify that the MySQL root user has cluster access:

       ```
       select users,host from mysql.users;
       ```

       The results table should contain the following information for the root user:

       ```
       *-------------*
       | user | host |
       |------+------|
       | root |   %  |
       *-------------*
       ```

       When the results table does not contain the correct root user information, you can grant cluster access to the root user by completing the "**To grant all privileges to the MySQL root user**" on page 4–4.

Password Reset

If you cannot log into MySQL as root using the password set starting up your cluster, you can reset the MySQL root password.

To reset the MySQL root password

1. On one database node computer in your MySQL Galera database cluster, enter the following command to log into the MySQL terminal:

   ```
   mysql -u root -p
   ```

2. In the MySQL terminal, enter the following command to reset the password for the MySQL root user:

   ```
   ALTER USER 'root'@'%' IDENTIFIED BY '<password>';
   ```

   Where `<password>` is the new MySQL root password.

Grant Access

If the MySQL root user does not have access to your cluster, you can grant all privileges to the root user.

To grant all privileges to the MySQL root user

1. On one database node computer in your MySQL Galera database cluster, enter the following command to log into the MySQL terminal:

   ```
   mysql -u root -p
   ```

2. In the MySQL terminal, enter the following command to grant all privileges to the MySQL root user:

   ```
   GRANT ALL PRIVILEGES ON *.* TO 'root'@'%' IDENTIFIED BY '<password>';
   ```