MySQL最酷和最新功能

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20191214

深圳[*3306π*]技术大会

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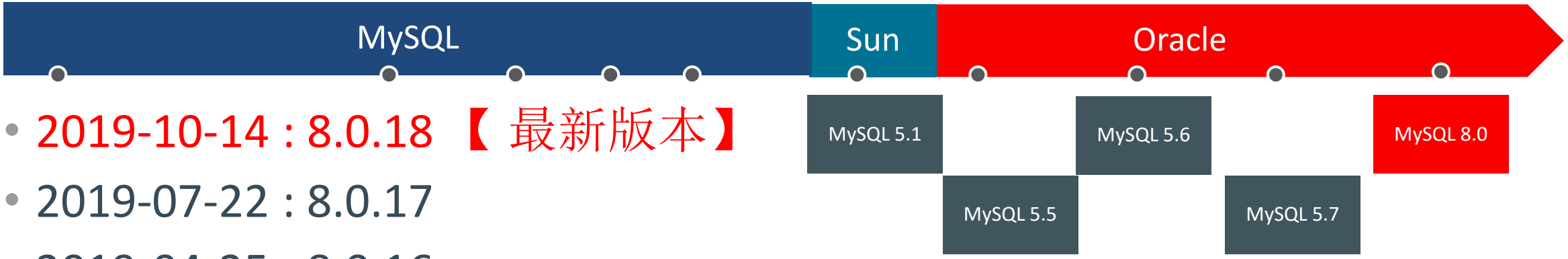
最新版本： MySQL 8.0.18



- 2019-10-14 : 8.0.18 【 最新版本】
- 2019-07-22 : 8.0.17
- 2019-04-25 : 8.0.16
- 2019-02-01 : 8.0.15 / 2019-01-21 : 8.0.14
- 2018-10-22 : 8.0.13
- 2018-07-27 : 8.0.12
- 2018-04-19 : 8.0.11 General Availability

Agenda

MySQL InnoDB Cluster Basics

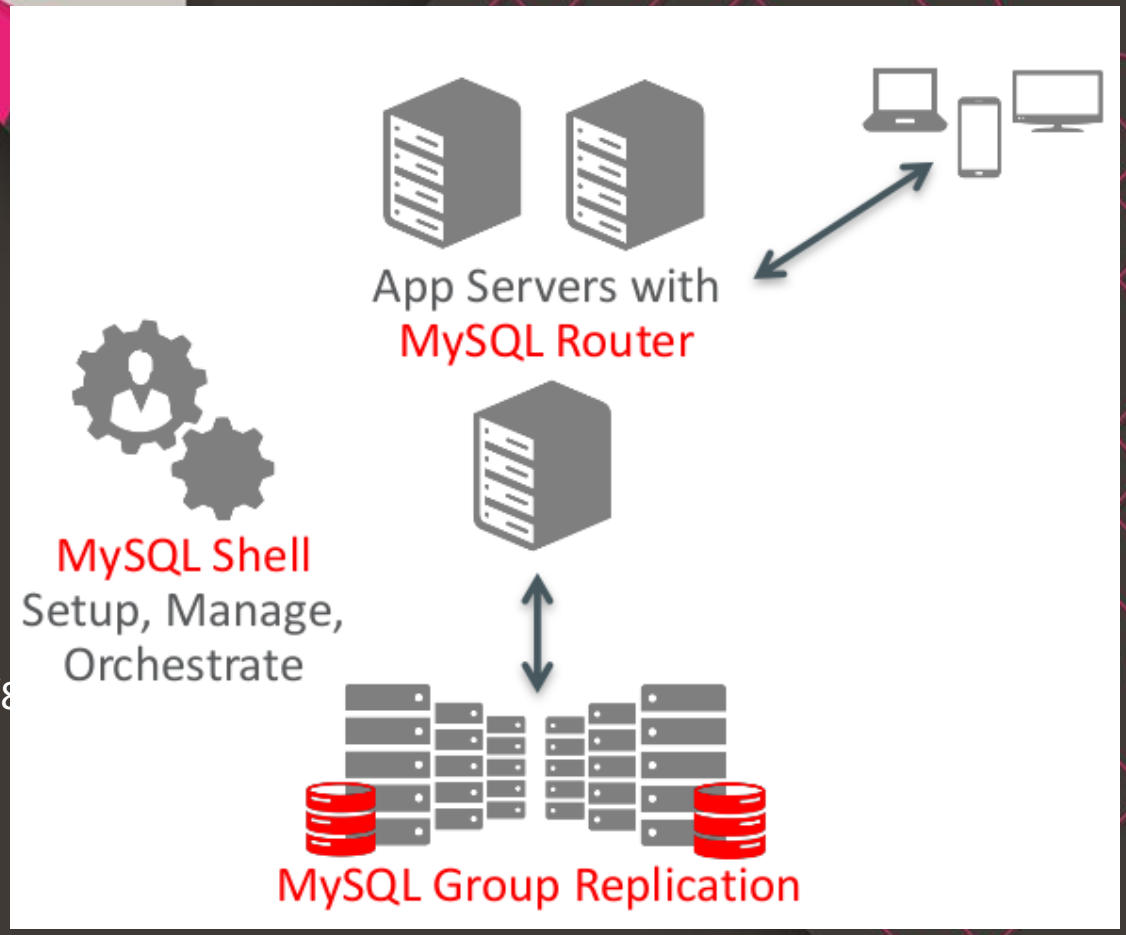
Deployment Example

DeepDive - InnoDB Cluster Configuration

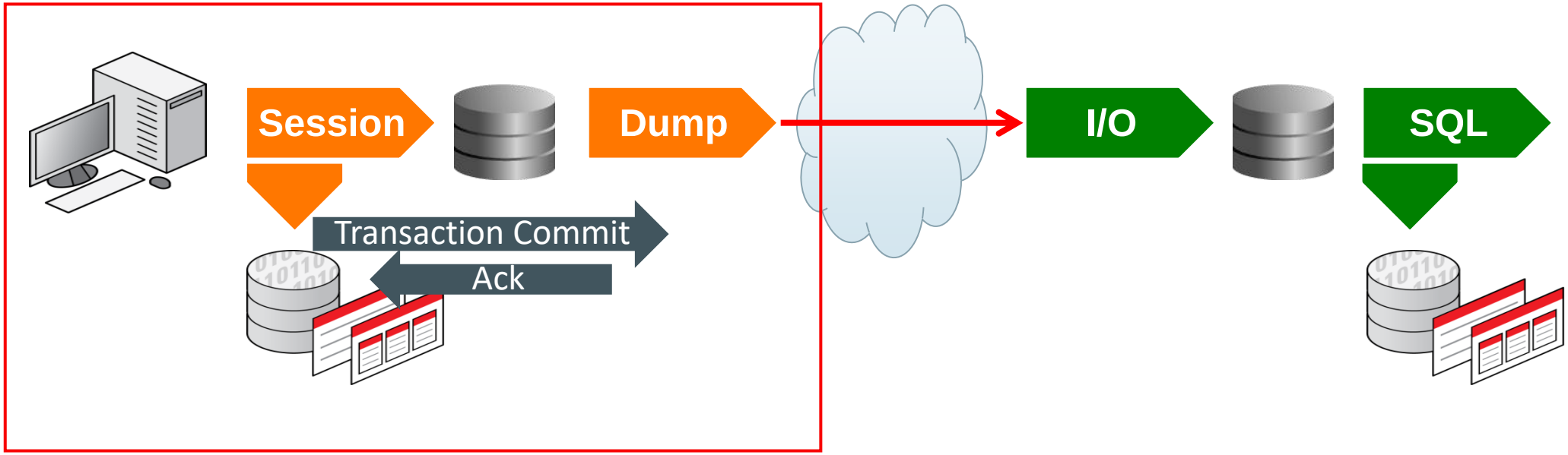
MySQL 8.0.18 – 好东西 !

MySQL InnoDB Cluster Basics

https://dev.mysql.com/doc/refman/8



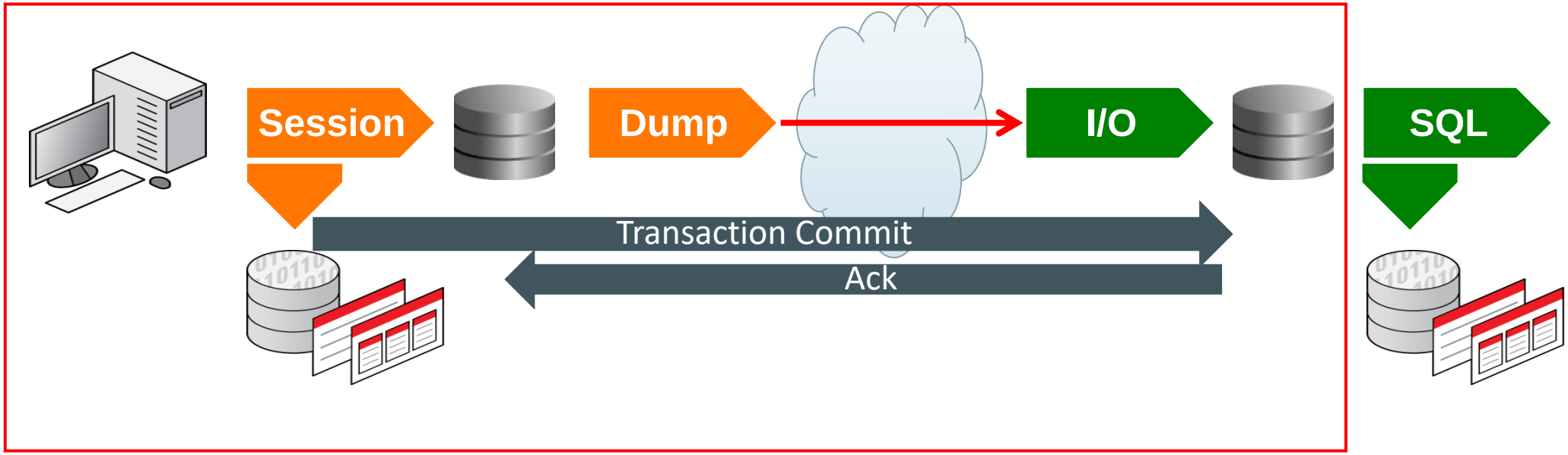
MySQL Replication –异步复制



- “DATA”在提交到存储引擎之前先提交到binlog
- “COMMIT” 在本地完成

- “DUMP”线程从binlog读取事件并将其传输到SLAVE服务器
- I/O线程读取复制事件，并将其存储到RELAY日志中
- SQL线程：读取RELAY日志并将其写入存储引擎

MySQL Replication – 半同步复制

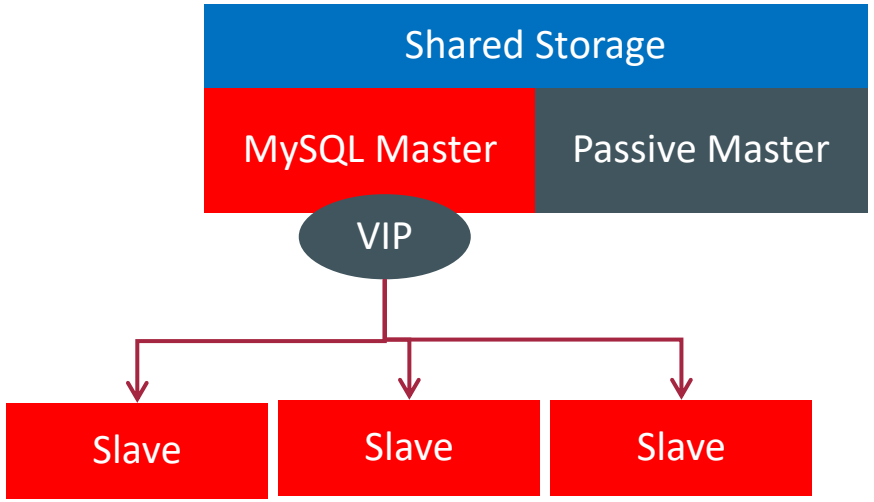


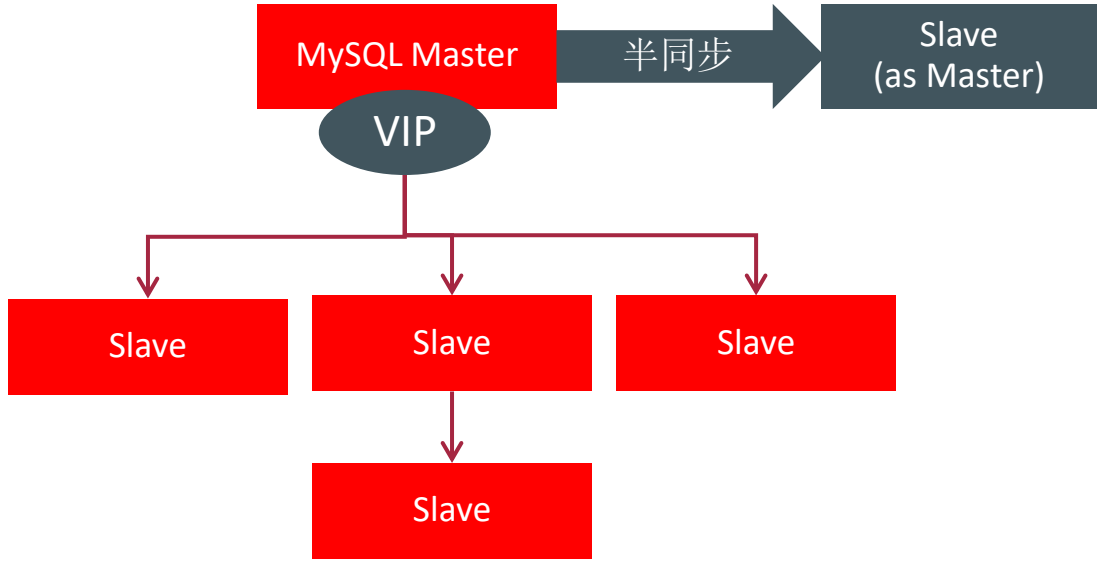
- “DATA”在提交到存储引擎之前先提交到binlog
- “DUMP”线程从binlog读取事件并将其传输到SLAVE服务器
- I/O线程读取复制事件，并将其存储到RELAY日志中
- “COMMIT”在提交完成

- SQL线程： 读取RELAY日志并将其写入存储引擎

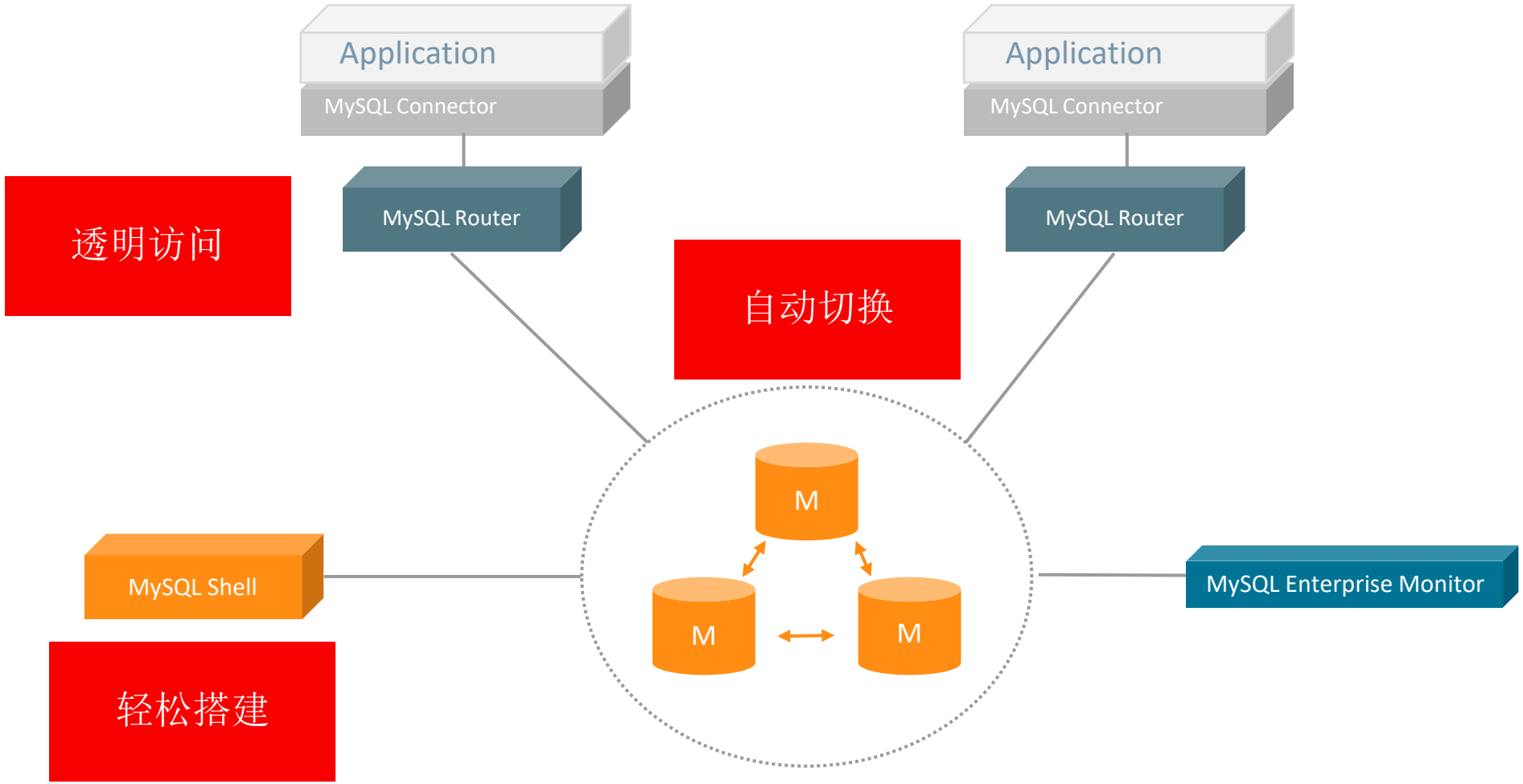
MySQL复制 (异步/ 半同步）

- Master & Slave （1 + 1）/ 主从 （1 + M）
- Master → Slave → Slave （1 + 1 + M …) / (1 + M + M …)





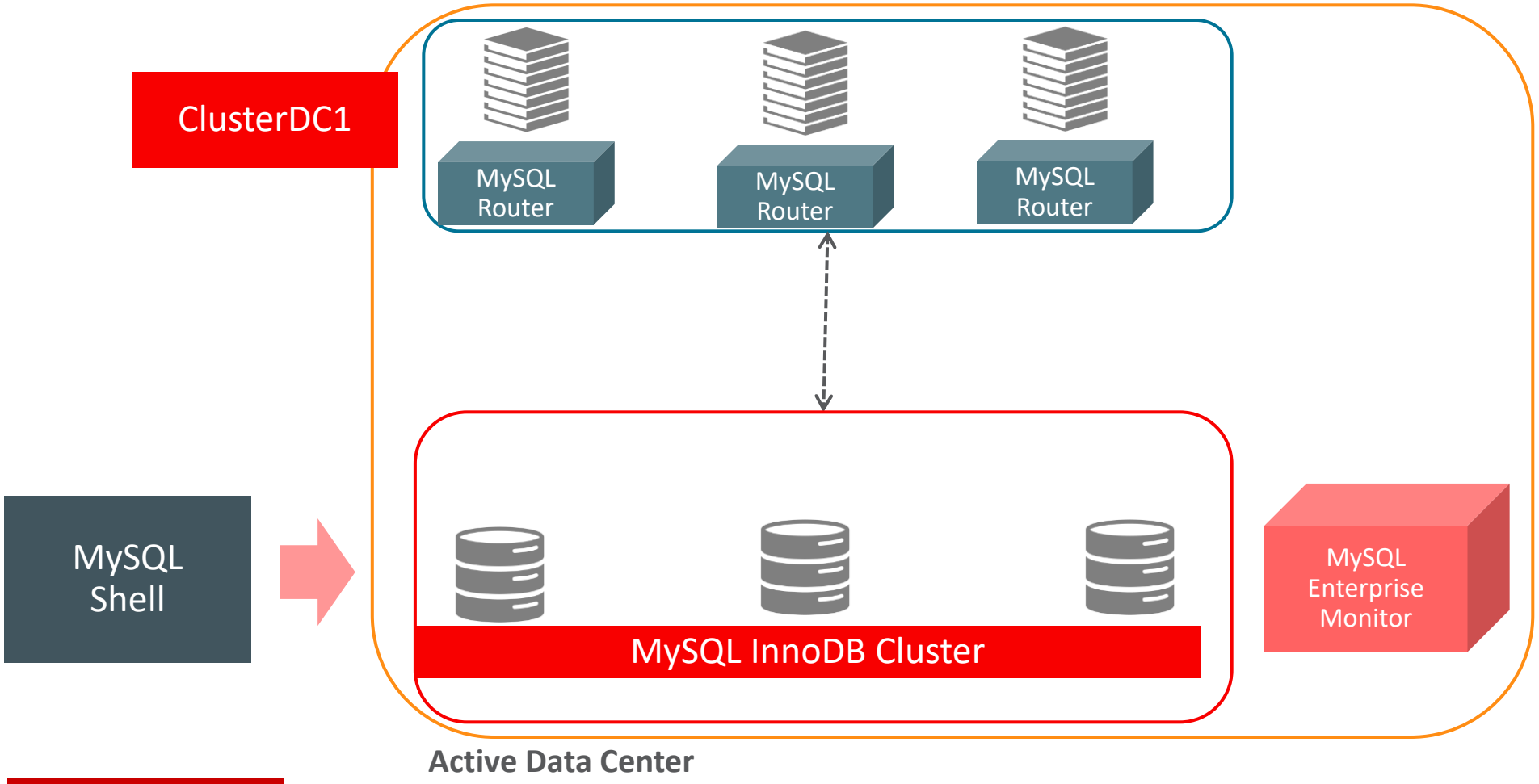
MySQL InnoDB Cluster:架构



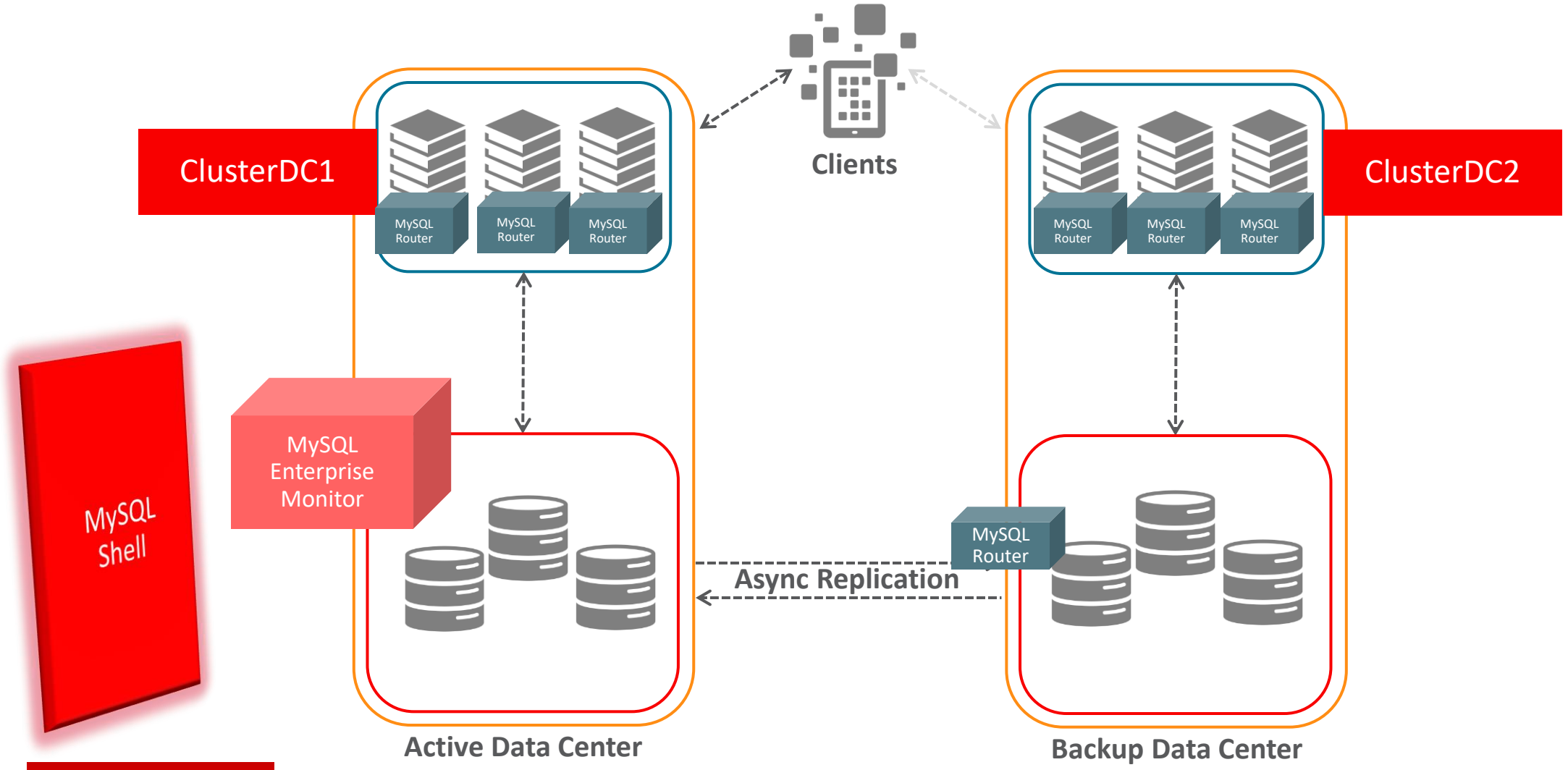
Deployment Examples
MySQL InnoDB Cluster

https://dev.mysql.com/doc/refman/8.0/en/mysql-innodb-cluster-production-deployment.html

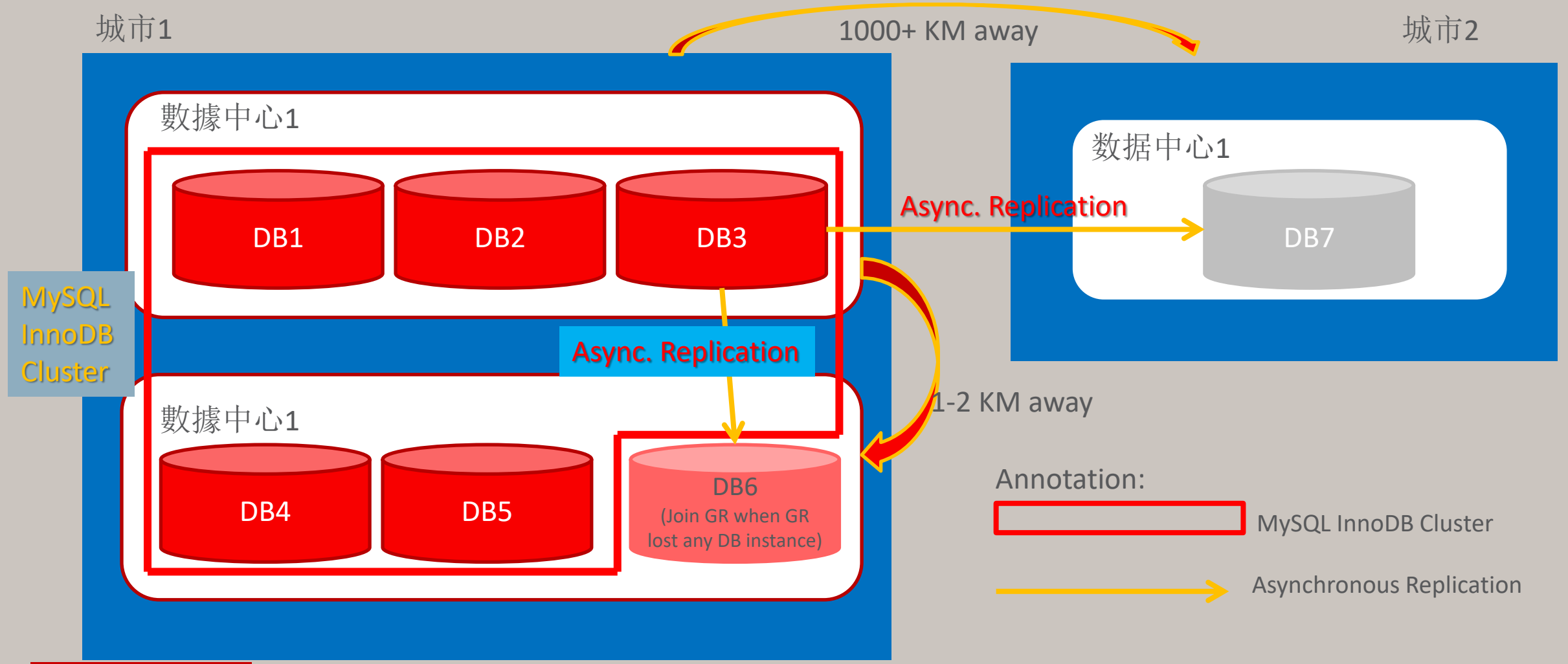
Single Data Center



跨地域异步复制



两地三个数据中心



探究MySQL InnoDB集群配置

MySQL InnoDB Cluster

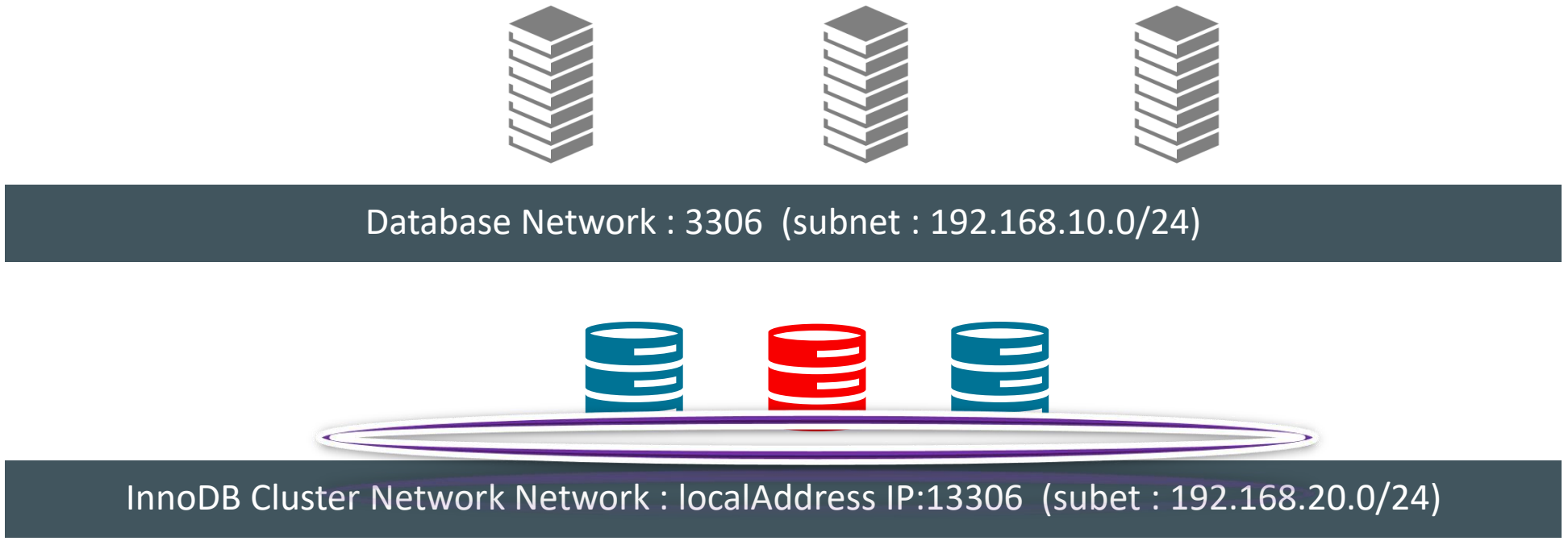
MySQL Server – Persisted Variables	默认值	试试看
group_replication_consistency	EVENTUAL	BEFORE_ON_PRIMARY_FAILOVER
group_replication_ip_whitelist group-replication-local-address	AUTOMATIC EMPTY	set to be the subnet of the PRIVATE IP
group_replication_member_expel_timeout	0 [NETWORK RELIABILITY]	set to the value of 30 (seconds)
group_replication_autorejoin_tries	- [NETWORK RELIABILITY]	set to 12 (5 mins interval for each retry)
group_replication_unreachable_majority_timeout	0 [NETWORK RELIABILITY]	Please set a value - the timeout value that the application will wait in the access minority (when there is network partition happening). e.g. (for 2 minutes wait time ➔ 120)
group_replication_member_weight	50 (for all nodes)	e.g. Configured for Node1,Node2,Node3 as 40,50,60 respectively
group-replication-exit-state-action	ABORT_SERVER / READ_ONLY	if 8.0.18 [OFFLINE_MODE]
report_host		To be defined for the hostname/ip Interface with Application

Innodb群集内网络和外网络

- 内网/专用网络 - 交换数据

  group_replication_ip_whitelist

  group-replication-local-address



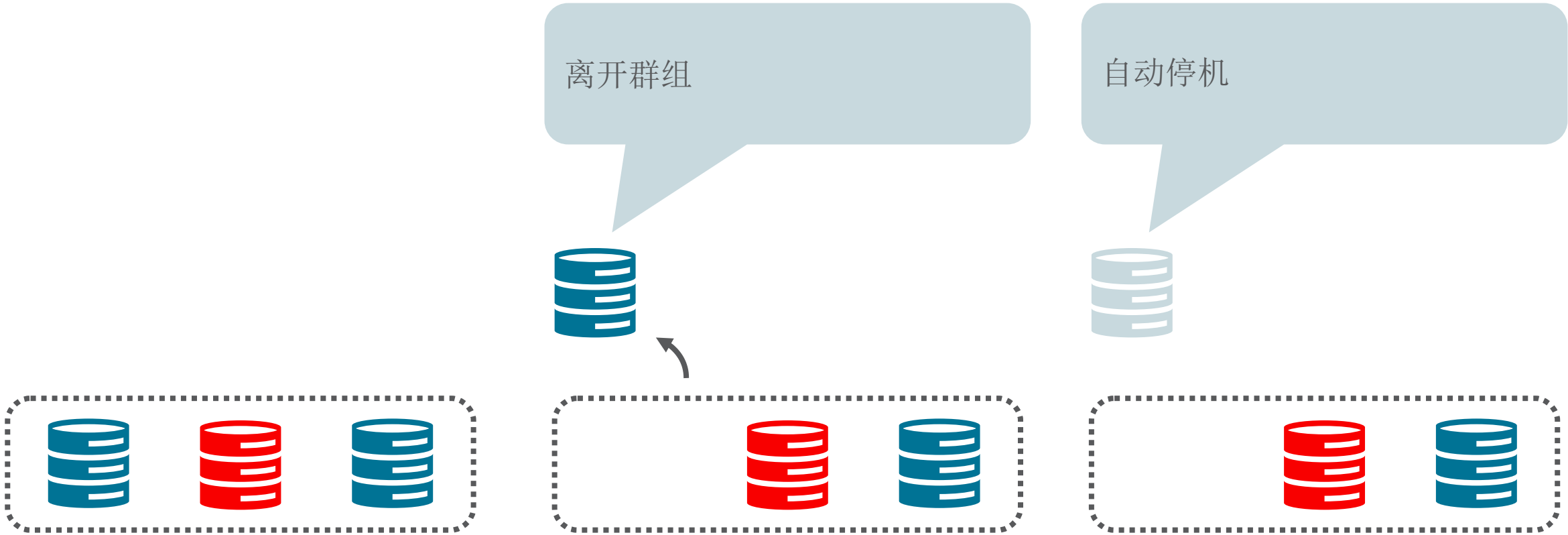
```
mysqlsh --uri gradmin:grpass@primary:3310 -e "

var x = dba.createCluster('mycluster',
{exitStateAction:'OFFLINE_MODE',
        consistency:'BEFORE_ON_PRIMARY_FAILOVER',
        expelTimeout:30,
        memberSslMode:'REQUIRED',
        ipWhitelist:'192.168.56.0/24',
        localAddress:'node1:13310',
        clearReadOnly:true,
        interactive:false,
autoRejoinTries:120,
        memberWeight:80
        })
x = dba.getCluster()
print(x.status())
“
```

```
mysqlsh --uri gradmin:grpass@primary:3310 -e "
x = dba.getCluster()
x.addInstance('gradmin:grpass@node1:3320',
{exitStateAction:'OFFLINE_MODE',
        recoveryMethod:'incremental',
        localAddress:'node2:13310',
        autoRejoinTries:120,
        memberWeight:70
        })
print(x.status())
"
```

```
mysqlsh --uri gradmin:grpass@primary:3310 -e "
x = dba.getCluster()
x.addInstance('gradmin:grpass@node1:3320',
{exitStateAction:'OFFLINE_MODE',
        recoveryMethod:'incremental',
        localAddress:'node3:13310',
        autoRejoinTries:120,
        memberWeight:60
        })
print(x.status())
"
```

退出群组时： 中止服务器 （停机）

SET GLOBAL group_replication_exit_state_action = ABORT_SERVER



dev.mysql.com/doc/refman/8.0/en/group-replication-options.html#sysvar_group_replication_exit_state_action

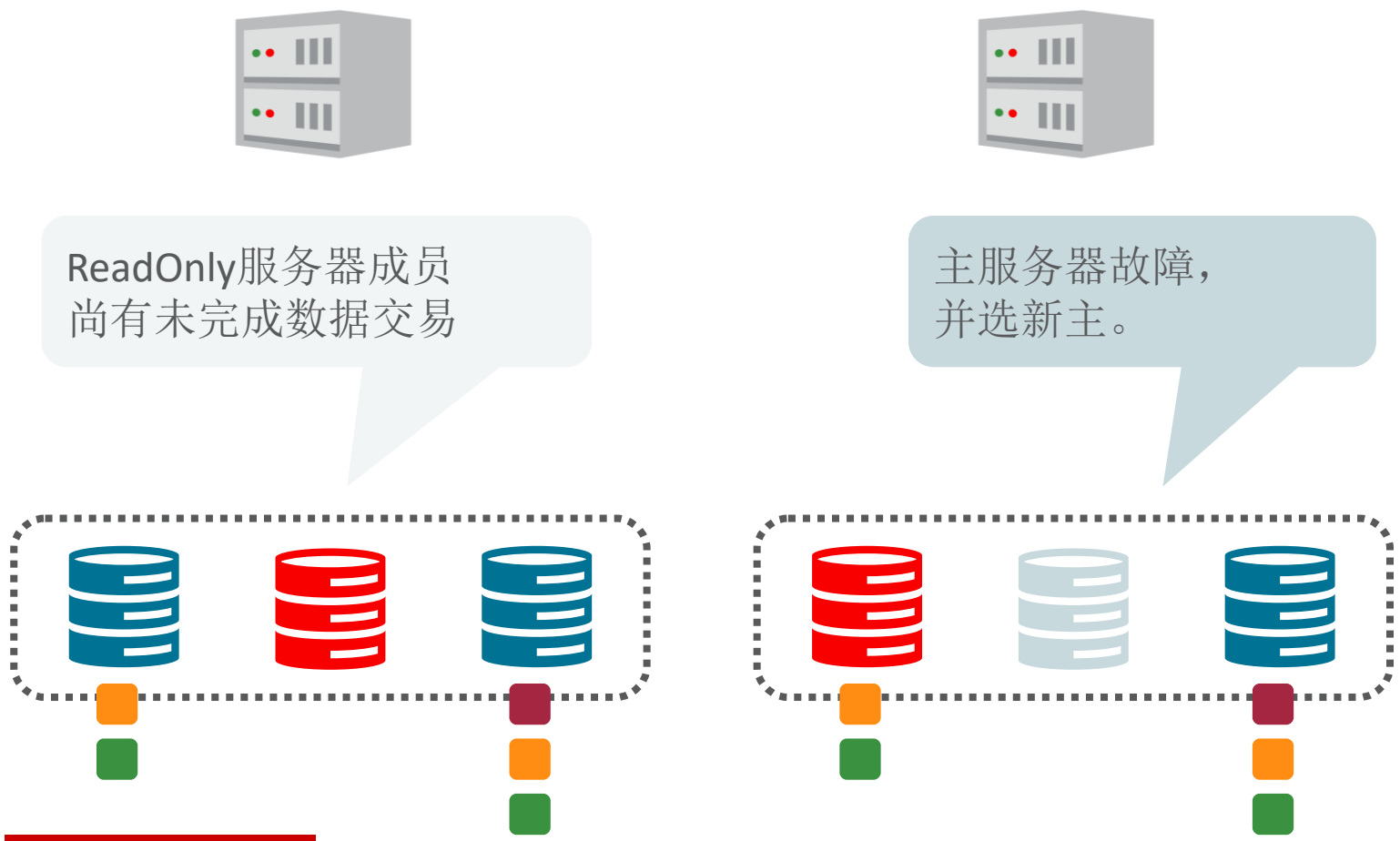
group_replication_consistency = BEFORE_ON_PRIMARY_FAILOVER

主故障转移上的数据一致性

Primary Secondary

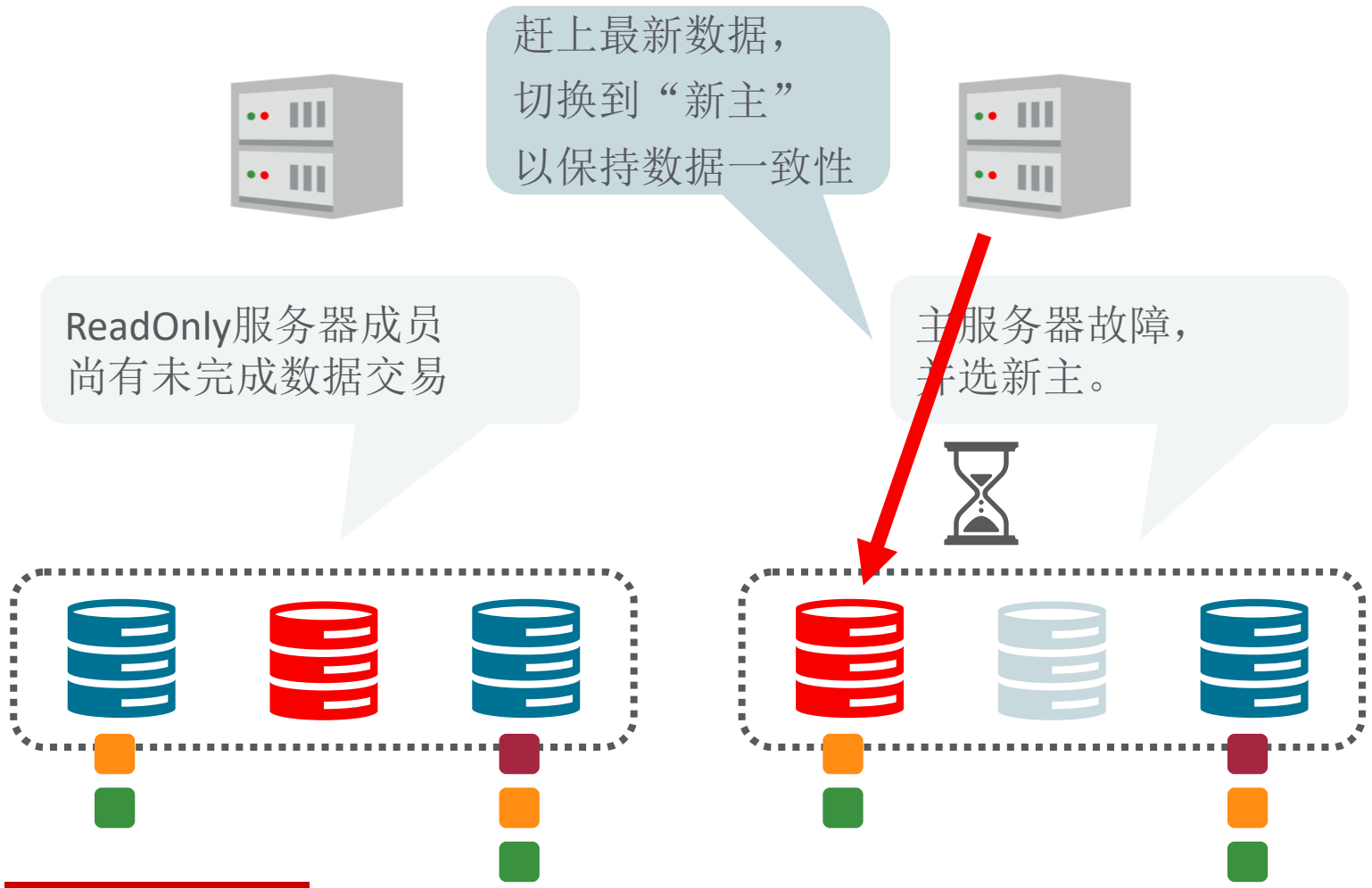
group_replication_consistency = BEFORE_ON_PRIMARY_FAILOVER

主故障转移上的数据一致性



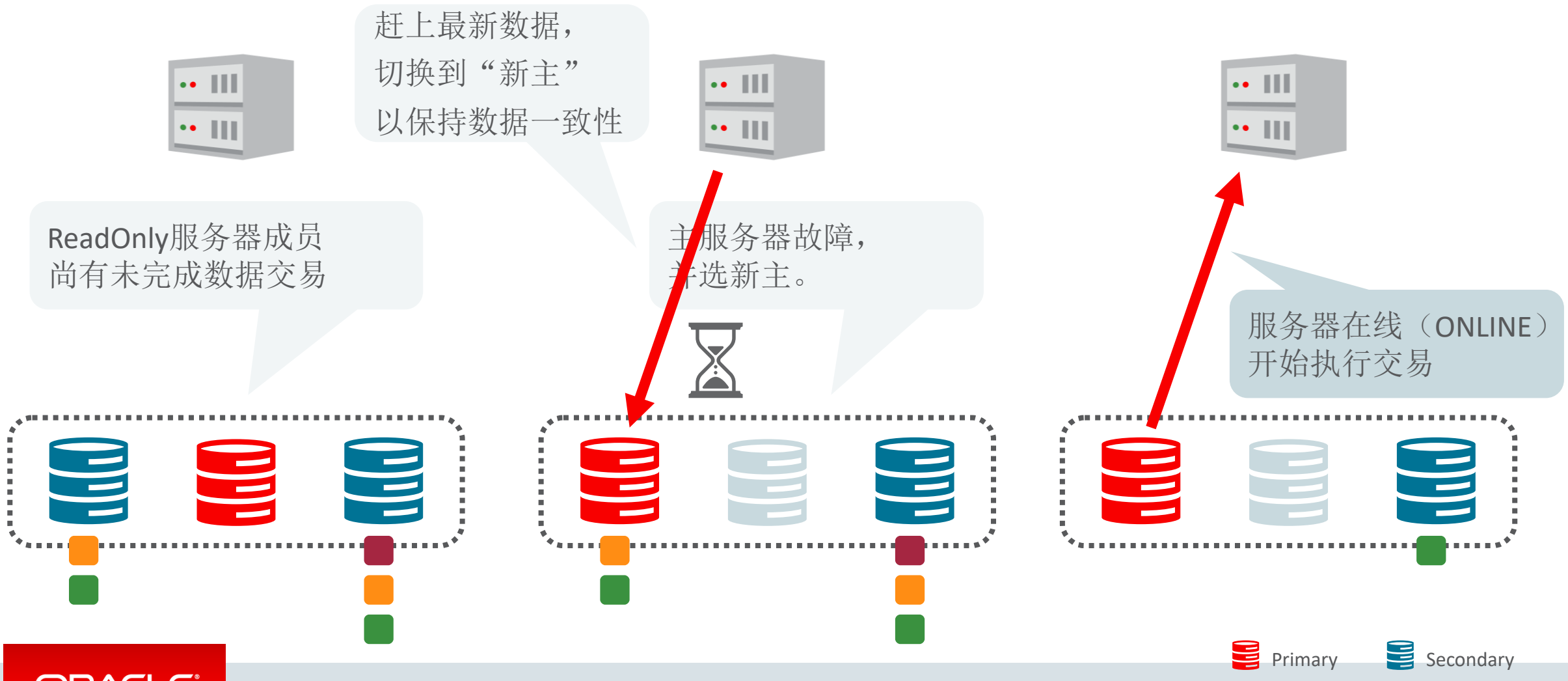
group_replication_consistency = BEFORE_ON_PRIMARY_FAILOVER

主故障转移上的数据一致性



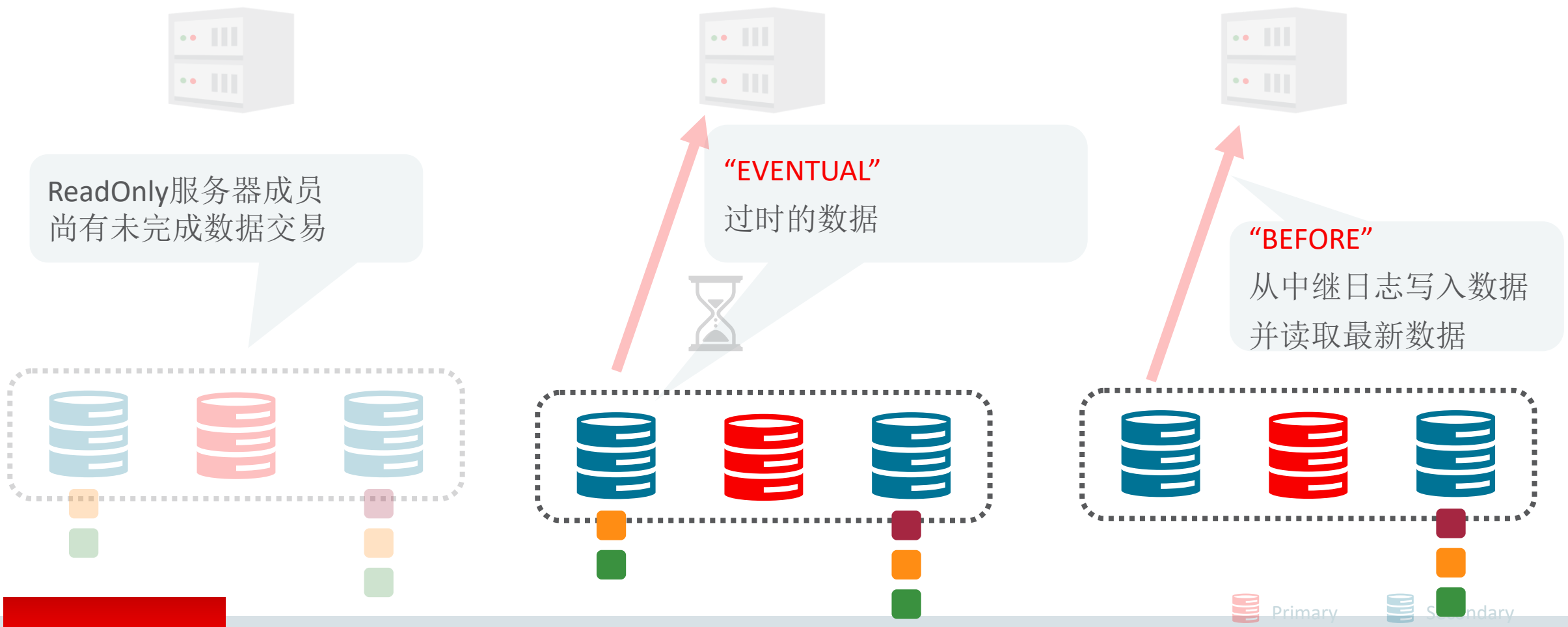
Primary Secondary

主故障转移上的数据一致性



数据一致性 : for Read

SET SESSION group_replication_consistency = BEFORE



数据一致性设置

SET SESSION group_replication_consistency = BEFORE

SET SESSION group_replication_consistency = AFTER

SET SESSION group_replication_consistency = BEFORE_ON_PRIMARY_FAILOVER

SET SESSION group_replication_consistency = BEFORE_AND_AFTER

DEFAULT : SET SESSION group_replication_consistency = EVENTUAL

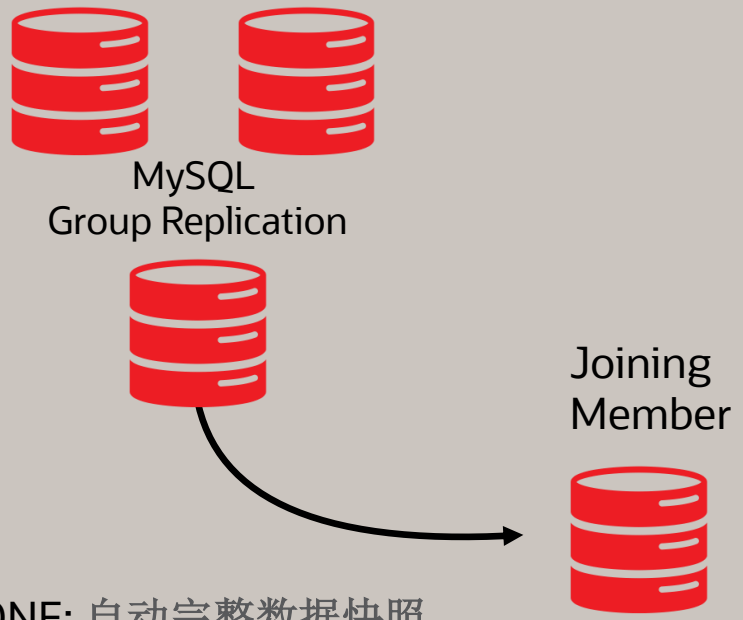
网络可靠性

- **group_replication_member_expel_timeout**
  - 默认值：5秒，如果没有响应，该服务器将被剔除！
    如果网络偶尔中断， 该怎么办？
    大事务正在运行，在”expel”情况下，才会进行选主！
- group_replication_autorejoin_tries
  - 对于发生故障的服务器（例如由于网络问题），无需人工干预即可重新加入
  - 每5分钟重试一次
- group_replication_unreachable_majority_timeout
  - 如果主服务器正在处理事务，但网络出现故障–节点将卡住 (default : 0)
  - E.g. 120 seconds : Hold up for 2 minutes

MySQL InnoDB Cluster

使用CLONE插件自动配置节点

NEW!



CLONE: 自动完整数据快照置备

```
Clone based state recovery is now in progress.

NOTE: A server restart is expected to happen as part of the clone process. If the
server does not support the RESTART command or does not come back after a
while, you may need to manually start it back.

* Waiting for clone to finish...
NOTE: 10.175.165.243:3320 is being cloned from 10.175.165.243:3310
** Stage DROP DATA: Completed
** Clone Transfer
    FILE COPY  ##################################==============   68%  In Progress
    PAGE COPY  ==================================================    0%  Not Started
    REDO COPY  ==================================================    0%  Not Started
```

关于MySQL Replication配置

MySQL Server		
slave-parallel-type	DATABASE	LOGICAL_CLOCK
slave-parallel-workers	not defined	say 2 threads or more
slave_preserve_commit_order	not defined	ON
binlog-format		ROW
binlog-checksum		NONE
gtid-mode enforce-gtid-consistency log-slave-updates		Turn ON
master-info-repository relay-log-info-repository		TABLE
transaction-write-set-extraction		XXHASH64

MySQL路由器配置示例

MySQL Router

MySQL Router		
max_connections max_connect_errors	Defaults as max_connections=512 max_connect_errors=100	Changed to Higher Value!!!
log	Default setting is INFO	Do you need initial setting of DEBUG for checking and turn it INFO for normal operation
[logger] sinks	Not specified	(e.g.) sinks=filelog,**eventlog,syslog**
use_gr_notifications (New in 8.0.17)	Default = 0	1 : Enable notification group_replication/membership/quorum_loss, group_replication/membership/view, group_replication/status/role_change, and group_replication/status/state_change.

MySQL Router

- The File System MUST not be FAT32/FAT/exFAT…

- MySQL Router will check for the privilege setting for key files which it must NOT be owned by ‘everyone’

```
PS E:\tempdata\myrouter1> & 'C:\Program Files\mysql\MySQL Router 8.0\bin\mysqlrouter.exe' -c
.\mysqlrouter.conf
PID 4260 written to 'e:/tempdata/myrouter1\mysqlrouter.pid'
Error: Invalid keyring file access rights (Everyone has full access rights).
PS E:\tempdata\myrouter1>
```

MySQL Router – Log (On Linux)

- **Logrotation via SIGHUP**
- Sending a SIGHUP signal to the router process will now close and reopen the logfile.
  - e.g.
    - # mv mysqlrouter.log mysqlrouter-`date`.log
    - # kill -SIGHUP <pid of the MySQL Router>
- It allows the integration with the logrotate to rotate and compress the Router's logfiles.

On Windows
sinks=eventlog

MySQL 8.0.18

Replication 改进

- MySQL InnoDB Cluster / GR
  - OFFLINE_MODE (ADMIN PORT)
  - TLSv1.3 Support with OpenSSL 1.1.1
- Replication with privilege Checks
  - In particularly useful for Multi-source (channel) Replication to allow restricted security applier
    - db1_channel (using priv check user db1_user)
    - db2_channel (using priv_check user db2_user)

权限检查for SLAVE Applier

Master	Slave – Channel1	Slave – Channel 2
	mysql> CREATE USER 'rpl_applier_dbuser1'@'localhost';	mysql> CREATE USER 'rpl_applier_dbuser2'@'localhost';
	mysql> GRANT REPLICATION_APPLIER,SESSION_VARIABLES_ADMIN ON *.* TO 'rpl_applier_dbuser1'@'localhost'; mysql> GRANT CREATE,INSERT,DELETE,UPDATE ON db1.* TO 'rpl_applier_dbuser1'@'localhost';	mysql> GRANT REPLICATION_APPLIER,SESSION_VARIABLES_ADMIN ON *.* TO 'rpl_applier_dbuser2'@'localhost'; mysql> GRANT CREATE,INSERT,DELETE,UPDATE ON db2.* TO 'rpl_applier_dbuser2'@'localhost';
	mysql> STOP SLAVE SQL_THREAD FOR CHANNEL ‘ch1’; mysql> CHANGE MASTER TO PRIVILEGE_CHECKS_USER = 'rpl_applier_dbuser1'@'localhost'; mysql> START SLAVE SQL_THREAD FOR CHANNEL ‘ch1’;	mysql> STOP SLAVE SQL_THREAD FOR CHANNEL ‘ch2’; mysql> CHANGE MASTER TO PRIVILEGE_CHECKS_USER = 'rpl_applier_dbuser2'@'localhost'; mysql> START SLAVE SQL_THREAD FOR CHANNEL ‘ch2’;
	mysql> SELECT Channel_name, Privilege_checks_user FROM performance_schema.replication_applier_configuration; +----------------------+---+ | Channel_name | Privilege_checks_user | +----------------------+---+ | ch1 | 'rpl_applier_dbuser1'@'localhost' | +----------------------+---+ 1 row in set (0.00 sec)	mysql> SELECT Channel_name, Privilege_checks_user FROM performance_schema.replication_applier_configuration; +----------------------+---+ | Channel_name | Privilege_checks_user | +----------------------+---+ | ch2 | 'rpl_applier_dbuser2'@'localhost' | +----------------------+---+ 1 row in set (0.00 sec)

InnoDB Cluster –选主

- Primary member election（Since 8.0.17)
  - 最低成员版本为先
  - 权重较高 （member weight)
  - server uuid的顺序

MySQL Shell 8.0.18

- **Python 3 Migration**
  - Python 2.7 – EOL by end of the year 2019
  - Minimum Support Version : 3.4.3
    - Bundled with 3.7.4
- Built-in Thread Reports
- \edit : External Editor

Ease of Use in MySQL Shell

- built-in \show command:
  - *\show threads， \show thread*

```
MySQL  localhost:3307  JS  \show threads -o tid,cid,time,state,info
+-----+-----+----------+---------------------------------+-----------------------
| tid | cid | time     | state                           | info
+-----+-----+----------+---------------------------------+-----------------------
| 108 | 65  | 00:28:00 | NULL                            | insert into test.user v
| 110 | 67  | 00:27:10 | Waiting for table metadata lock | drop table user
| 118 | 75  | 00:00:00 | executing                       | SELECT json_object('cid
+-----+-----+----------+---------------------------------+-----------------------
```

  - *External Editor*

```
Type '\help' or '\?' for help; '\quit' to exit.
MySQL  JS  \edit function sample()
```

```
function sample() {
  var text = "This function was created in an external editor";
  println(text);
}
```

MySQL 8.0.18

- SQL – Hash Join
  - For example SELECT * FROM t1 JOIN t2 ON t1.col1 = t2.col1;
    不需要任何索引来执行，并且在大多数情况下比当前的算法更有效。
- Before 8.0.18, Join : Nested-Loop Join or Block nested Loop
  - Nested-Loop : Inner table to be READ many times (e.g. Outer : 100, Inner : 100 ➔ 10,000 次)
  - Block Nested loop : Reduce the # of READ for Inner Table / Inner table to match a BLOCK of rows from Outer Table(e.g. Outer : 100, Inner : 100, BLOCK : 10 ➔ 10 x 100 ➔ 1,000 次)
  - Batched Key Access (BKA) : Similar to Block Nested Loop
- 新功能 8.0.18, for eq_ref or ref join types and no indexes
  - To build hash table for the values from outer table and read inner table to match the rows in Hash table
  - Less I/O, Read Only once in INNER table

innodb_idle_flush_pct

- *InnoDB:*
  - *Add new option to control write IOPs when idle* (WL#13115) - option innodb_idle_flush_pct
  - which controls write IOPs when InnoDB is idle.
  - The purpose is to reduce write IO for longer life of the flash storage.
- This feature is based on a contribution from Facebook, see bug#88566.

Security

- Only OpenSSL
  - *Remove support for wolfSSL and yaSSL from the MySQL codebase*
- Random Password
  - CREATE USER user IDENTIFIED BY RANDOM PASSWORD
  - ALTER USER user IDENTIFIED BY RANDOM PASSWORD
  - SET PASSWORD [FOR user] TO RANDOM.

8.0.18 变量的变化

- TDE – New Hashicorp
- Compression
- Security
- Replication
- InnoDB – Flush

https://dev.mysql.com/doc/refman/8.0/en/added-deprecated-removed.html

MySQL Enterprise Backup

- MEB 8.0.18 : MySQL Enterprise Backup通过MySQL的页面跟踪功能，支持更快的增量备份
  set --incremental=page-track.
  - https://dev.mysql.com/doc/mysql-enterprise-backup/8.0/en/backup-incremental-options.html
    - --incremental[={page-track|full-scan|optimistic}]
- Pre-requisite :
  - Base Backup while the page track is enabled
    - INSTALL COMPONENT "file://component_mysqlbackup";
    - SELECT mysqlbackup_page_track_set(true);
  - mysqlbackup needs enough memory to process all the tracked pages in memory.
    - A rough guideline is as follows: the default value of 300 [MB] for the --limit-memory option allows **mysqlbackup** to handle about 600GB of changed data.

MySQL Enterprise Backup Process

https://docs.oracle.com/cd/E17952_01/mysql-enterprise-backup-8.0-en/meb-backup-process.html

InnoDB data files
Redo logs
Relay logs except for the log fliles currently in use

Backup Lock – block DDL operations

Scan Innodb tables for DDL changes since the start of the backup an make the changes accordingly

FLUSH TABLES tbl_name, [, tbl_name] .. WITH READ LOCK

Collect logging-related data like the current innoDB LSN, binary log position, GTID, replication master or slave status …

The rest of the files are copied (redo log which are not copied, metadata files, etc…)

BACKUP lock - RELEASED

The latest info from binary or relay log file in use is coied

RELEASE the LOCKS from non-InnoDB Tables

8.0.17

- Log Archiving
  - Online Backup – MySQL Enterprise Backup
  - Start Archive Log so to catch up data during the backup
- Clone feature in MySQL 8.0.17
  - Important feature in MySQL InnoDB Cluster

MySQL 8.0.17

- Automatic Provisioning via Cloning
  - Clone is a “Database Snapshot”
  - Ease of Use, Takes away and surpasses Gallera
  - *Includes integration on distributed recovery*
    - start the group replication process in a new server and automatically clone the data from a donor with very little effort
- JSON
  - MVI – Multi-Value Indexes
    - Make it possible to index JSON arrays
  - Schema

Server Platforms

- Added support for EL8
  - Highlights
    - Added ARM64 support
    - More container / virtualization support
    - Improved security

Router

- Rest API
  - Monitoring
  - Health
  - Metadata
  - Routing
- Change notification
  - Notified about most of the cluster changes asynchronously, almost immediately

Shell

- Clone support
  - Can configure how *Cluster*.addInstance() behaves
  - Letting cloning operations proceed in the background
  - Show different levels of progress in MySQL Shell
- New – shell extensions
- Upgradechecker fixes.
- Easiest way to get started is
  - https://github.com/mzinner/mysql-shell-ex

Connectors - X Dev API

- Supports indexing array fields
- Send connection attributes
- OVERLAPS and NOT OVERLAPS operators for expressions on JSON arrays or objects

MEB

- MEB now uses mysql redo archive for backups
  - No longer issue with race condition on redo
- Now with support for encrypted redo log files

8.0.16

- mysqld – automatic upgrade
  - No more mysql_upgrade

THANK YOU

Q&A