

# Tungsten Cluster Master Class

Intermediate: Backup & Recovery

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# Topics

In this short course, we will discuss:

- How to develop a backup plan
- Methods and tools for taking a backup
- Verifying the back contains the last binary position, and the importance of this
- Restore backups into the cluster
- Provision a replica from an existing Datasource (deep dive in next session)

# Backup Plan

# Backup Plan – Considerations

- How much data can you realistically afford to lose in a disaster?
  - Business decision that will have an impact on backups
  - The less you can lose, the more complex the backup plan
  - RPO – Recovery Point Objective
- How long can you realistically be offline in a disaster?
  - Restoring a backup takes time
  - Less time offline adds complexity to the plan
  - RTO – Recovery Time Objective
- Where will you keep your backups?
  - Requires provisioning of space
  - Must be durable
  - Must factor in backup retention time



# Backup Plan – Best Practices

- “We don’t take backups, we use replication instead”
- Backups should not be considered viable until they have been restored
  - Backups need to be tested
  - Backup process can also test restore
- Restore process for production needs to be documented
  - Avoid panic during a disaster
  - Test regularly



# Backup Plan – Best Practices

## 3-2-1 Rule

- 3 copies total copies of your data
- 2 local copies
  - Good: Separate disk
  - Better: Separate servers
  - Even Better: Separate LANs
  - Yes, this applies for cloud too.
  - For cloud, 2<sup>nd</sup> copy in another account
- 1 offsite copy
  - Cloud if using on site production
  - On site or another cloud if using cloud
  - Protects again unauthorized access

# Backup Tools

## `mysqldump`

- Installed with all MySQL deployments
- Easy to make backup, easy to restore
- Quick for small datasets
- Slow for large datasets, especially restore
- Locks tables
- Adds load to MySQL server

## `xtrabackup`

- Free
- Online, does not lock tables
- Can load server, however, does not put a high load on MySQL itself
- Ideal for larger datasets
- A lot of options, though confusing

# Backup Tools

## Snapshots [LVM, Cloud, via Hypervisor, etc.]

- Ideal for very large datasets
- Extremely quick
- Requires working at the OS or hardware level
- Need to backup the snapshot – extra step
- Having several snapshots will impact disk performance

## File Copy [`rsync` and Others]

- Fast
- Works with large datasets
- Familiar tools
- Requires scripting to automate
- Must stop MySQL server to get a viable backup



# Taking and Restoring Backups

# Within a Cluster

```
[LOGICAL:EXPERT] /alpha > datasource host3 backup
```

Using the 'mysqldump' backup agent.

```
Replicator 'host3' starting backup Backup of dataSource 'host3' succeeded;  
uri=storage://file-system/store-0000000001.properties
```

- Select a secondary when using this to keep load off of the primary
- Backups by default will be saved into `/opt/continuent/backups`
- Backup command will use `xtrabackup` if available, otherwise it will use `mysqldump`
- A properties file is also created, which includes backup method and checksum

# Automate Backups Within the Cluster

```
shell> crontab -l  
00 00 * * * /opt/continuent/tungsten/cluster-home/bin/cluster_backup  
>>/opt/continuent/service_logs/cluster_backup.log 2>&1
```

- Use the `cluster_backup` command within cron on all database nodes
- `cluster_backup` will ONLY run on the coordinator; it will gracefully exit on other hosts
- The coordinator will select a secondary to backup
- Exactly like running `datasource host backup` in `cctrl`

# Restoring a Backup Within a Tungsten Cluster

```
[LOGICAL] /alpha > datasource host3 shun  
[LOGICAL] /alpha > replicator host3 offline  
[LOGICAL] /alpha > datasource host3 restore
```

- This restore process will restore the latest available backup
- Only searches for backups on the host specified, does NOT search all nodes for the latest backup

```
[LOGICAL] /alpha > datasource host3 shun  
[LOGICAL] /alpha > replicator host3 offline  
[LOGICAL] /alpha > datasource host3 restore storage:///file-system/store-  
0000000004.properties
```

- Specifying a properties file allows you to select a particular backup to restore

# External Backups

- Use your favorite method to take a backup
- When backing up a primary, you MUST record the binlog position of the backup
  - Binary log position may be different than the values in `trp_commit_seqno`
  - For `mysqldump`, include `--master-data=2`, which will include a line in the dump:  

```
CHANGE MASTER TO MASTER_LOG_FILE='mysql-bin.000002', MASTER_LOG_POS=622;
```
  - `xtrabackup` always records the position in `xtrabackup_binlog_info`
  - For file copy or snapshot backups on a primary:
    - quiesce the database, then
    - run `SHOW MASTER STATUS;` in MySQL to obtain the binary log position
    - Execute backup
    - Record the binary log position with the backup

# Restoring an External Backup

- SHUN the node if it's not already Shunned or Failed (`datasource host shun`)
- Take the replicator offline (`trepctl -all-services offline`)
- MUST remove ALL THL: `thl -service service-name purge`
- Stop the MySQL server
- Perform the restore (load a previous dump, xtrabackup copy-back, file copy, etc)
- If backup was taken from a primary, we must perform some additional steps (on following pages)
- Verify ownership and permissions of database files
- Start MySQL
- Finally, RECOVER the node

# Restoring from a Primary

# The Tungsten Tracking Schema

```
mysql> select * from tungsten_east.trep_commit_seqno;
```

| task_id | seqno | fragno | last_frag           | source_id | epoch_number | eventid                                  |
|---------|-------|--------|---------------------|-----------|--------------|------------------------------------------|
| 0       | 190   | 0      | 1                   | db1       | 0            | mysql-bin.000002:00000000000048972;32826 |
| 1       |       |        | 2017-10-17 03:20:39 | music     |              | 2017-10-17 03:20:38                      |

- Tungsten creates a “tracking” schema in the MySQL database
- GTID and binlog positions are stored within this schema
- When a database is restored, Tungsten uses the data in the tracking schema to set the replicator position



# Setting the Correct Position

- When backing up a busy primary, the actual binary log position may be different than the values in the `trep_commit_seqno` table
- Compare the binary log values in `trep_commit_seqno` with the values obtained from the backup (`mysqldump master-data` or `xtrabckup_binlog_info`)
- If the values are the same, no further action is needed
- If the values differ, note the sequence number in `trep_commit_seqno` table
- Find the binlog position in the THL, using the sequence number from the above step as a starting point
- Note this new sequence number obtained from the THL, and use `dsctl` on the slave node to set the replicator position with this new sequence number

# Setting the Correct Position

## Example

```
mysql> select seqno,epoch,source_id, event_id from tungsten_east.trep_commt_seqno;  
seqno      epoch      source_id  eventid  
32033674   32032892   host1      mysql-bin.000032:0000000473860407;-1
```

Examine binary log position in backup. In our example, the position is `mysql-bin.000032:473863524`

Now on the primary:

```
Shell> thl list -service alpha -low 32033674 -headers | grep 473863524  
32033678 32030709 0 true 2014-10-17 16:58:11.0 mysql-bin.000032:0000000473863524;-1 db1-east.continuent.com
```

On the secondary, use Info from above:

```
Shell> dsctl set -service alpha -epoch 32030709 -source-id host1 -seqno 32033678 -event-id "mysql-  
bin.000032:0000000473863524;-1" -reset
```

# Summary

What we have learned today:

- Factors to consider for your backup plan
  - RPO
  - RTO
  - 3-2-1 rule
  - Testing
- Review of backup tools
- Backup and restore within the cluster
- External backups and restore
- Special considerations when restoring a backup taken from a Primary

# Thank you for listening

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