GALERA G CLUSTER

Making Back-Ups with Galera Cluster

Codership Training

Introduction

Making Back-Ups with Galera Cluster

GALERA CLUSTER

Introductions

Codership Oy

Creators & Developers of
Galera Cluster

Employees in Multiple
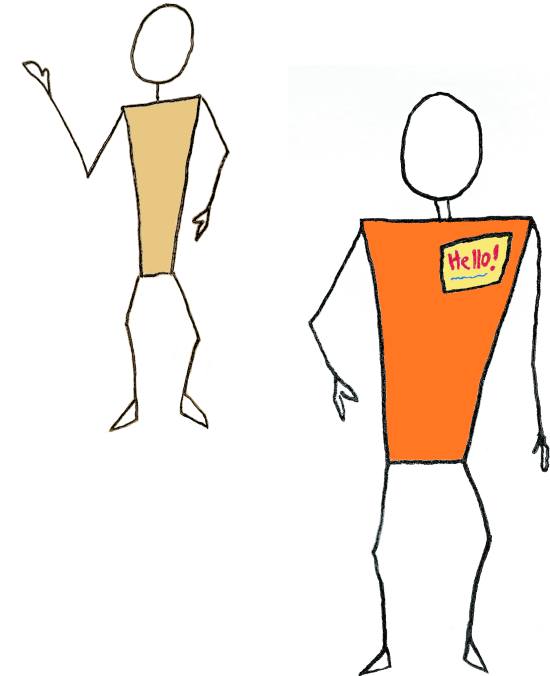Countries

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)

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Tutorial Outline

Back-Up Basics

Using Standard Replication

Using Galera Arbitrator

Restoring Nodes

Back-Up Plan

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Back-Up Basics

Making Back-Ups with Galera Cluster

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Backup Principles

POLICIES

Make Thorough Back-Ups

    Synchronize & Copy Binary Logs

    Copy Configuration Files

Make Daily & Continuous Backups

Store Backups in Multiple
      Locations

PRAXIS

Back-Up Methods

    Physical Back-Ups

    Logical Back-Ups

Verify Back-Ups

Practice Recovering

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Physical Back-Ups

PRO POINTS

More Intuitive & Simple

Faster than Other Methods

CONTRA POINTS

Usually Have to Stop `mysqld`

Won't Detect Corrupted Files

Not Useful for Migrations –

Same Storage Engine

Physical & Logical Back-Ups: https://dev.mysql.com/doc/mysql-backup-excerpt/en/backup-types.html

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Logical Backups

PRO POINTS

Produces Text Files with SQL
 Statements

Full or Specific Back-Ups

Can Be Used for Migration

 Independent of Storage Engines

CONTRA POINTS

Slower & Requires Table Locks

Uses a Local Drive, not across
 Network

Physical & Logical Back-Ups: https://dev.mysql.com/doc/mysql-backup-excerpt/en/backup-types.html

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Simple Galera Node Back–Up Procedure

Stop MySQL Daemon

Run Back-Up Utility on Down Node

   mysqldump

   rsync

Start MySQL Daemon

Logical Back-Up

```
mysqldump -p -u admin_backup /
         --flush-logs /
         --all-databases /
   > /backups/backup-20191015.sql
```

Executed from Command-Line

Physical Back-Up

```
cd /backups/temp/

rsync -a /var/lib/mysql/ .

tar -czf ../backup-20191015.tgz *
```

Executed from Command-Line

Documentation on **mysqldump**: https://mariadb.com/kb/en/mariadb/mysqldump/

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Simple Galera Node
Back–Up Demonstration

Using Standard Replication

Making Back-Ups with Galera Cluster

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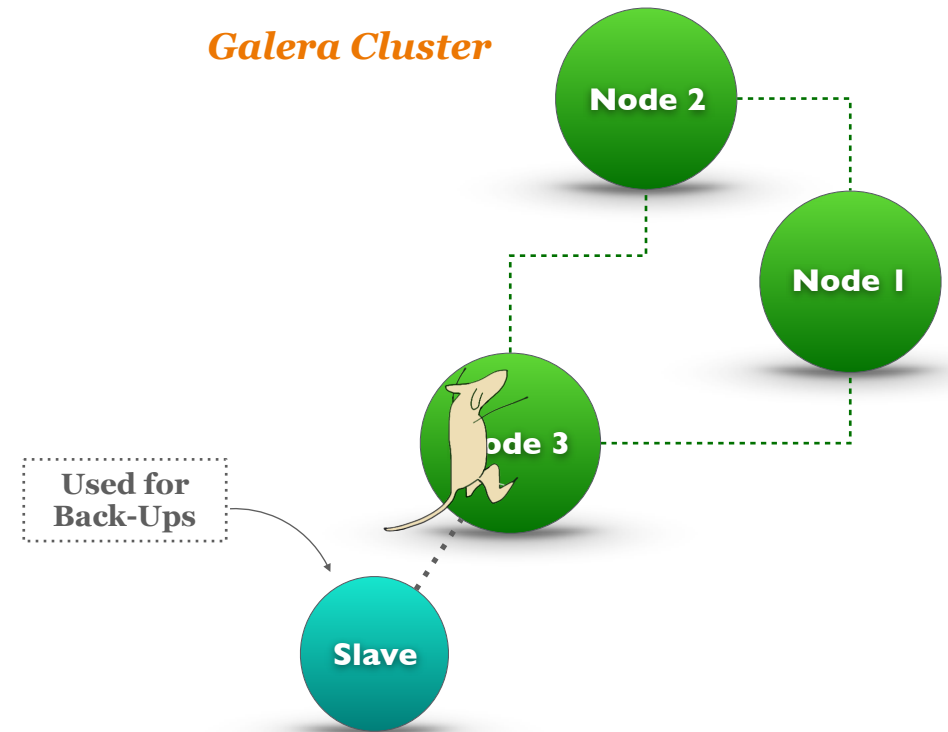
Using a Galera Slave

Galera Nodes can be Master to Slave

Slave may be Used for Back-Ups

Extra Requirements for Galera Master & Slave

    Enable Binary Logs

    Extra Parameter Settings

Galera Cluster

Node 2

Node 1

ode 3

Used for Back-Ups

Slave

Using Standard Replication with Galera: https://mariadb.com/kb/en/library/using-mariadb-replication-with-mariadb-galera-cluster-using-mariadb-replica/

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Galera Master Configuration

Set **server-id** and

    wsrep_gtid_domain_id & —
Same Value on All Nodes

Set **gtid_domain_id** to Unique

    Values — Different Value than
wsrep_gtid_domain_id

Enable **wsrep_gtid_mode** and **log-slave-updates** — All Nodes

Enable Binary Log on All Nodes

```
[mysqld]
...
server-id = 01
gtid_domain_id = 1
wsrep_gtid_domain_id = 0

wsrep_gtid_mode = ON
log_slave_updates = ON


log-bin = /var/lib/mysql/master-bin
log-bin-index = /var/lib/mysql/master-bin.index
```

Excerpt from Database Configuration File

Galera Options: https://galeracluster.com/library/documentation/mysql-wsrep-options.html

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Galera Slave Configuration

Set `server-id` to Unique Value

Add `read-only` on to Prevent Writes

Restart **mysqld**
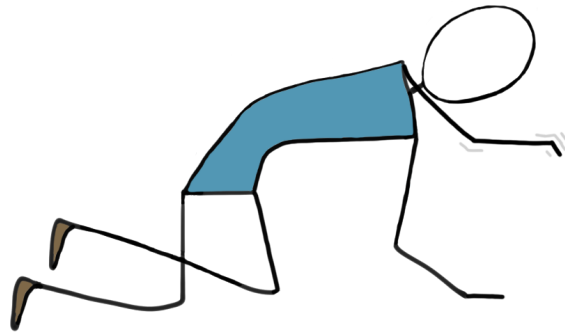
```
[mysqld]
…
server-id = 02
gtid_domain_id = 99

log-bin = /var/log/mysql/slave-bin
log-bin-index = /var/log/mysql/slave-bin.index
binlog_format = MIXED

relay-log-index = /var/lib/mysql/slave-relay-bin.index
relay-log = /var/lib/mysql/slave-relay-bin

read-only = 1
innodb-read-only = 1
```

Excerpt from Database Configuration File

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Galera Slave Preparation

Load Data from Master

Execute **CHANGE MASTER** Statement

Execute **START SLAVE** on Slave

Logical Back-Up

```
mysqldump -p -u admin_backup /
    --flush-logs --all-databases /
    > /backups/backup-20191015.sql
```

Executed from Command-Line

```
mysql -p -u root < backup-20191015.sql
```

Executed from Command-Line

```
CHANGE MASTER TO
MASTER_HOST='172.31.31.202',
MASTER_PORT=3306,
MASTER_USER='replicator',
MASTER_PASSWORD='rover123';
```

Executed from **mysql** Client

MySQL Slave Options: https://dev.mysql.com/doc/refman/en/replication-options-slave.html
MySQL **CHANGE MASTER**: https://dev.mysql.com/doc/refman/en/change-master-to.html

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Monitoring Replication

Regularly Check Status on Master

   Includes Binary Log File

     Name & Position

Check Often Status of

   Replication on Slave


```
SHOW MASTER STATUS;
```

Executed from `mysql` Client on Master

```
SHOW SLAVE STATUS \G

Slave_IO_State:
Waiting for master to send
event
Slave_IO_Running: Yes
Slave_SQL_Running:  Yes
Last_Errno: 0
Last_Error:
Seconds_Behind_Master: 0
```

Executed from `mysql` Client on Slave

MySQL `SHOW MASTER STATUS`: https://dev.mysql.com/doc/refman/en/show-master-status.html
MySQL `SHOW SLAVE STATUS`: https://dev.mysql.com/doc/refman/en/show-slave-status.html

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Demonstration of Backing–Up a Galera Slave

Using Galera Arbitrator

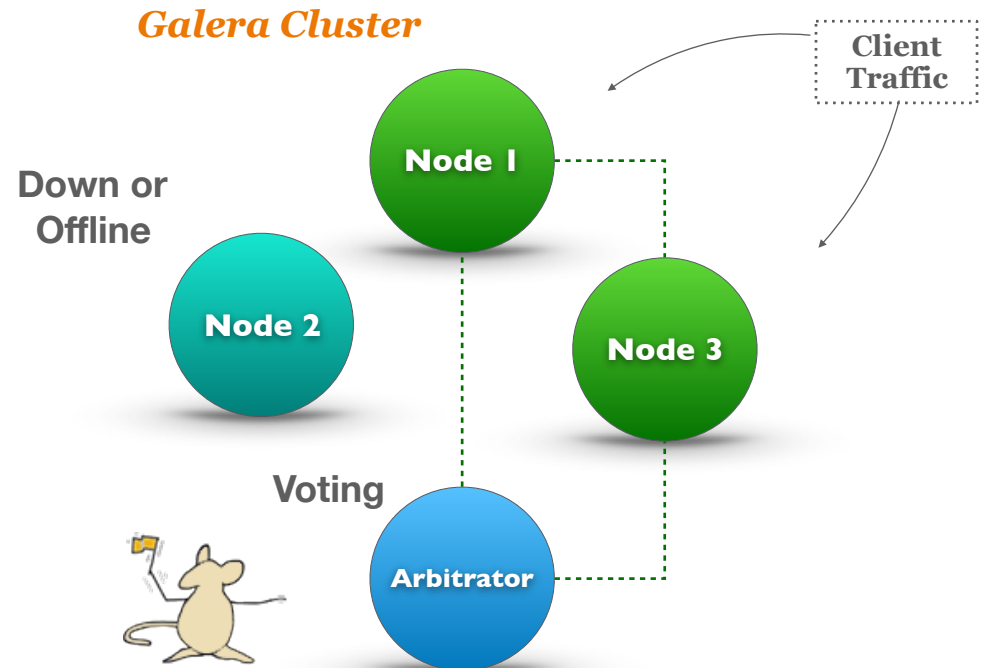Making Back-Ups with Galera Cluster

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Galera Arbitrator

Deciding Vote among Even Number
of Nodes

Avoids Split-Brain

Requests Consistent Application
State Snapshot

Used for Making Back-Ups

Galera Arbitrator: https://galeracluster.com/library/documentation/arbitrator.html

Galera Cluster

Client Traffic

Node 1

Down or Offline

Node 2

Node 3

Voting

Arbitrator

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Back–Ups with Galera Arbitrator

Arbitrator Receives Back-Up Request

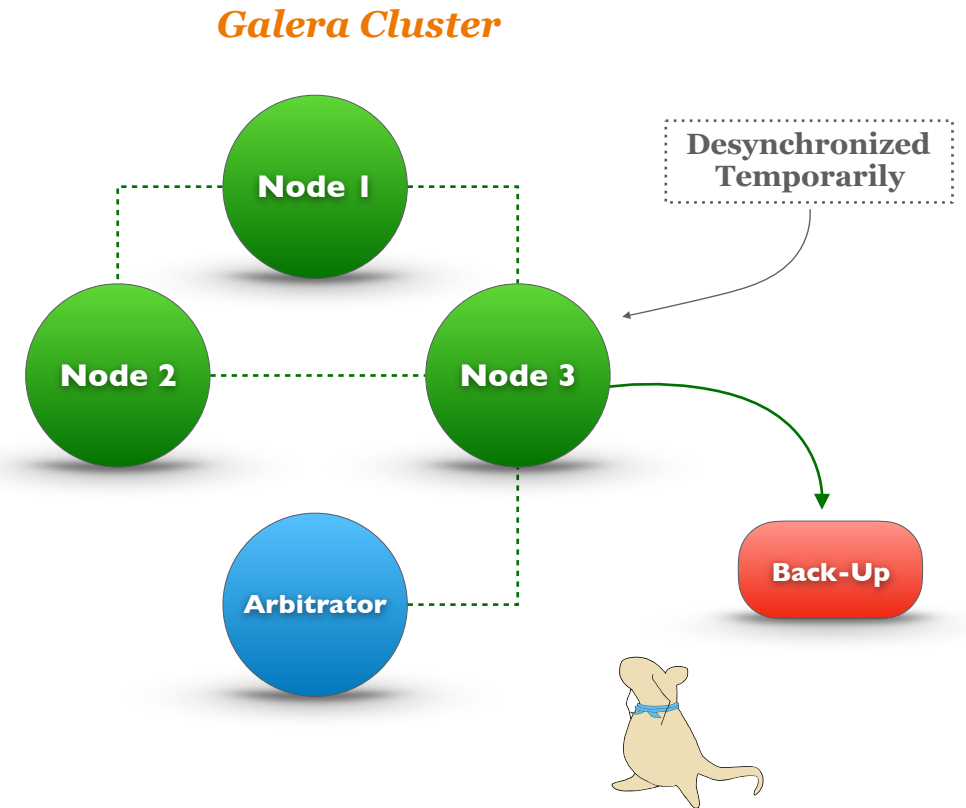Manual or Automated (e.g., `cron`)

Node is Chosen for SST — Donor

Desynchronized from Cluster

Back-Up Script is Run

Donor Node is Resynchronized

Galera Cluster

Node 1

Node 2

Node 3

Arbitrator

Desynchronized
Temporarily

Back-Up

Configure Galera Arbitrator

Configuration File for Arbitrator

    Name of Cluster

    IP Addresses of Nodes — Ports Optional

    Local IP Addresses (i.e., `0.0.0.0`) & Port

    Back-Up Node (i.e., Donor)

    Naming of Back-Up Script

    Path & Name of Log File

Execute `garbd` with `--cfg`

```
group='galera-training'
address="gcomm://172.31.30.39:4567,
                172.31.18.53:4567,
                172.31.26.106:4567"

options="gmcast.listen_addr=tcp://0.0.0.0:4444"
donor="galera-3"

sst='backup_mysqldump'

log='/var/log/garbd.log'
```

Contents of `/etc/garbd.cnf` File

```
garbd --cfg /etc/garb.cnf
```

Executed from the Command-Line

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Demonstration of Back–Ups with Galera Arbitrator

Restoring Nodes

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Galera Node Failure Scenarios
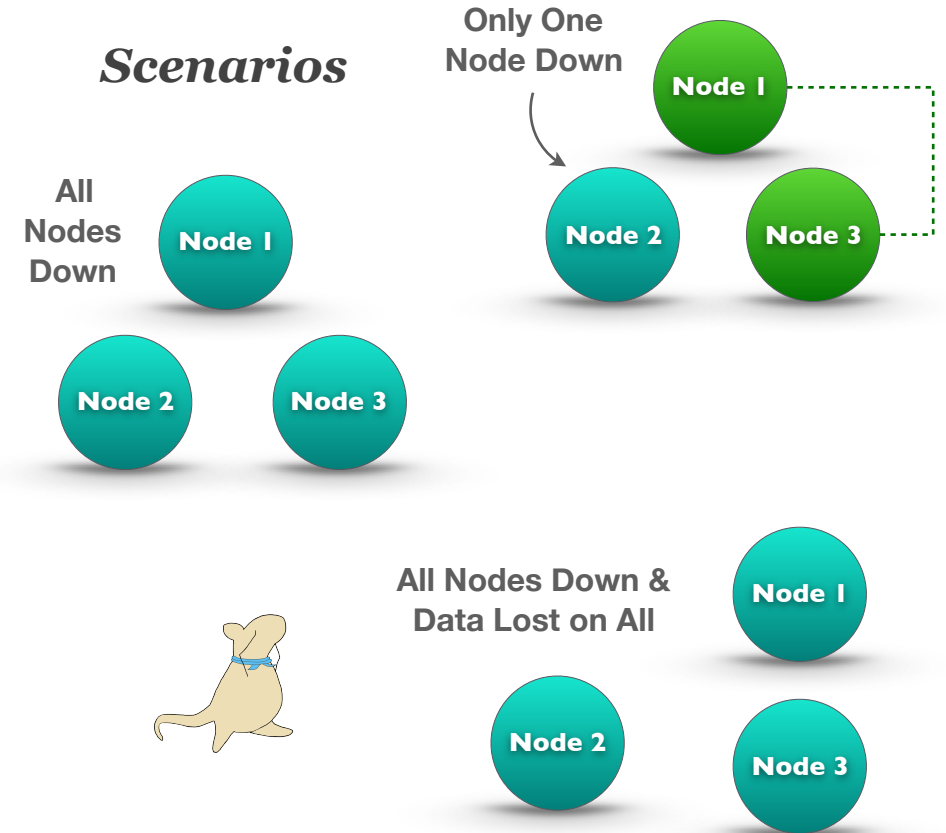
One Node Crashed in Cluster

Start Fresh without Restoring Back-Up

All Nodes Down with Good Data

Restart Most Up-to-Date Node First

Data on All Nodes Lost

Restore Data from Back-Up

Scenarios

Only One Node Down

All Nodes Down

Node 1

Node 2   Node 3

Node 1

Node 2   Node 3

All Nodes Down & Data Lost on All

Node 1

Node 2   Node 3

Node Failure and Recovery: https://galeracluster.com/library/documentation/recovery.html

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Recovering a Single Node

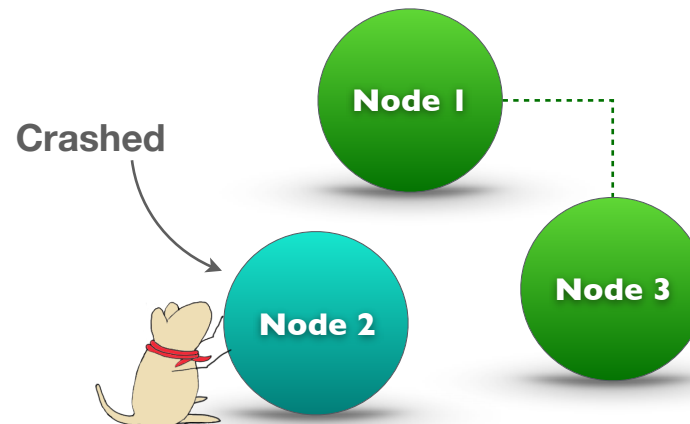Uninstall MySQL or MariaDB

Delete Database Directory

Install MySQL or MariaDB and Secure

Edit Configuration File

Start Database

```
systemctl stop mysqld
yum remove mysql mysql-server
rm -rf /var/lib/mysql
yum install mysql mysql-server
systemctl start mysqld
mysql_secure_installation
vi /etc/my.cnf
systemctl start mysqld
```

Executed from Command-Line

Crashed

Node 1

Node 2

Node 3

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Restarting a Cluster

Determine Most Up-to-Date Node

View Each Node's `grastate.dat` File

Ensure UUID Values the Same for All Nodes

Find Node with Highest Sequence Number

Restart Most Up-to-Date Node First

Use `mysqld_bootstrap` on MySQL

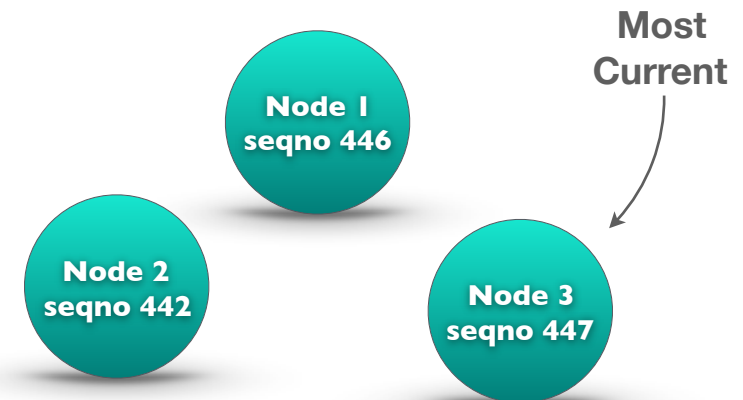Use `galera_new_cluster` on MariaDB

Start Other Nodes

Use `systemctl`

```
cat /var/lib/mysql/grastate.dat

# GALERA saved state
version: 2.1
uuid:    336389bc-eae9-11e9-9695-46444c043f7f
seqno:   447
safe_to_bootstrap: 1
```

Executed from Command-Line

**Most
Current**

Node 1
seqno 446

Node 2
seqno 442

Node 3
seqno 447

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Restoring All Nodes

Install Software on All Nodes — Without Data

    Secure Database (e.g., root password)

    Edit Configuration File

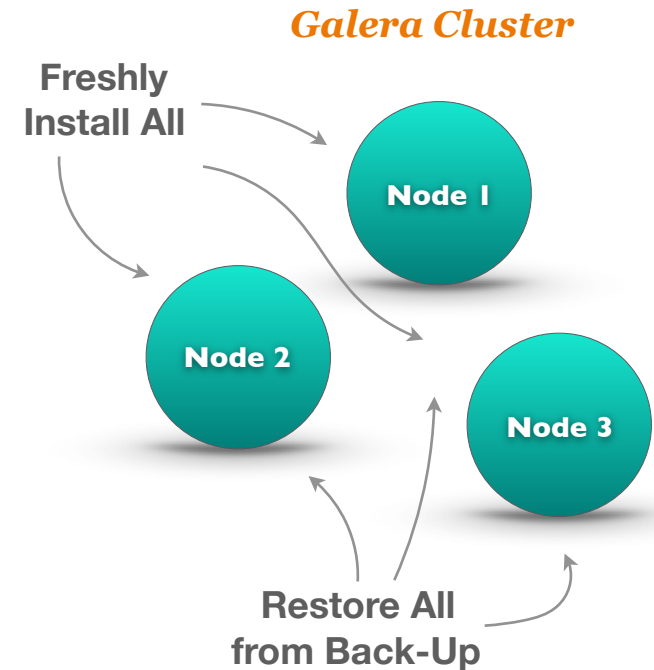Restore Data on One or All Nodes

    On One Node is Simpler

    All Nodes is Potentially Faster

Start Nodes

    Start & Check Seed Node

    Start & Check Other Nodes

Galera Cluster

Freshly Install All

Node 1

Node 2

Node 3

Restore All from Back-Up

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Demonstration of Recovering a Galera Node & Cluster

Back–Up & Restoration Plan

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Take Inventory

Assemble Information on Nodes

    List of Key Software and Versions

    Keep Printed Copies of Configuration Files

Assess & Assign Staff

    DBAs with Needed Skills

    Who Does Back-Ups — At Least Two

    Most Skilled for Restoring Nodes & Cluster

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Develop a Back–Up Plan

Make a Back-Up Schedule

    Which Days & Times

    Which Nodes Used

    Where are Copies Kept Off-Site

Regularly Look for Trouble

    Review Error Logs for Warnings & Error Messages

    Reads Messages from Codership for Security Vulnerabilities

    Keep Database and Galera Cluster Software Up-to-Date

Verification & Restoration

Write a Verification Schedule

Check File Sizes & Contents — Different DBA

Ensure Configuration Files are Copied

Create a Restoration Plan

Practice Restoring Nodes — All DBAs

Use Test Servers to Assemble New Cluster

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Conclusion

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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**)

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