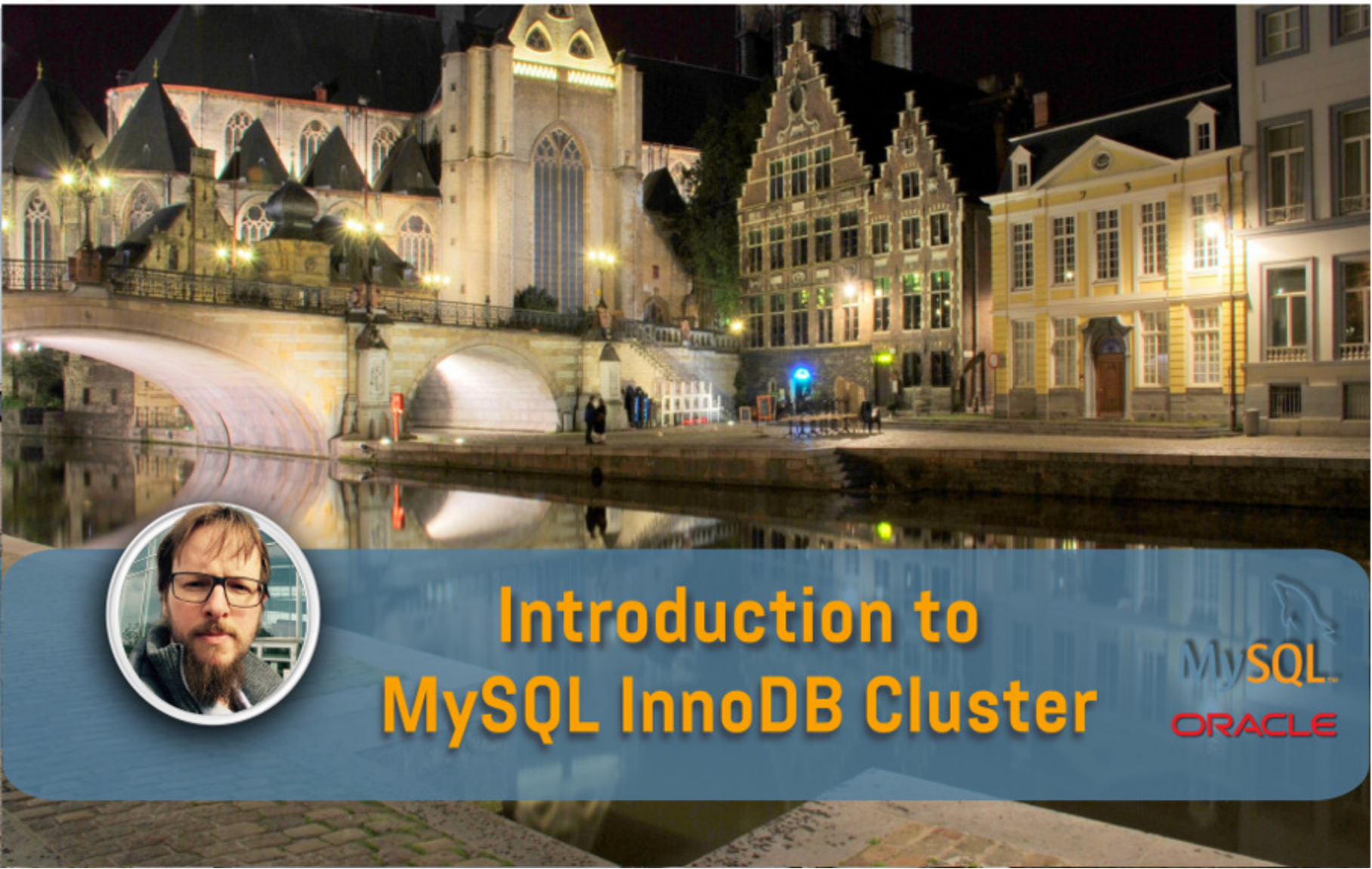
PERCONA UNIVERSITY

June 22,2017
5.00PM

Co.Station Ghent
Oktrooiplein 1, 9000 Ghent



Introduction to MySQL InnoDB Cluster

MySQL
ORACLE


ORACLE®

MySQL InnoDB Cluster

MySQL High Availability made easy

Percona University, Ghent, Belgium June 2017

Frédéric Descamps - MySQL Community Manager - Oracle

Safe Harbor Statement

The following is intended to outline our general product direction. It is intended for information purpose only, and may not be incorporated into any contract. It is not a commitment to deliver any material, code, or functionality, and should not be relied up in making purchasing decisions. The development, release and timing of any features or functionality described for Oracle´s product remains at the sole discretion of Oracle.

about.me/lefred

Who am I ?

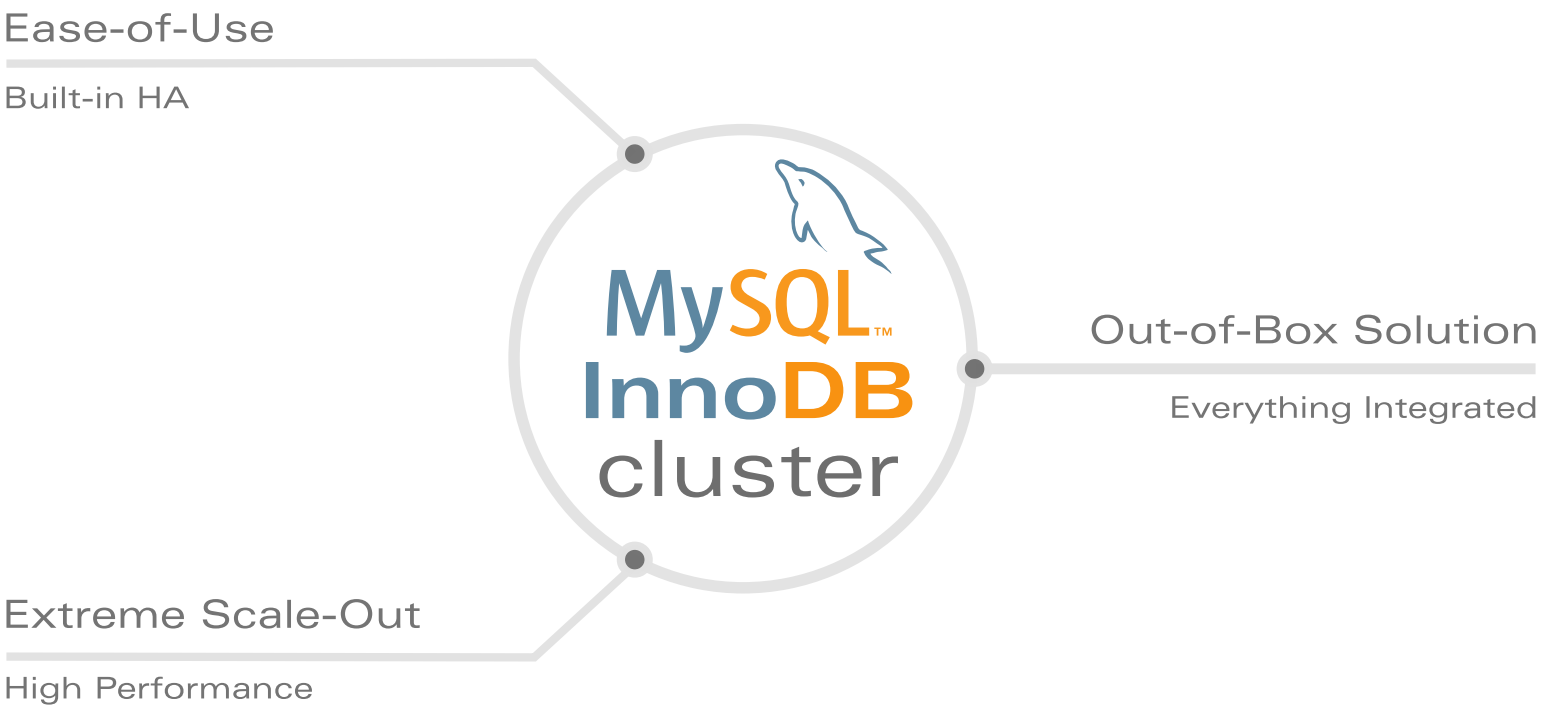
Frédéric Descamps

- @lefred
- MySQL Evangelist
- Hacking MySQL since 3.23
- devops believer
- MySQL Community Manager since May 2016
- living in Belgium **B E**

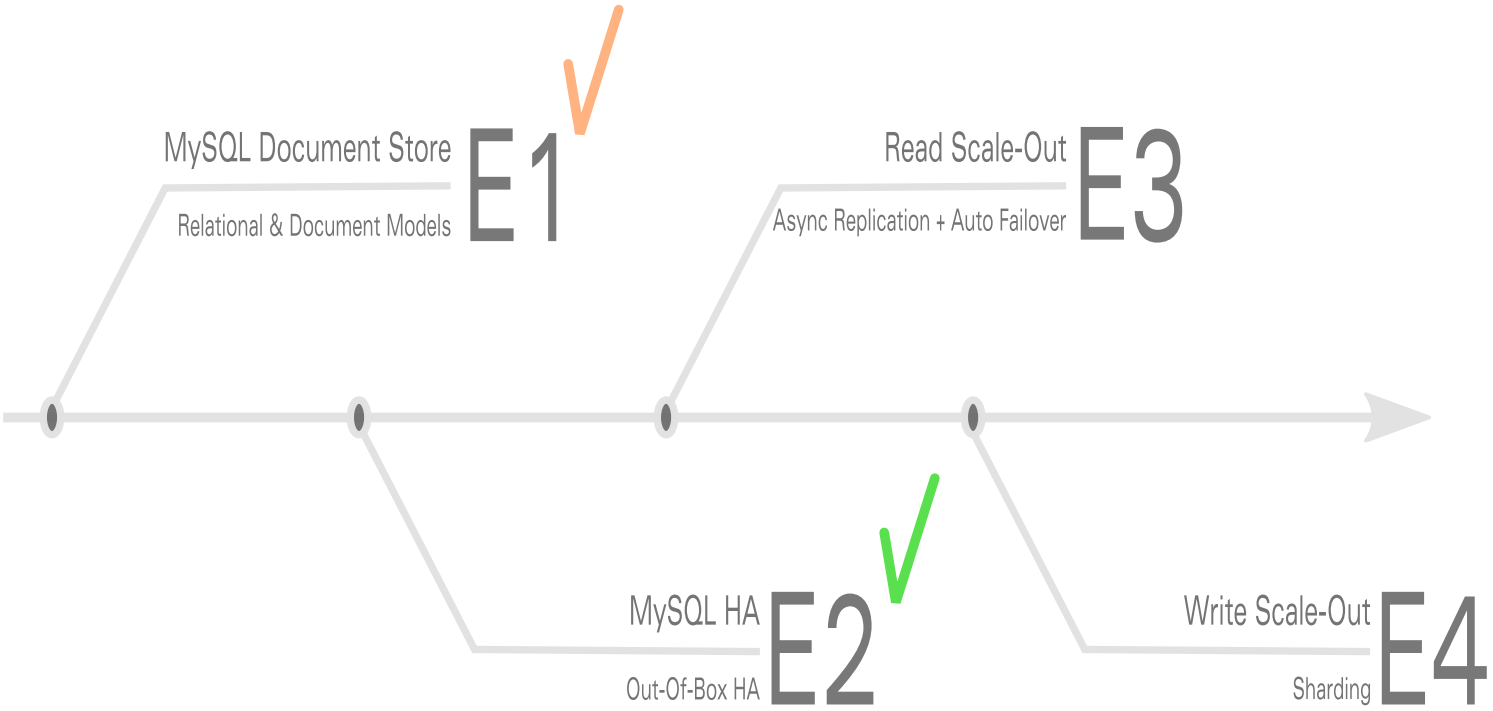
ORACLE

MySQL InnoDB Cluster

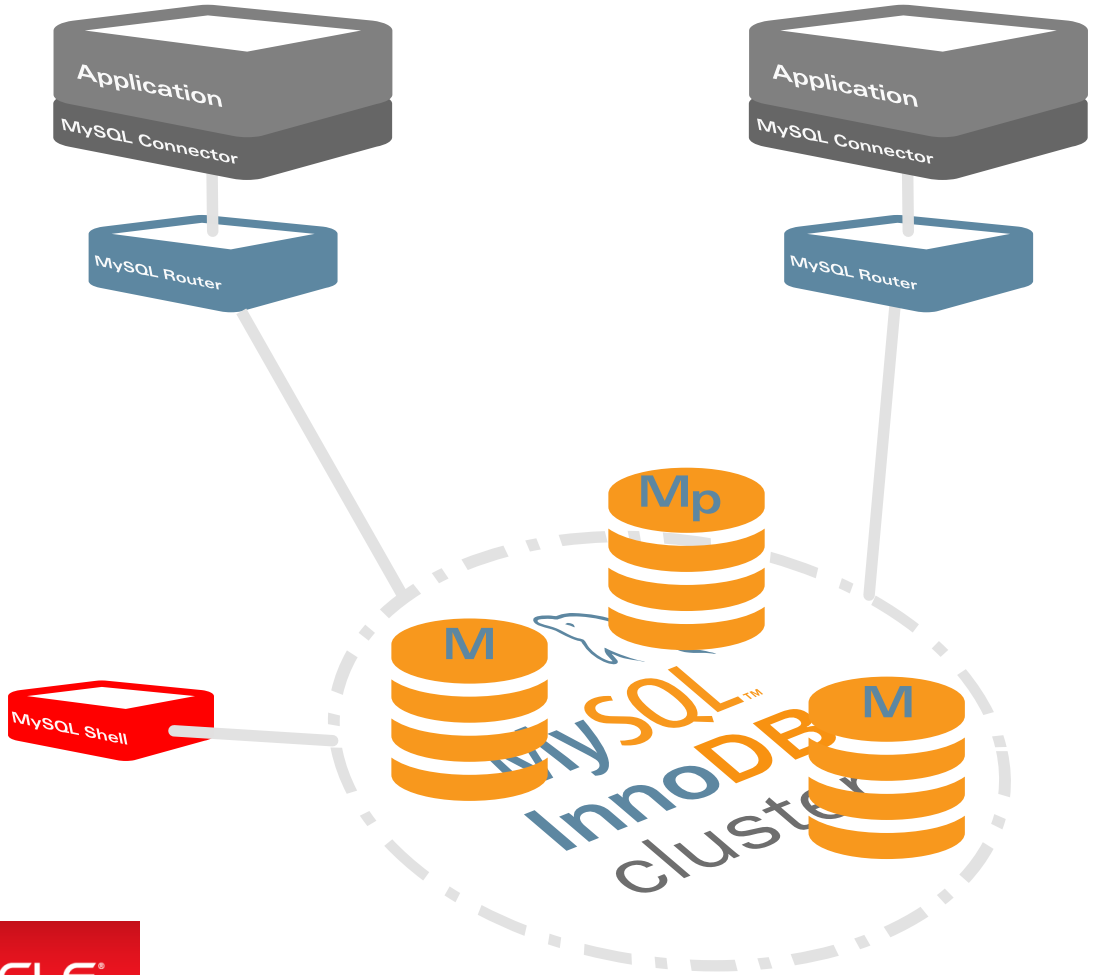
Easy MySQL High Availability



Our vision in 4 steps



Step 2´s Architecture



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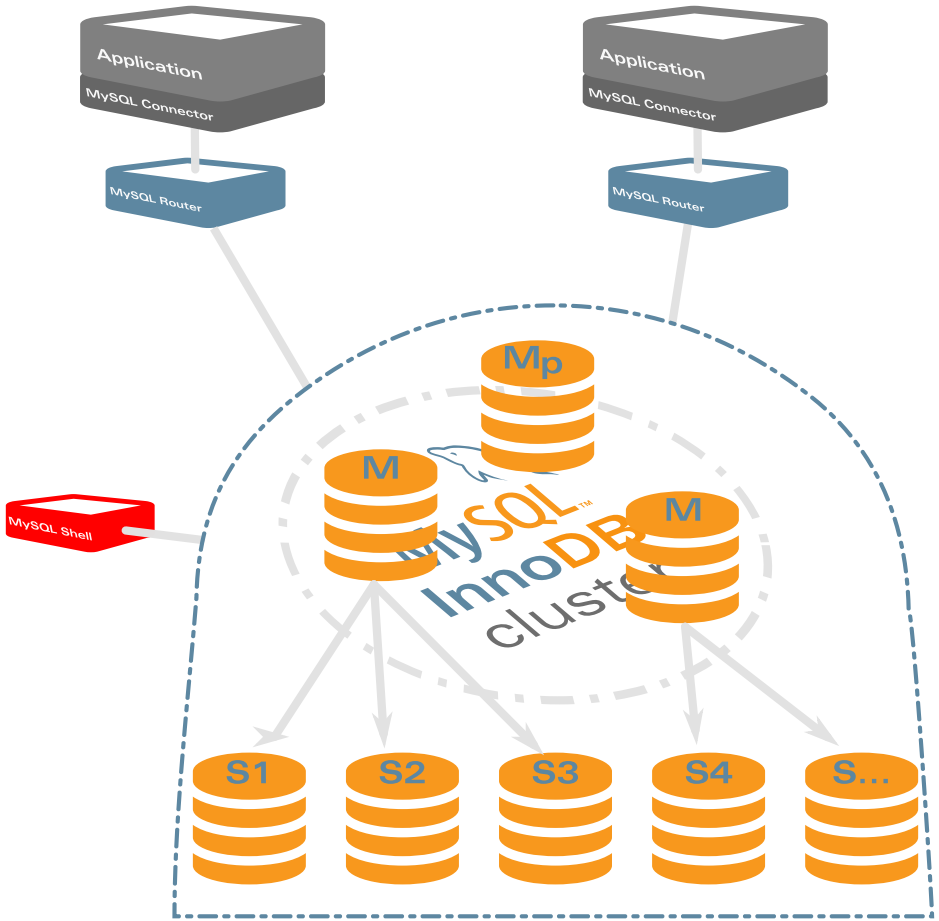

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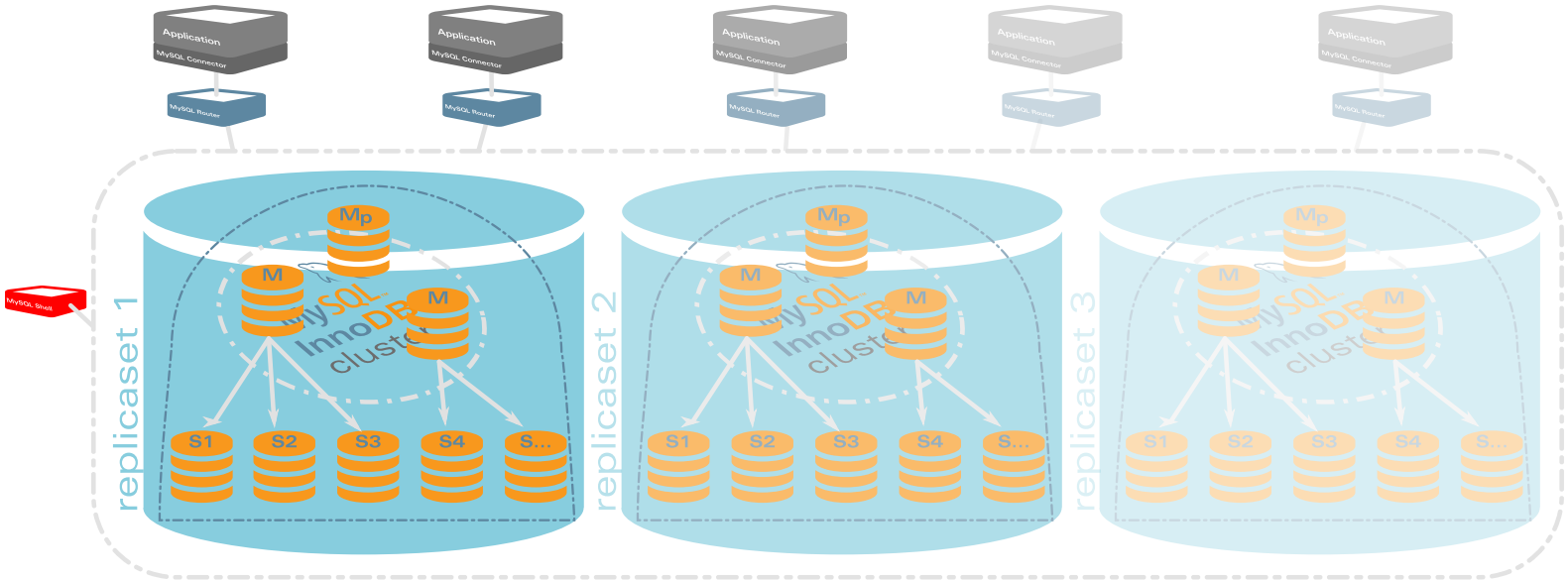
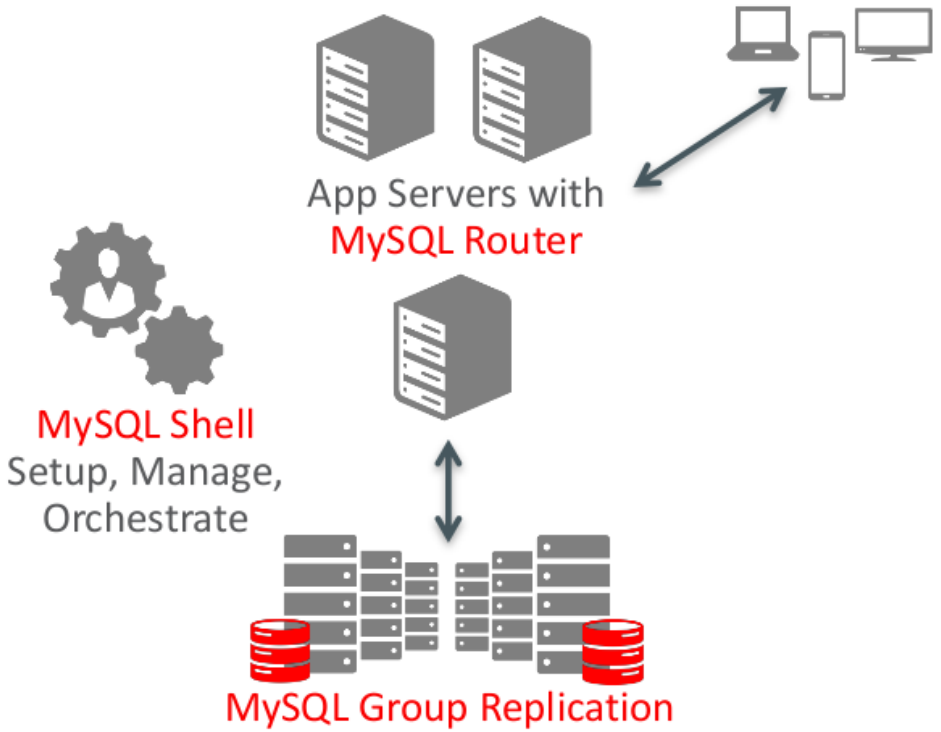


Group Replication: heart of MySQL InnoDB Cluster



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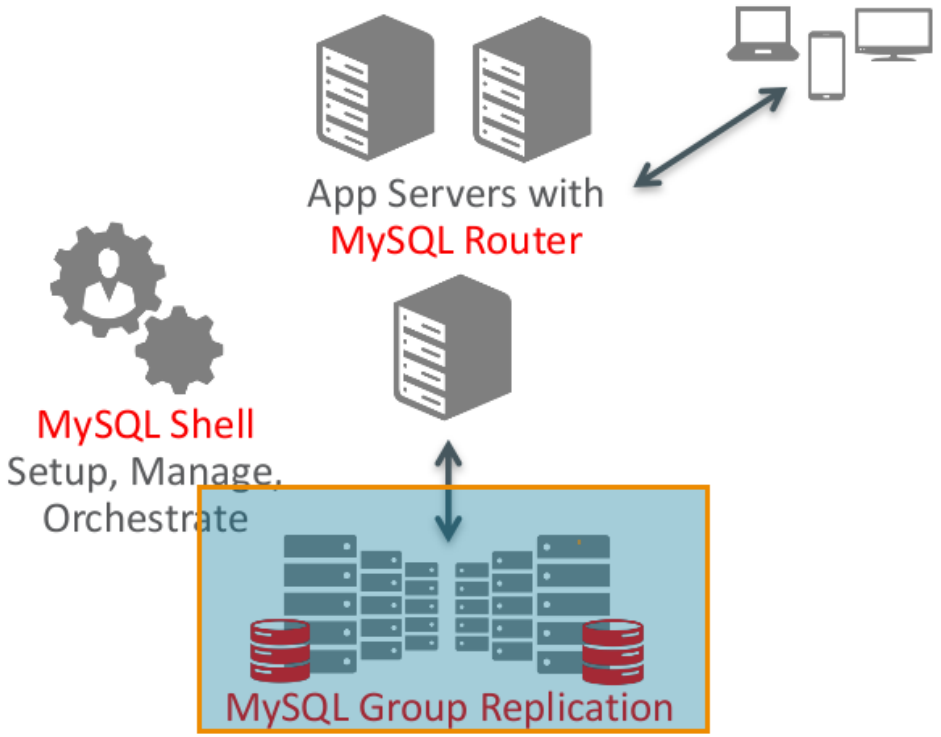

But before going further...

What is

High Availability ?

High Availability

High availability is a characteristic of a system, which aims to ensure an agreed level of operational performance, usually uptime, for a higher than normal period.

There are three principles of systems design in reliability engineering which can help achieve high availability:

- *Elimination of single points of failure. This means adding **redundancy** to the system so that failure of a component does not mean failure of the entire system.*
- *Reliable crossover. In redundant systems, the crossover point itself tends to become a single point of failure. Reliable systems must provide for reliable crossover.*
- *Detection of failures as they occur. If the two principles above are observed, then a user may never see a failure. But the maintenance activity must.*

Source: Wikipedia

Database Redundancy

How to achieve it ?

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Multiple solutions exist, some worse than the others ;-)

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Of course the last one is the technique most spread, more flexible and more reliable.

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- semi-synchronous replication (semi-sync)
- group replication - *since (5.7.17) !!*

Asynchronous Replication(s)

- replicas (also called slaves) stream the replication logs from a unique master *(multi-source replication is possible since 5.7.6)*

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- write operations are safe only from a unique global master

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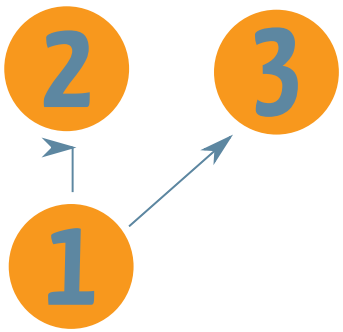

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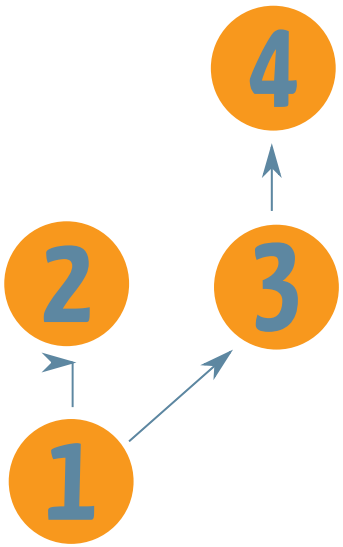

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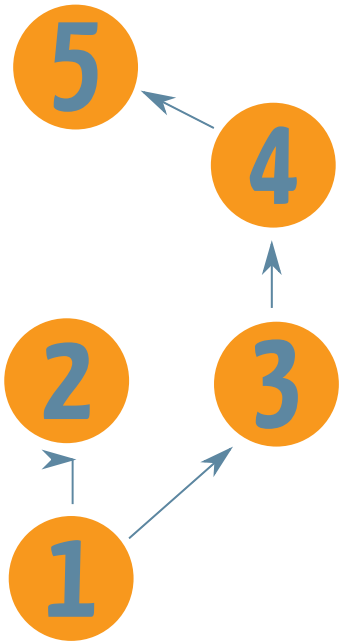

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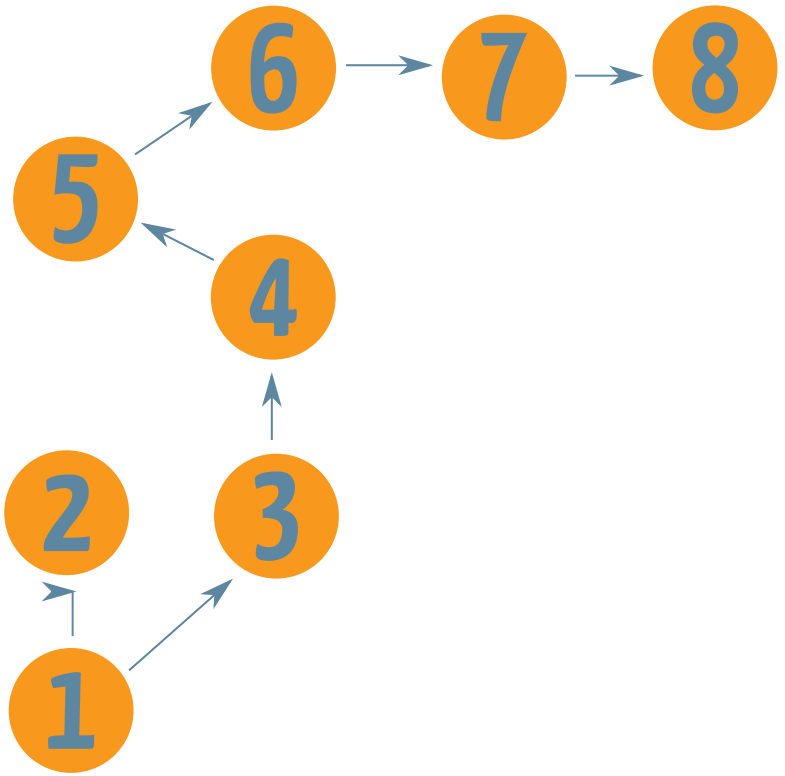

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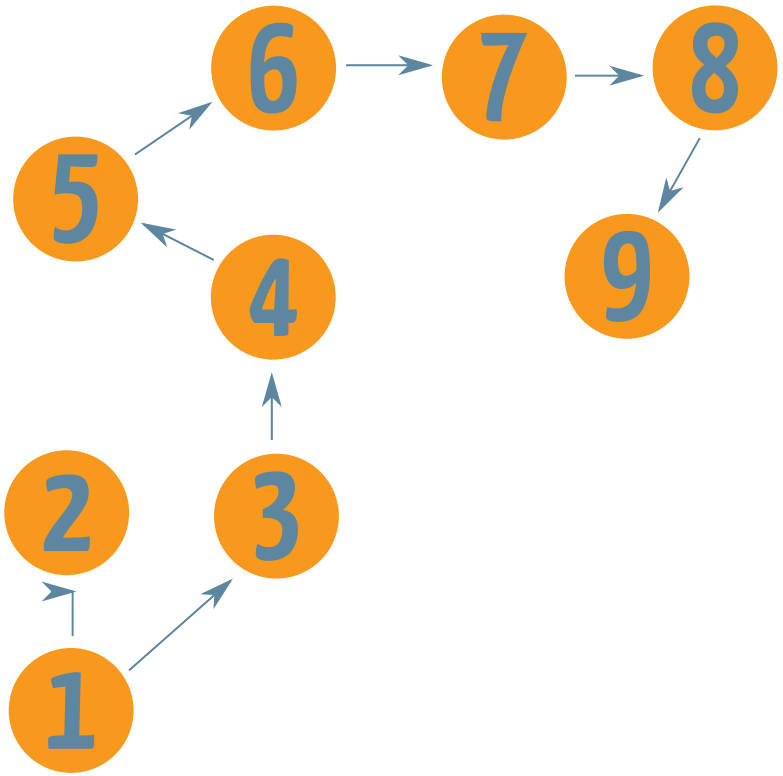

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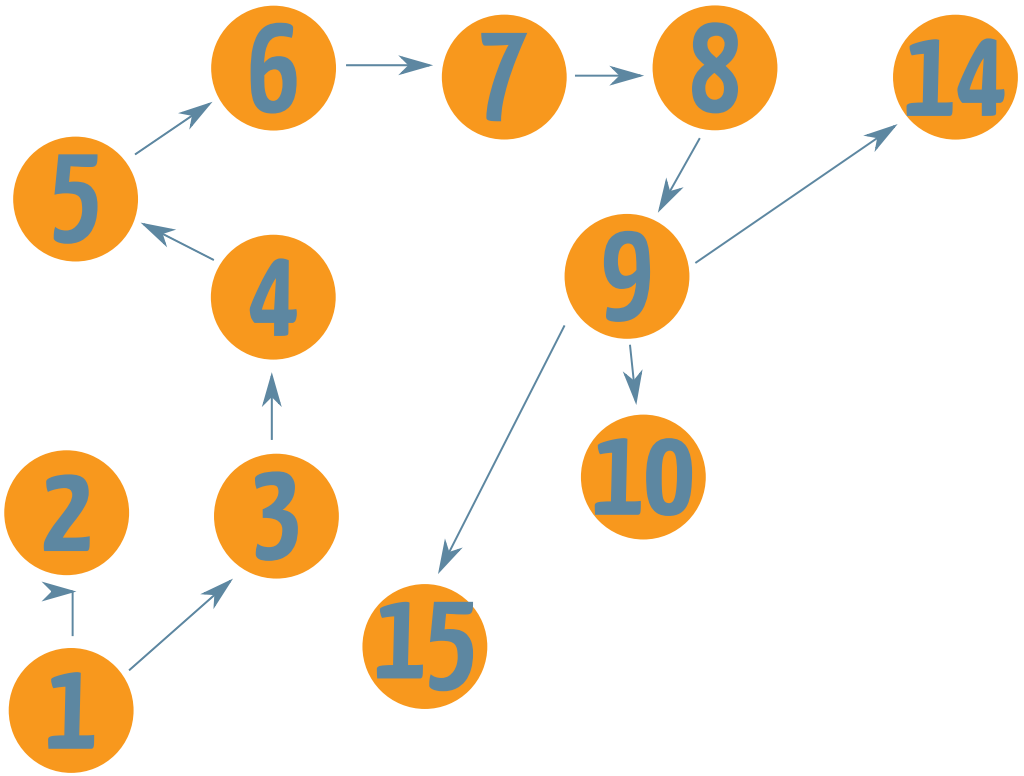

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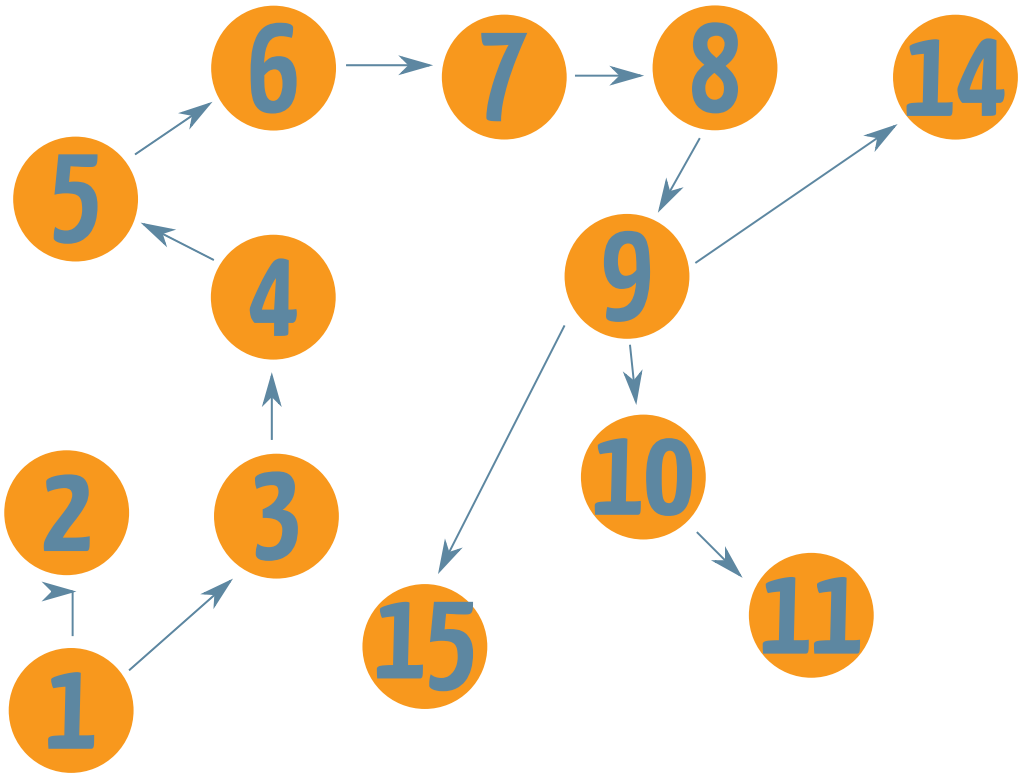

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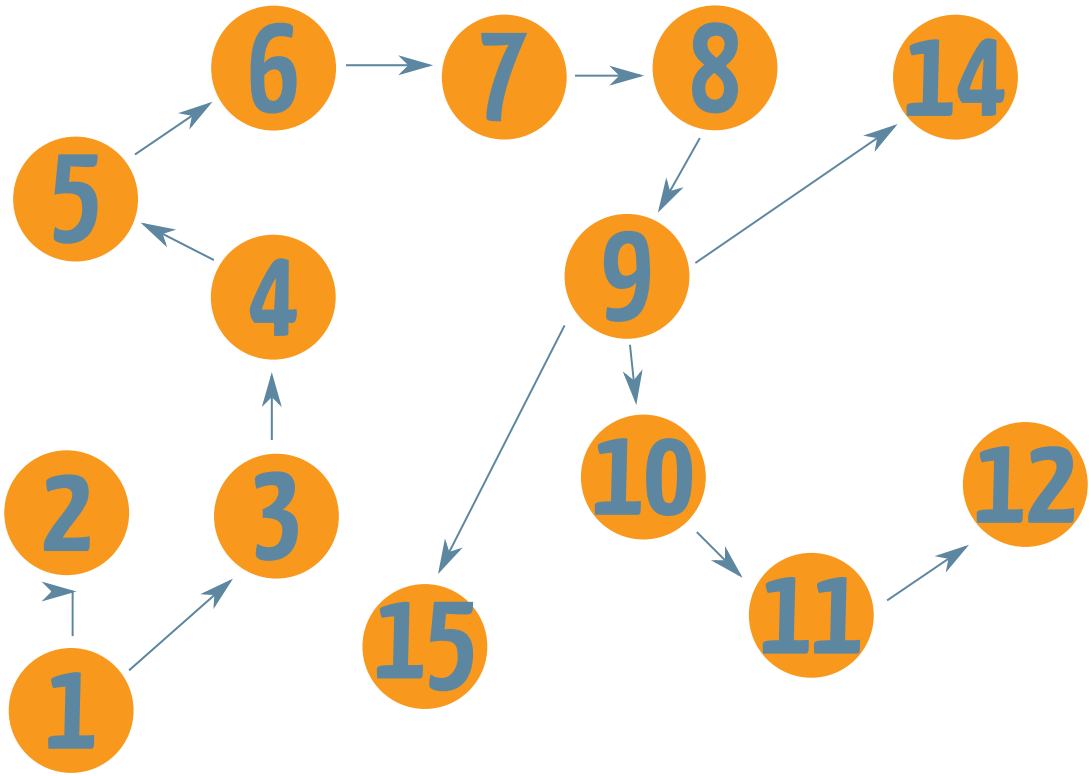

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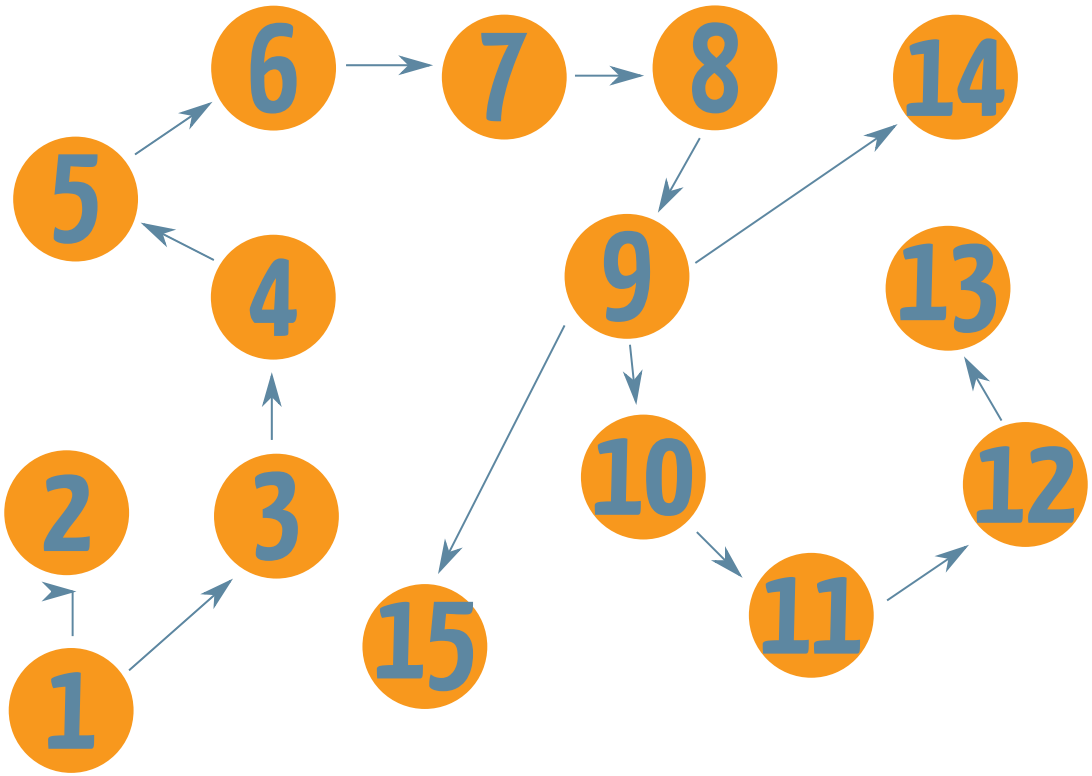

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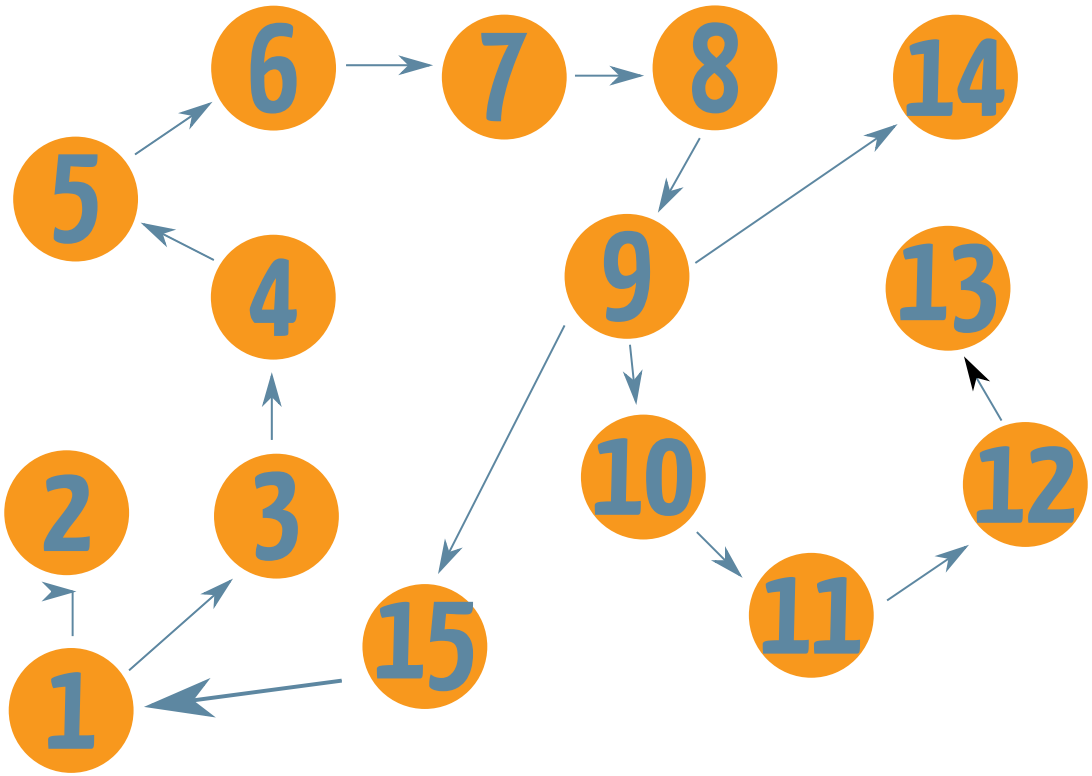

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If the master as an issue, the most accurate slave needs to takeover the role and be promoted as master for all the remaining slaves still online.

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- Supported on **all MySQL platforms** !!
  - Linux, Windows, Solaris, OSX, FreeBSD

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- GR handles crashes, failures, re-connetcs automatically
- **Allows an easy setup of a MySQL service high available !**

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not that easy to understand... right ? As a picture is worth a 1000 words, let's illustrate this...

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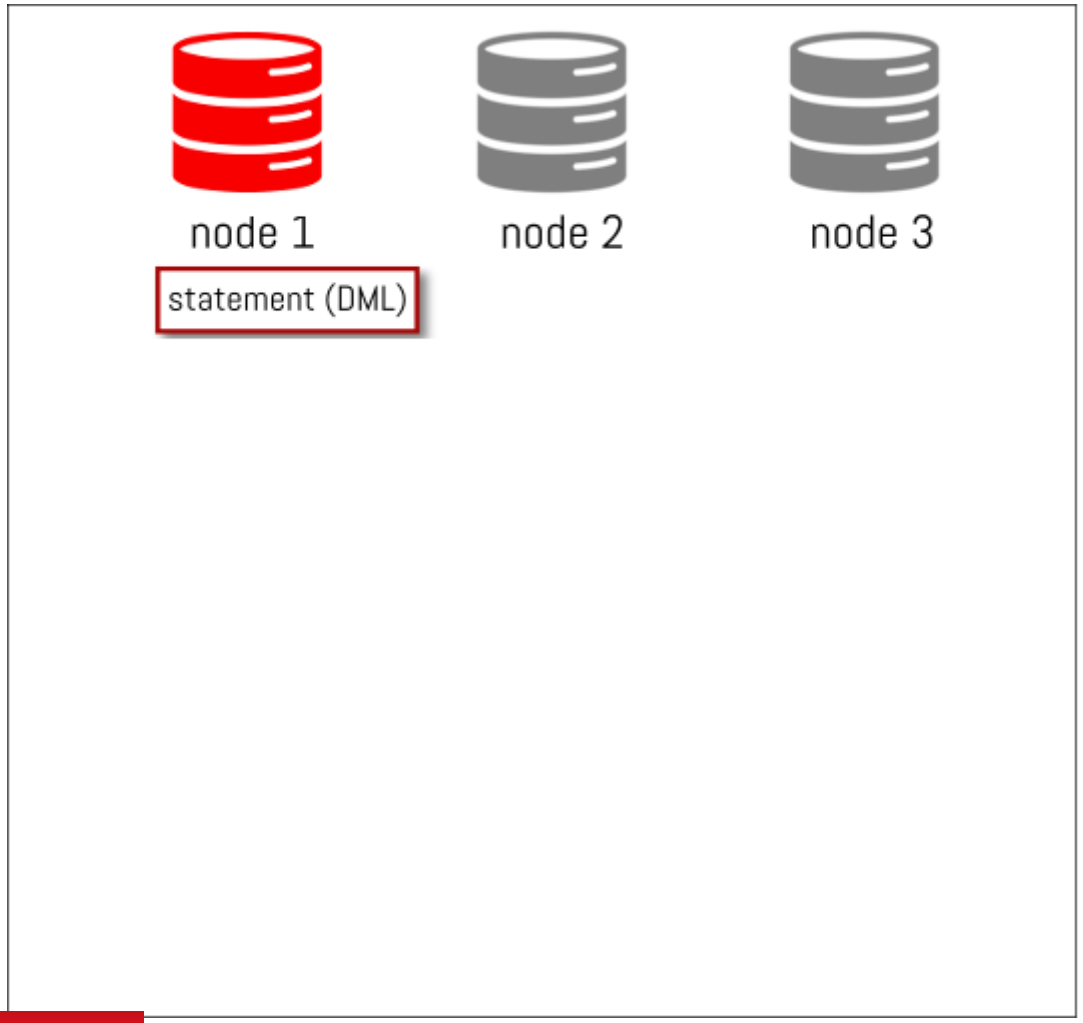

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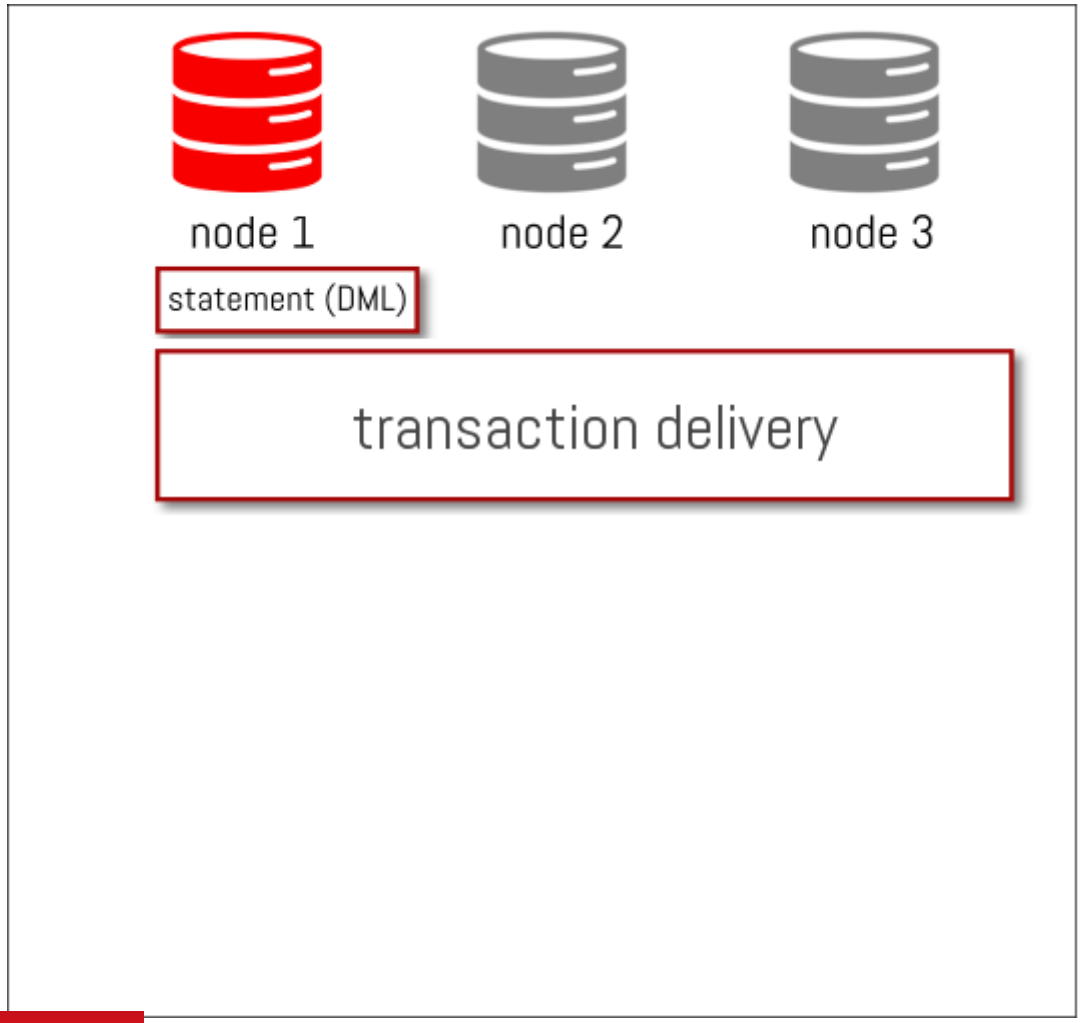

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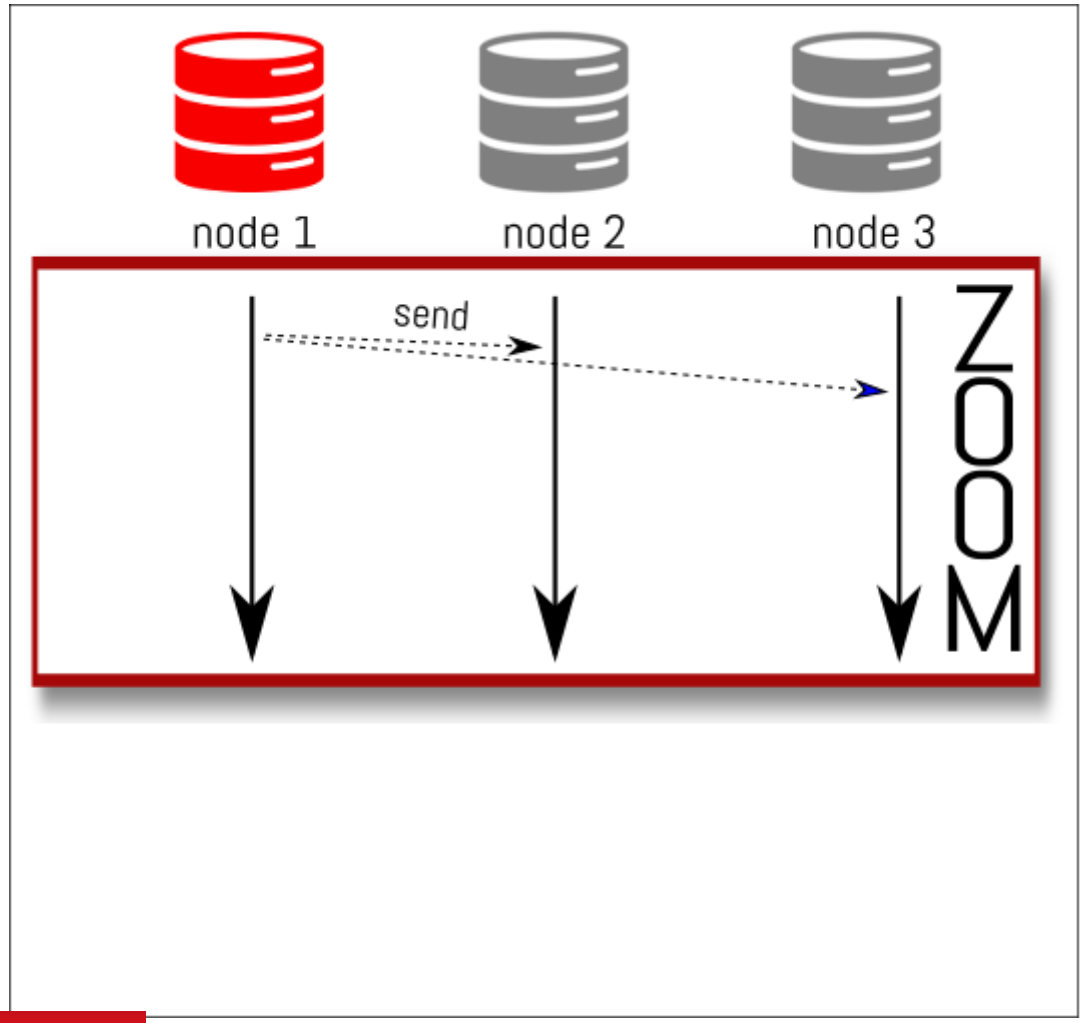

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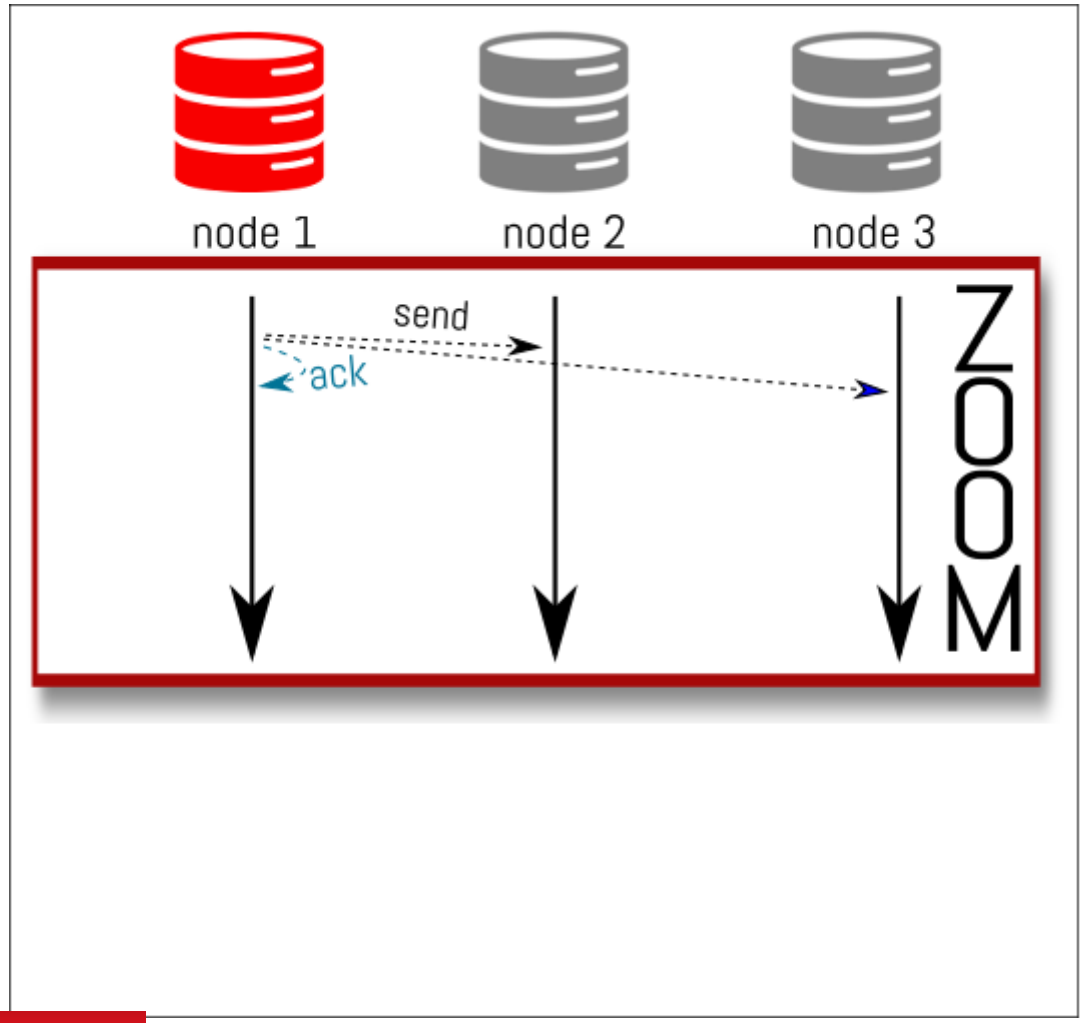

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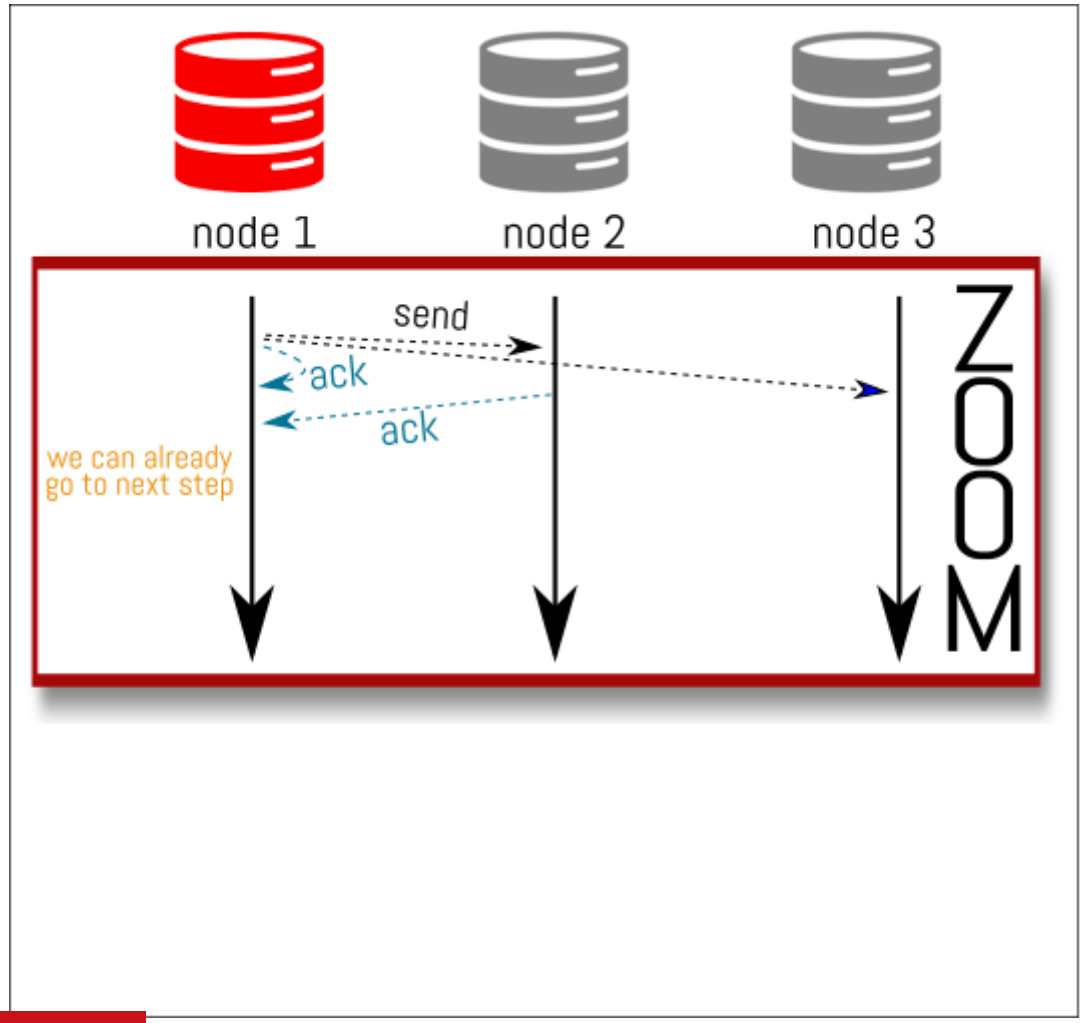

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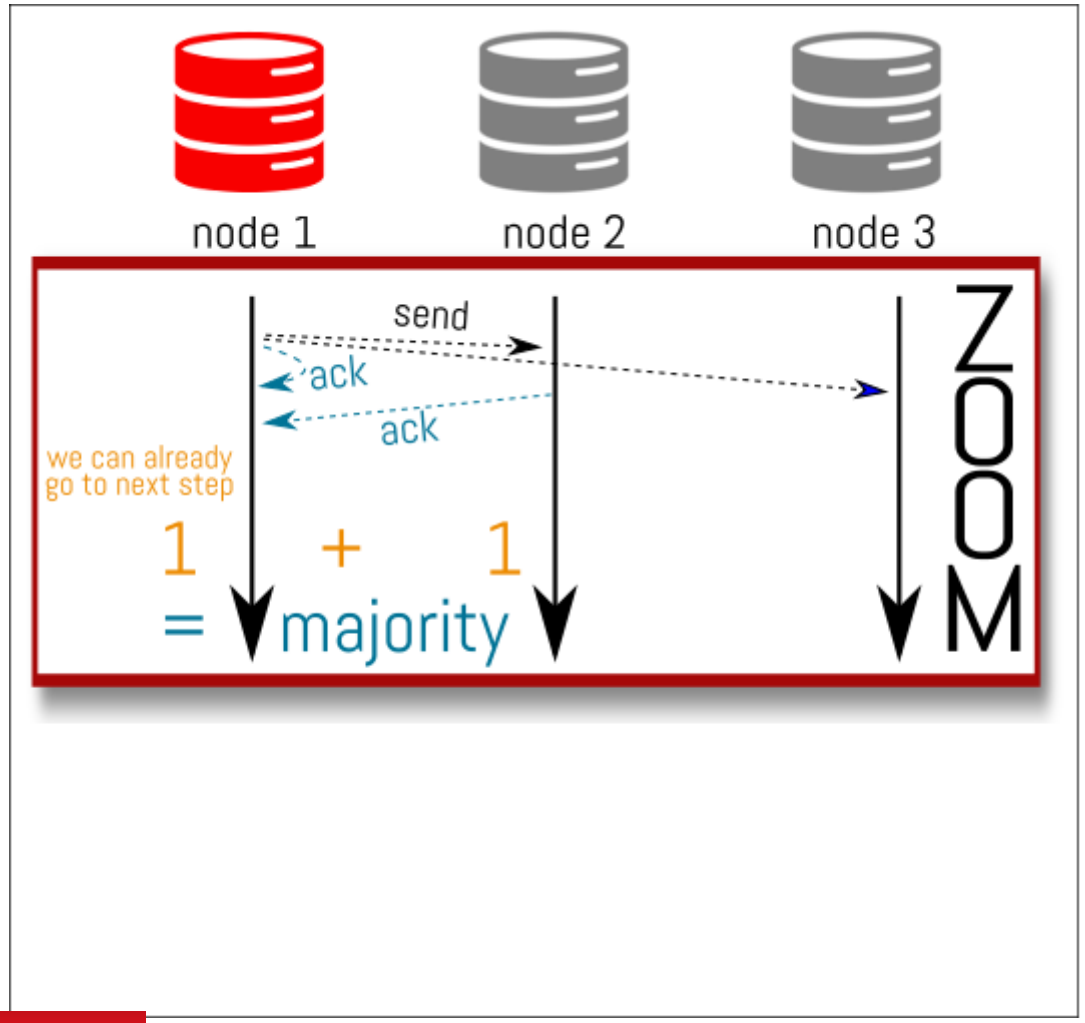

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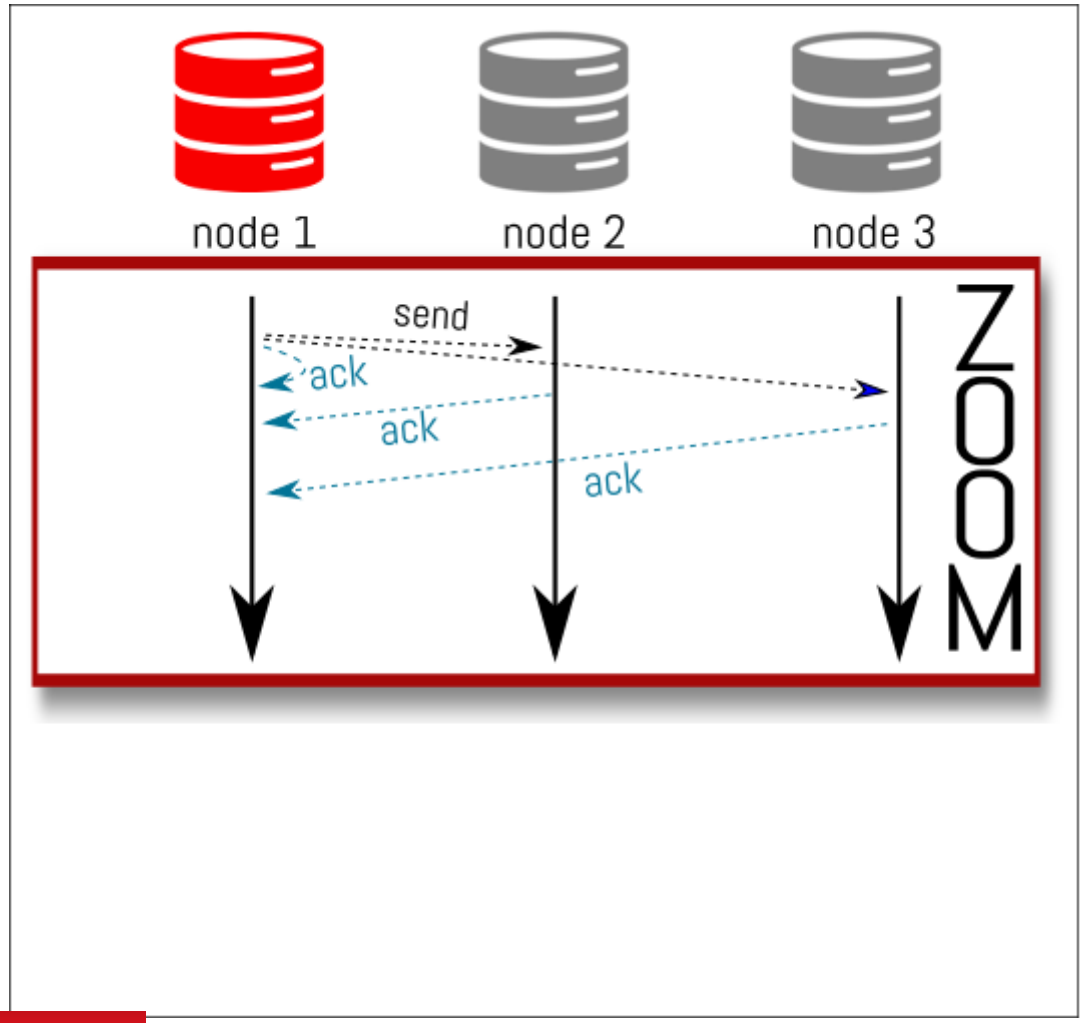

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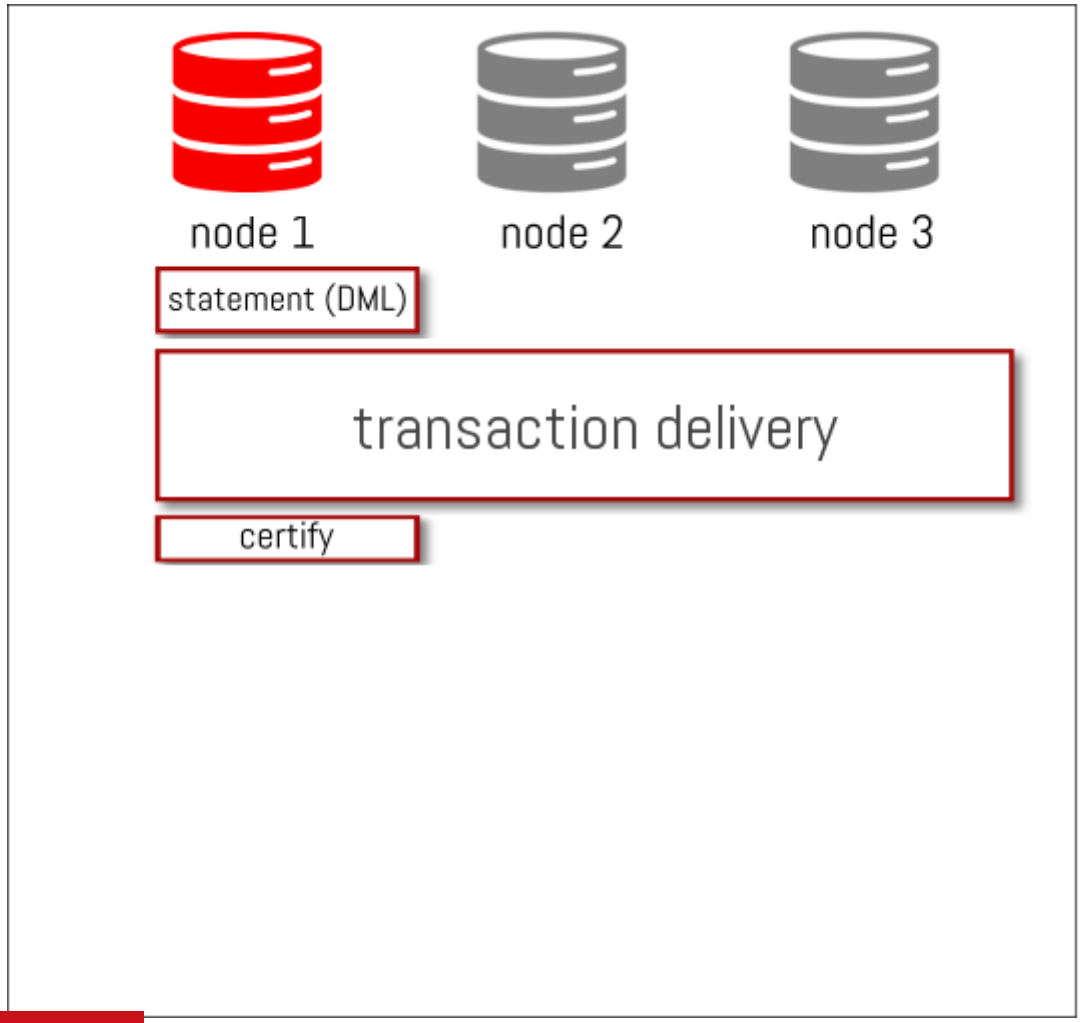

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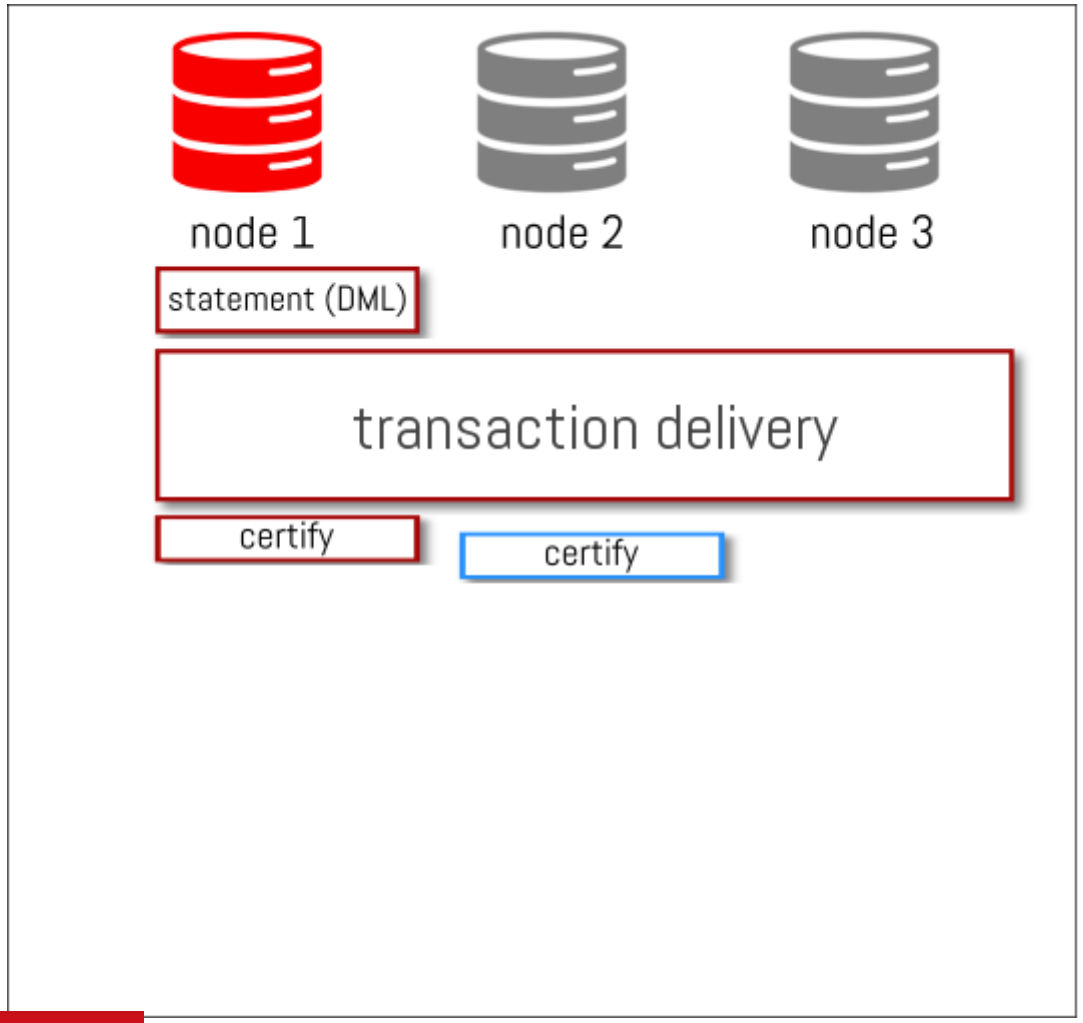

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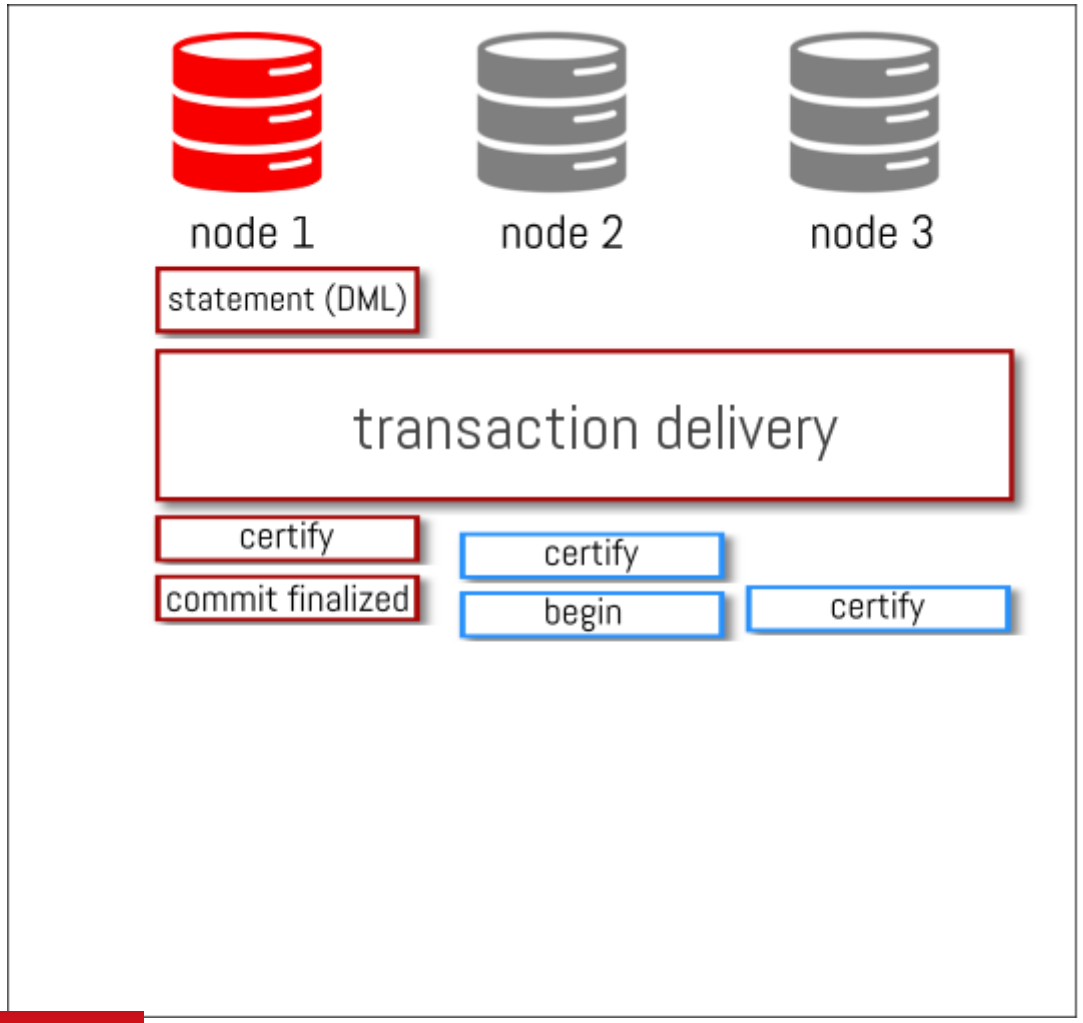

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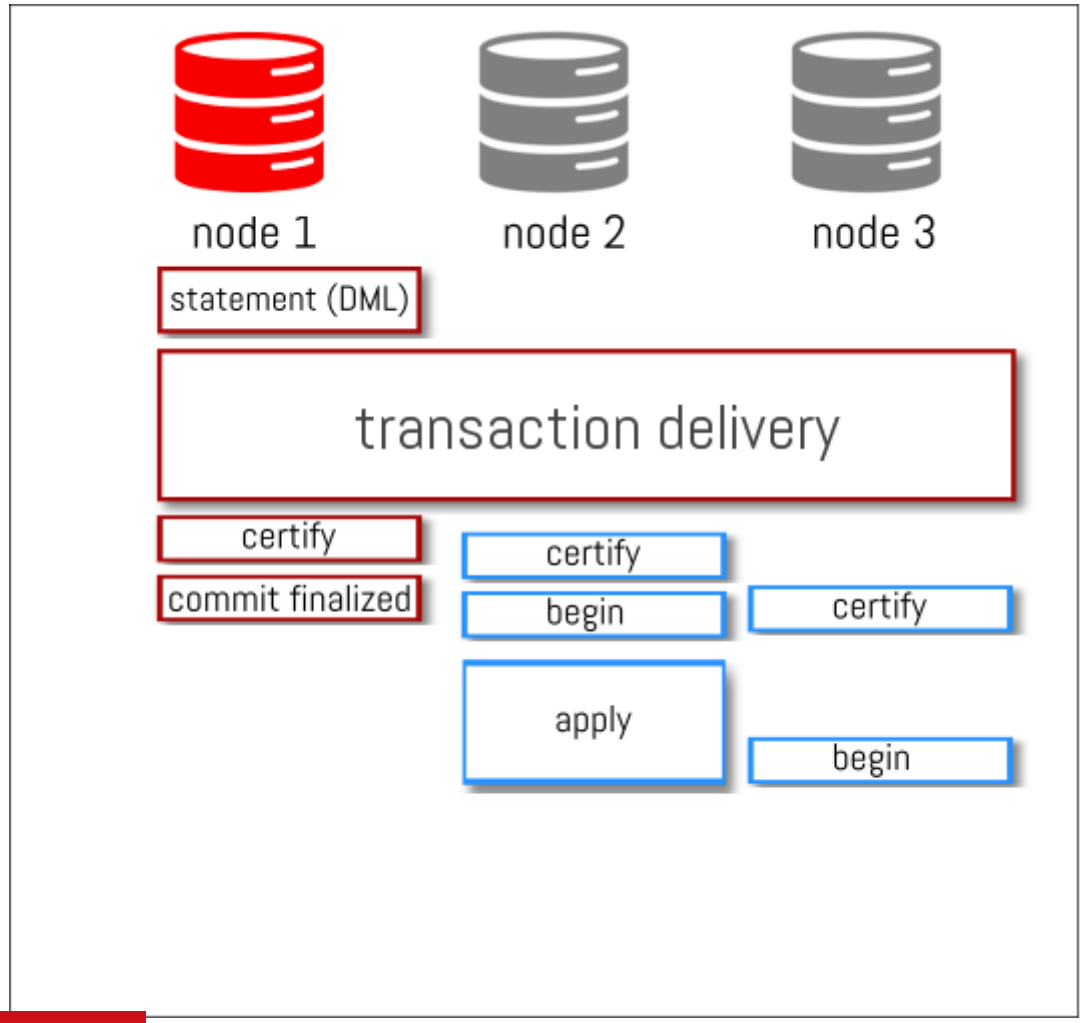

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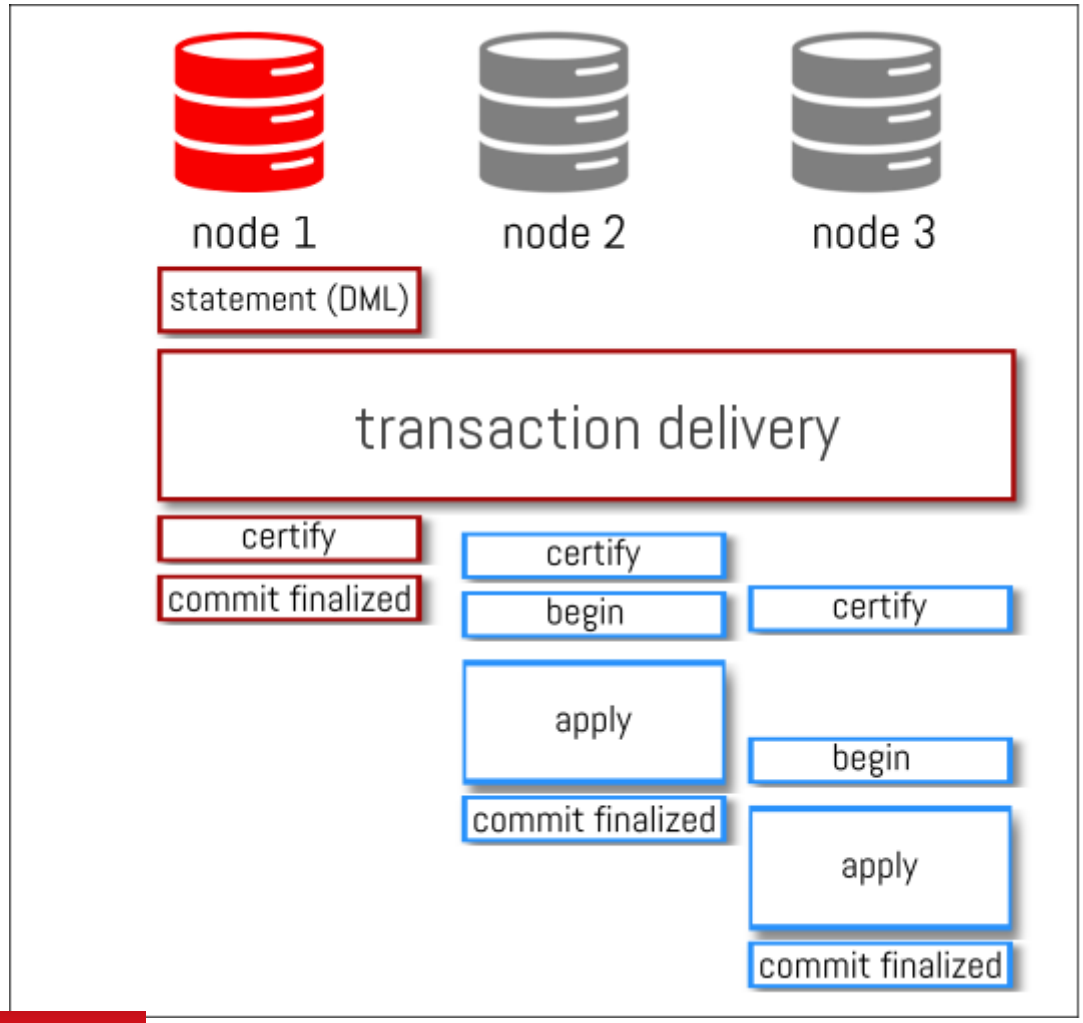

Certification

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- serialized by the total order in GCS/XCOM + GTID
- cost is based on trx size (# rows & # keys)

GTID

- GTIDs are the same as those used by asynchronous replication.

```
mysql>  SELECT * FROM performance_schema.replication_connection_status\G
*************************** 1. row ***************************
             CHANNEL_NAME: group_replication_applier
               GROUP_NAME: afb80f36-2bff-11e6-84e0-0800277dd3bf
            SOURCE_UUID: afb80f36-2bff-11e6-84e0-0800277dd3bf
              THREAD_ID: NULL
          SERVICE_STATE: ON
COUNT_RECEIVED_HEARTBEATS: 0
 LAST_HEARTBEAT_TIMESTAMP: 0000-00-00 00:00:00
  RECEIVED_TRANSACTION_SET: afb80f36-2bff-11e6-84e0-0800277dd3bf:1-57,
f037578b-46b1-11e6-8005-08002774c31b:1-48937
        LAST_ERROR_NUMBER: 0
       LAST_ERROR_MESSAGE:
     LAST_ERROR_TIMESTAMP: 0000-00-00 00:00:00
```

- but transactions use the Group´s GTID

```
mysql> show master status\G
*************************** 1. row ***************************
             File: mysql4-bin.000001
         Position: 1501
     Binlog_Do_DB:
 Binlog_Ignore_DB:
 Executed_Gtid_Set: afb80f36-2bff-11e6-84e0-0800277dd3bf:1-57,
f037578b-46b1-11e6-8005-08002774c31b:1-48937
```

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- every tables must have a PK defined
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- a good network with low latency is important
- maximum of 9 members per group
- `log-bin` must be enabled and only **ROW** format is supported

Requirements (2)

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- replication meta-data must be stored in system tables

```
--master-info-repository=TABLE
--relay-log-info-repository=TABLE
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```
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```

- `log-slave-updates` must also **be enabled**

Limitations

- binlog checksum is not supported *(but we have checksum in the replication channel)*

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- savepoints **were** not supported before 5.7.19 & 8.0.1
- *SERIALIZABLE* is not supported as transaction isolation level
- http://lefred.be/content/mysql-group-replication-limitations-savepoints/
- http://lefred.be/content/mysql-group-replication-and-table-design/

Default = Single Primary Mode

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```
mysql> show global variables like 'group_replication_single_primary_mode';
+----------------------------------------+-------+
| Variable_name                          | Value |
+----------------------------------------+-------+
| group_replication_single_primary_mode | ON    |
+----------------------------------------+-------+
```

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+----------------------------------------+-------+
| group_replication_single_primary_mode | ON    |
+----------------------------------------+-------+
```
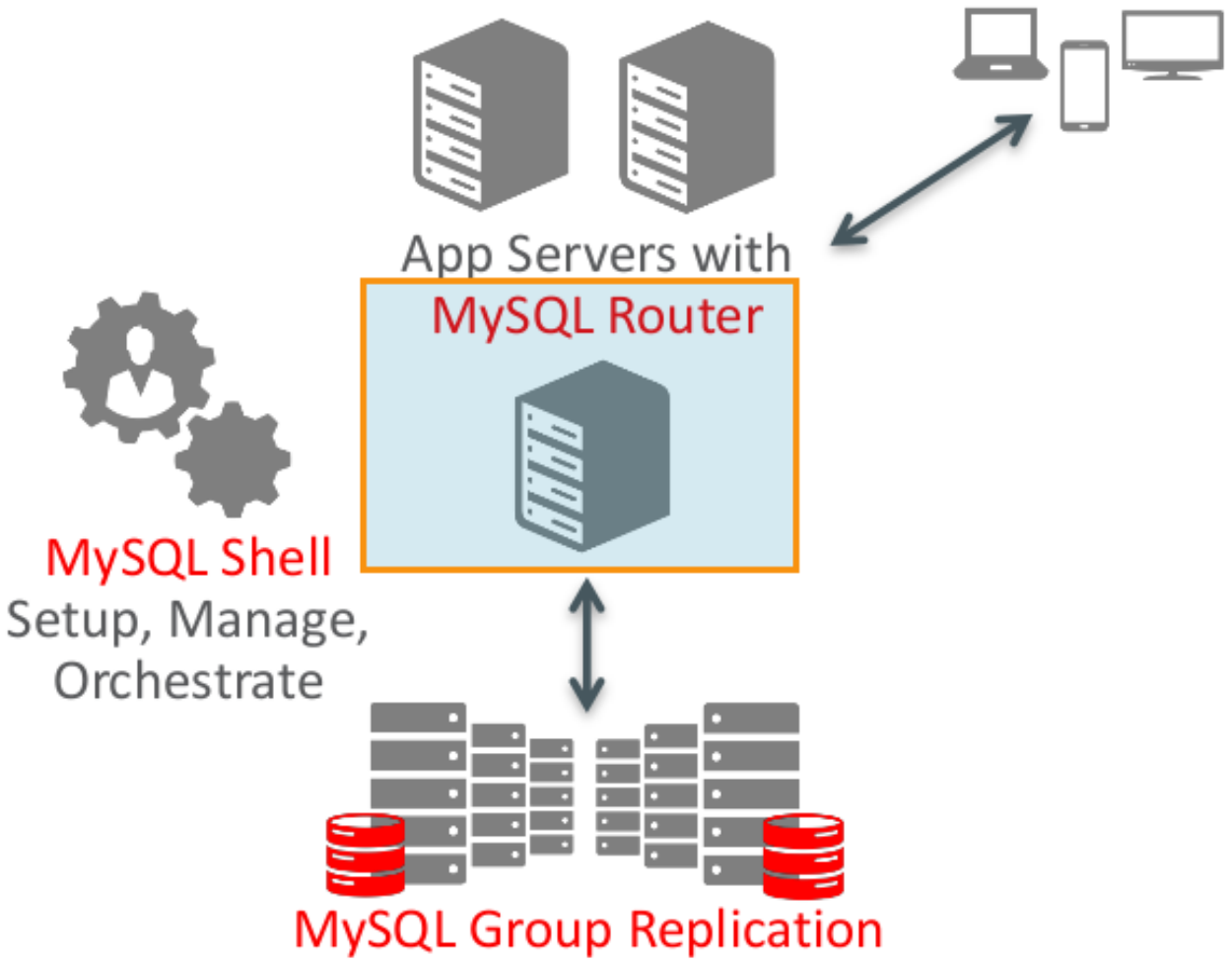

In Single Primary Mode, a single member acts as the writable master (`PRIMARY`) and the rest of the members act as hot-standbys (`SECONDARY`).

The group itself coordinates and configures itself automatically to determine which member will act as the `PRIMARY`, through a leader election mechanism.



MySQL Router (GA!)

MySQL Router is lightweight middleware that provides transparent routing between your application and backend MySQL Servers. It can be used for a wide variety of use cases, such as providing high availability and scalability by effectively routing database traffic to appropriate backend MySQL Servers.

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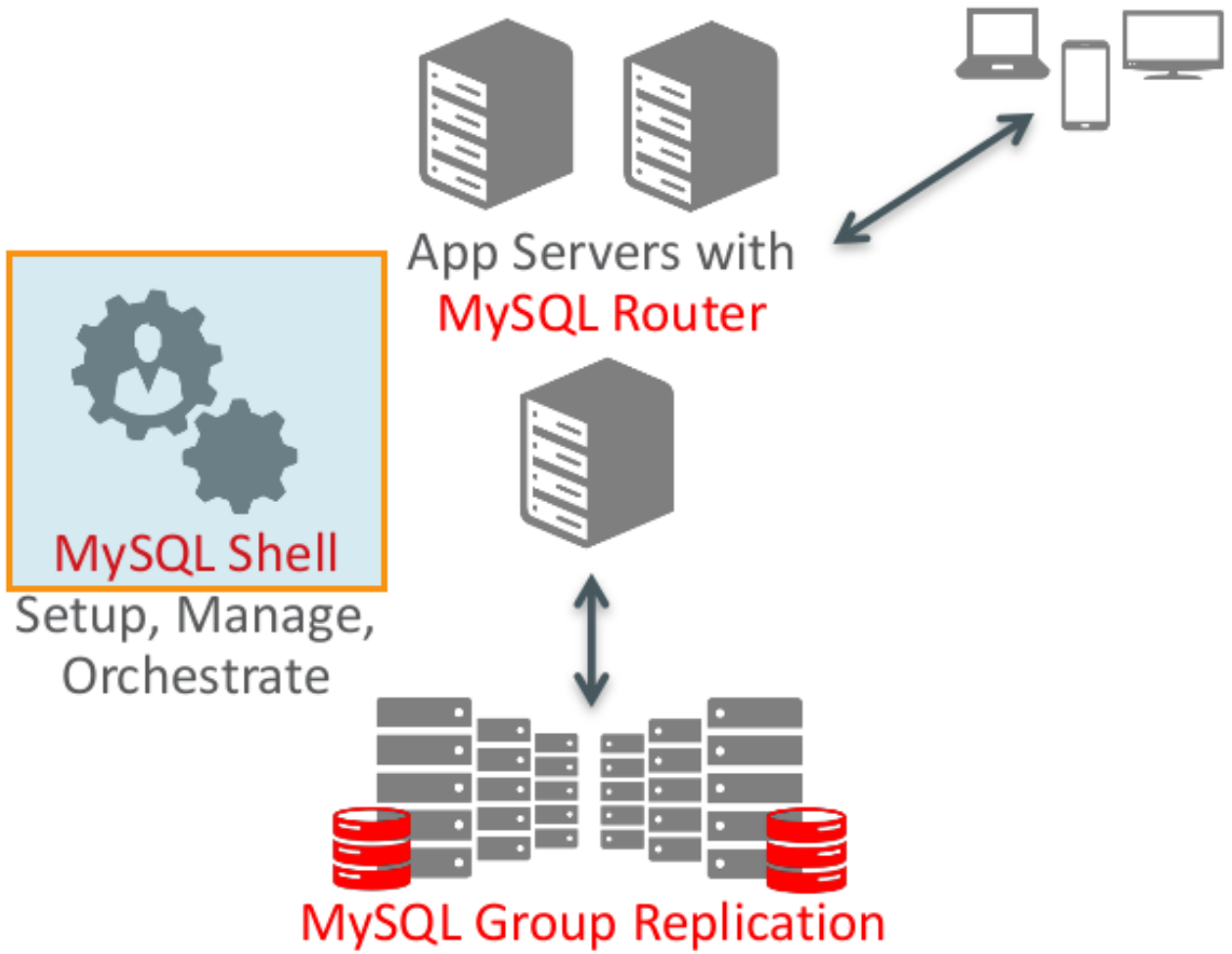
The MySQL Router development will be focusing on sharding.

ProxySQL

If you need some specific features that are not yet available in MySQL **Router**, like transparent R/W splitting, then you can use your software of choice.

We are also collaborating with ProxySQL.

ProxySQL has native support for Group Replication which makes it a good choice for advanced users.



MySQL Shell (GA!)

The MySQL Shell is an interactive Javascript, Python, or SQL interface supporting development and administration for the MySQL Server and is a component of the MySQL Server. You can use the MySQL Shell to perform data queries and updates as well as various administration operations.

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The MySQL Shell provides:

- Both Interactive and Batch operations
- Document and Relational Models
- CRUD Document and Relational APIs via scripting
- Traditional Table, JSON, Tab Separated output results formats
- MySQL Standard and X Protocols
- and more...

MySQL Shell (3)

PREVIEW: the new Shell´s prompt is nice and clear !

```
 MySQL   JS  dba.checkInstanceConfiguration(i2)
Please provide the password for 'root@mysql2:3306':
Validating instance...

The instance 'mysql2:3306' is valid for Cluster usage
{
    "status": "ok"
}

 MySQL   JS  dba.checkInstanceConfiguration(i3)
Please provide the password for 'root@mysql3:3306':
```

don´t forget, this is a HA solution !

Deploying a MySQL InnoDB Cluster using MySQL Shell´s adminAPI:

```
mysql-js> var i1 = 'root@instance01:3306';
mysql-js> var i2 = 'root@instance02:3306';
mysql-js> var i3 = 'root@instance03:3306';

mysql-js> dba.checkInstanceConfiguration(i1);
mysql-js> dba.checkInstanceConfiguration(i2);
mysql-js> dba.checkInstanceConfiguration(i3);

mysql-js> shell.connect(i1);
mysql-js> var cluster = dba.createCluster('GhentCluster');

mysql-js> cluster.checkInstanceState(i2);
mysql-js> cluster.addInstance(i2);

mysql-js> cluster.checkInstanceState(i3);
mysql-js> cluster.addInstance(i3);
```

DEMO !

https://youtu.be/y3WywG7Zhks

Thanks to the MySQL Shell we can automate everything ;-)

https://github.com/lefred/puppet-lefred-innodbcluster

Super easy using hiera:

`common.yaml`:

```
innodbcluster::mysql_root_password:  StRongP4ssw0rD!
innodbcluster::mysql_bind_interface: eth1
innodbcluster::cluster_name:         GhentCluster
innodbcluster::grant::user:          fred
innodbcluster::grant::password:      fred
innodbcluster::seed:                 instance01
```

`instance01.yaml` :

```
classes:
    - innodbcluster

innodbcluster::mysql_serverid:    1
```

example (2)

With `hiera-eyaml` you can even encrypt your password:

```
innodbcluster::mysql_root_password: >
    ENC[PKCS7,MIIBeQYJKoZIhvcNAQcDoIIBajCCAWYCAQAxggEhMIIBHQIBADAFMAACAQEw
    DQYJKoZIhvcNAQEBBQAEggEAhqKUTXZ/4L8/aL3XARMfDBEI+s5HPshPg9BI
    ...
    FLfovstrb8zmcbk5yb/KD0lDM8Elas0lrnpk8MxwNfKw+hB299JFp8ldAtUk
    ODIieTA8BgkqhkiG9w0BBwEwHQYJYIZIAWUDBAEqBBBJEeoyzHtW/WGpbiUz
    gcXTgBAnb1gGrBZAfAiv/ztwuZ9z]
innodbcluster::mysql_bind_interface:    eth1
innodbcluster::cluster_name: GhentCluster
innodbcluster::grant::user: root
innodbcluster::grant::password: >
    ENC[PKCS7,MIIBeQYJKoZIhvcNAQcDoIIBajCCAWYCAQAxggEhMIIBHQIBADAFMAACAQEw
    DQYJKoZIhvcNAQEBBQAEggEAhqKUTXZ/4L8/aL3XARMfDBEI+s5HPshPg9BI
    ...
    FLfovstrb8zmcbk5yb/KD0lDM8Elas0lrnpk8MxwNfKw+hB299JFp8ldAtUk
    ODIieTA8BgkqhkiG9w0BBwEwHQYJYIZIAWUDBAEqBBBJEeoyzHtW/WGpbiUz
    gcXTgBAnb1gGrBZAfAiv/ztwuZ9z]
```

DEMO !

https://www.youtube.com/watch?v=skwlmBNE7ts


MySQL
Oracle OpenWorld
October 1–5, 2017
San Francisco
#oow17

Resources

http://lefred.be/content/mysql-innodb-cluster-mysql-shell-starter-guide/

http://lefred.be/content/mysql-innodb-cluster-automated-installation-with-puppet/

http://lefred.be/content/category/mysql/group-replication/

https://www.slideshare.net/lefred.descamps/mysql-devops-webinar

http://mysqlserverteam.com/innodb-cluster-in-opc/

Thank you !

Kenny & Vadim for their tests, bugs and feature requests

Thank you !

Any Questions ?