Tungsten Cluster Master Class

Basics: Working with Command Line Tools

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Topics

In this course, we will

- Explore the main Command Line Tools
  - `tpm`
  - `cctrl`
  - `trepctl`
  - `thl`

Command Line Tools

tpm

- Tungsten Package Manager
- As well as using `tpm` for installs and updates, it can also be used for a number of other actions. You can issue `tpm help` for a list of possible options.
- Most common options:
  - `tools/tpm validate[-update]`
  - `[tools/]tpm update [--replace-release] [--no-connectors]`
  - `tools/tpm install`
  - `tpm diag` – Gathers package of stats for support!
  - `tpm connector` – Launches the MySQL command-line client and connects to the current Primary node via locally-running Connector process
  - `tpm mysql` – Launches the MySQL command-line client and connects to the MySQL server process running on the local host
  - `tpm policy` – a quick way to switch between AUTOMATIC and MAINTENANCE policy
  - `tpm copy` – Useful when setting up security for copying certificates and keys to other cluster hosts
  - `tpm cert` – Used for managing certificate generation

tpm connector

- Simple and quick way to connect to the current MySQL Primary node via the command line
- Only works on hosts where the Connector is running
- Will authenticate using credentials supplied via `application-user` and `application-password` properties
- Provides additional commands to query database and cluster stats:
  - Connector-based Tungsten commands are NOT available in Bridge Mode
  - This is a good way to tell if you are in Bridge mode – if no commands are available, then you are in Bridge mode
  - `tungsten help` will show all commands available

```
mysql> tungsten help;
+-----------------------------------------------------------------------------------------------------------------------------------------------------+
| Message                                                                                                                                             |
+-----------------------------------------------------------------------------------------------------------------------------------------------------+
| tungsten connection status:                 display information about the connection used for the last request ran                                   |
| tungsten connection count:                  gives the count of current connections to each one of the cluster datasources                           |
| tungsten cluster status:                    prints detailed information about the cluster view this connector has                                   |
| tungsten show [full] processlist:           list all running queries handled by this connector instance                                             |
| tungsten show variables [like '<string>']:  list connector configuration options in use. The <string> may contain '%' wildcards                       |
| tungsten flush privileges:                  reload user.map and refresh user credentials                                                            |
| tungsten mem info:                          display memory information about current JVM                                                            |
| tungsten gc:                                calls garbage collector                                                                                 |
| tungsten help:                              display this help message                                                                               |
+-----------------------------------------------------------------------------------------------------------------------------------------------------+
9 rows in set (0.00 sec)
```

cctrl

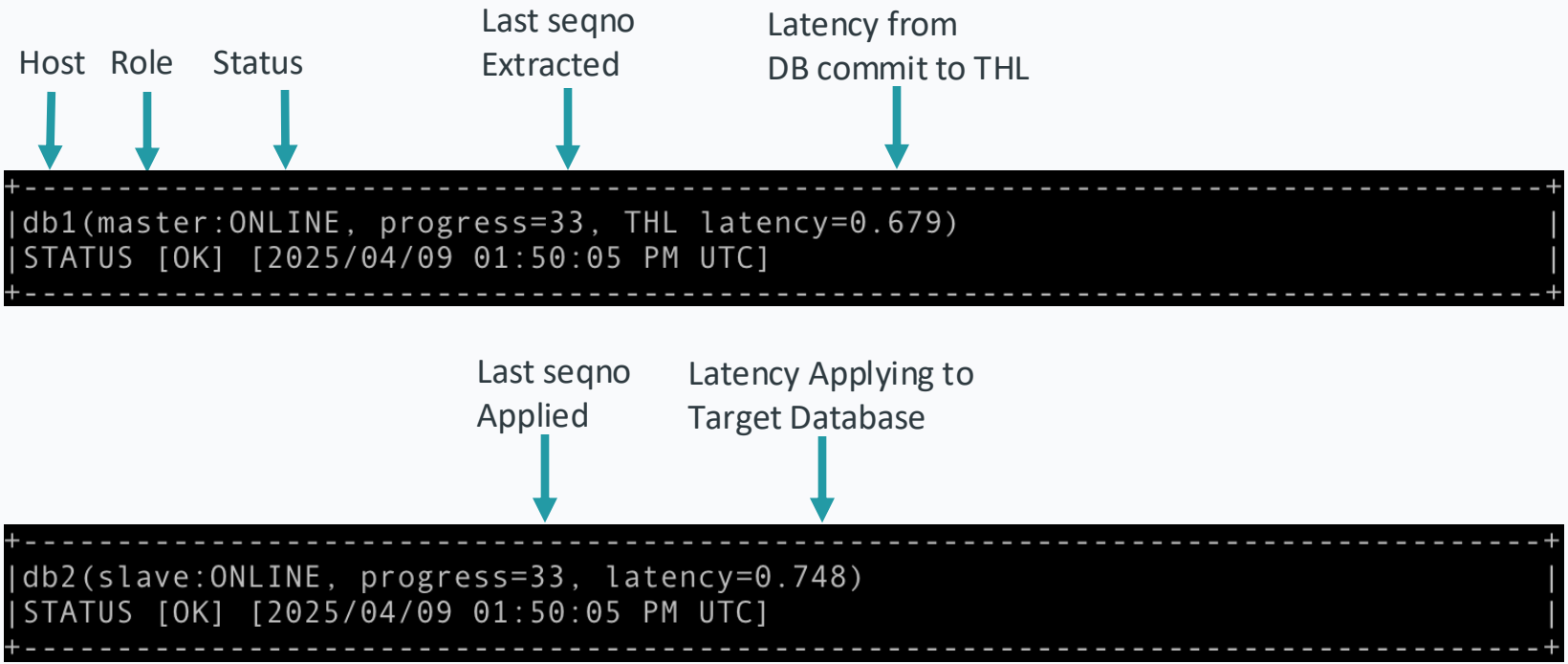
- `cctrl` stands for Cluster Control
- Can be executed from any node running the manager in the cluster. For example, running `cctrl` on a Connector-only host will fail.
- Allows control of all nodes in the cluster
- Main uses are
  - Check cluster state
  - Isolate nodes for maintenance
  - Switch Primary nodes
  - Recover nodes following failure/recovery
  - Perform backup/recovery operations
- Requires the Manager to be running

cctrl

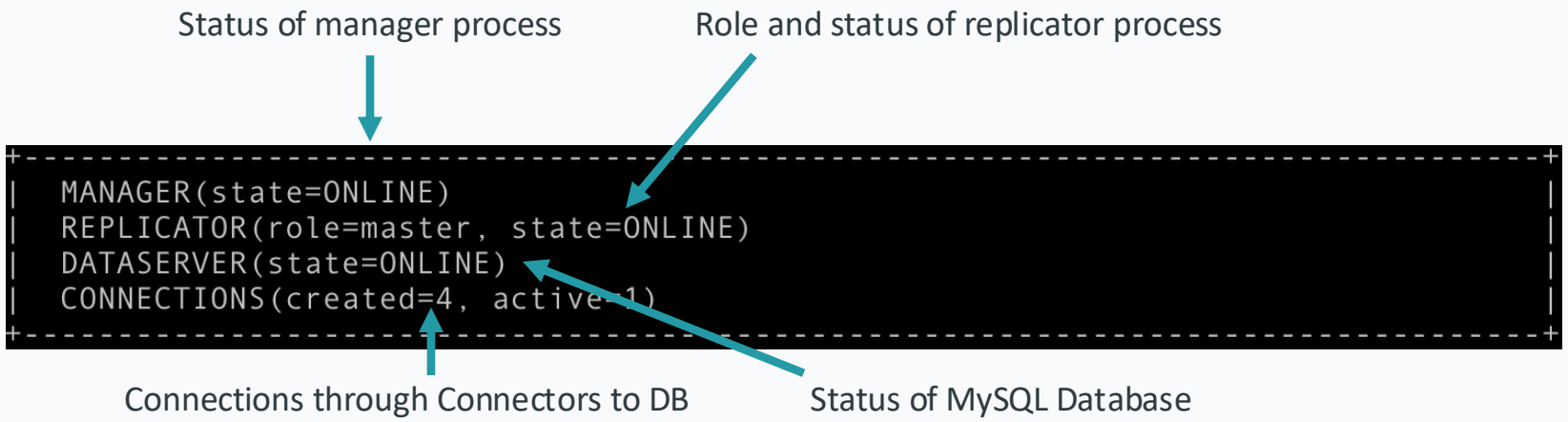
```
ls
```

- `COORDINATOR[db3:AUTOMATIC:ONLINE]`
  - Identifies current Coordinator host and Current Cluster Mode
- `ROUTERS:`
  - Lists all connectors associated with the installation, each connector shows status, and created/active connection counts
- `DATASOURCES:`
  - Lists all nodes that form the cluster

cctrl


Host
Role
Status
Last seqno
Extracted
Latency from
DB commit to THL
+----------+
|db1(master:ONLINE, progress=33, THL latency=0.679)
|STATUS [OK] [2025/04/09 01:50:05 PM UTC]
+----------+
Last seqno
Applied
Latency Applying to
Target Database
+----------+
|db2(slave:ONLINE, progress=33, latency=0.748)
|STATUS [OK] [2025/04/09 01:50:05 PM UTC]
+----------+

cctrl



Role and status of replicator process. On a replica, shows primary the replica is connected to

```
| REPLICATOR(role=slave, master=db1, state=ONLINE)
```

cctrl

cluster validate

Checks the validity of the cluster and ensures that all nodes are reachable

```
[LOGICAL] /alpha > cluster validate
================================================================================
CHECKING FOR QUORUM: MUST BE AT LEAST 2 DB MEMBERS
POTENTIAL QUORUM SET MEMBERS ARE: db1, db3, db2
SIMPLE MAJORITY SIZE: 2
GC VIEW OF CURRENT DB MEMBERS IS: db1, db2, db3
VALIDATED DB MEMBERS ARE: db1, db3, db2
REACHABLE DB MEMBERS ARE: db1, db3, db2
================================================================================
CONCLUSION: I AM IN A PRIMARY PARTITION OF 3 DB MEMBERS OUT OF THE REQUIRED MAJORITY OF 2
VALIDATION STATUS=VALID CLUSTER
ACTION=NONE
```

cctrl

`cluster heartbeat`

- Inserts an entry into the Primary ‘heartbeat’ table
- Good way to check that replication is flowing properly
- Check the `progress=` entries in the `ls` output

```
[LOGICAL] /alpha > cluster heartbeat
HEARTBEAT 'DEFAULT' INSERTED
```

cctrl

Cluster Policy Modes

- `AUTOMATIC`
  - Normal Operational state
  - Ensures automatic failover
  - Will attempt auto-recovery of components (MySQL server and Replicator)
- `MAINTENANCE`
  - Prevents automatic operations mentioned above
  - Should ONLY be used during Maintenance Windows

trepctl

- Used to control and manage the replicator Java process
- Most common uses are
  - View replicator status
  - Stop/Start replication
  - Skip “safe” errors
- `trepctl help` to see all options

trepctl

- `trepctl services`
  - Short list output of all services running on the host
  - Shows basic information
- `trepctl [-service SERVICENAME] status [-r N]`
  - Shows the full status of the replicator
  - Specify `-service` if multiple services available
  - Specify `-r N` to refresh every *N* seconds or until CTRL+C
- `trepctl [-service SERVICENAME] status -name stages`
  - A more complete status view showing detailed output of each replicator stage

trepctl

- `trepctl [-service SERVICENAME] qs [-r N]`
  - Shows a quick summary/status of the replicator progress
  - Specify `-service` if multiple services available
  - Specify `-r N` to refresh every *N* seconds or until CTRL+C
- `trepctl [-service SERVICENAME] perf [-r N]`
  - Shows the status of each stage of the replication pipeline
  - Output differs between Primary and Replicas
  - Specify `-service` if there are multiple services available
  - Specify `-r N` to refresh every *N* seconds or until CTRL+C

trepctl

- `trepctl [-service SERVICENAME] reset {OPTIONS}`
  - Performs a FULL reset of the replicator
  - **VERY** destructive if used incorrectly
  - Resets SEQNO to 0
- `trepctl [-service SERVICENAME] offline|online {OPTIONS}`
  - Bring a service online or offline
  - Can be used with various options to control how/when
  - Used with –skip-seqno to skip errors

trepctl status

```
[tungsten@db1 ~]$ trepctl status
Processing status command...
NAME                     VALUE
----                     -----
appliedLastEventId     : mysql-bin.000013:0000000000010868;1932
appliedLastGoodLatency : 1.004
appliedLastGoodSeqno   : 34
appliedLastSeqno       : 34
appliedLatency         : 1.004
applying               :
autoRecoveryEnabled    : false
autoRecoveryTotal      : 0
channels               : 1
clusterName            : alpha
currentEventId         : mysql-bin.000013:10868
currentTimeMillis      : 1744207507798
dataServerHost         : db1
extensions             :
host                   : db1
latestEpochNumber      : 0
```

trepctl status

```
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currentTimeMillis      : 1744207507798
dataServerHost         : db1
extensions             :
host                   : db1
latestEpochNumber      : 0
```

On a Primary, the last binary log position written to the THL along with the Seqno for that event, and the latency between the database commit to the binlog and the THL write completion.

On a replica, displays the last event written to the target database with the corresponding Seqno, and the latency between the source database commit and the completed apply of that event to the target database.

'applying' on a replica will show progress of current seqno and can be useful for seeing long running transactions. Will always be empty on an extractor (introduced in v8.0.0)

trepctl status

```
[tungsten@db1 ~]$ trepctl status
Processing status command...
NAME                     VALUE
----                     -----
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appliedLastGoodLatency : 1.004
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appliedLastSeqno       : 34
appliedLatency         : 1.004
applying               :
autoRecoveryEnabled    : false
autoRecoveryTotal      : 0
channels               : 1
clusterName            : alpha
currentEventId         : mysql-bin.000013:10868
currentTimeMillis      : 1744207507798
dataServerHost         : db1
extensions             :
host                   : db1
latestEpochNumber      : 0
```

Auto-Recovery properties

trepctl status

```
[tungsten@db1 ~]$ trepctl status
Processing status command...
NAME                     VALUE
----                     -----
appliedLastEventId     : mysql-bin.000013:0000000000010868;1932
appliedLastGoodLatency : 1.004
appliedLastGoodSeqno   : 34
appliedLastSeqno       : 34
appliedLatency         : 1.004
applying               :
autoRecoveryEnabled    : false
autoRecoveryTotal      : 0
channels               : 1
clusterName            : alpha
currentEventId         : mysql-bin.000013:10868
currentTimeMillis      : 1744207507798
dataServerHost         : db1
extensions             :
host                   : db1
latestEpochNumber      : 0
```

Current Binlog position of the database (NONE on Replicas)

trepctl status

```
masterConnectUri       : thl://localhost:/
masterListenUri        : thl://db1:2112/
maximumStoredSeqNo     : 34
minimumStoredSeqNo     : 0
offlineRequests        : NONE
pendingError           : NONE
pendingErrorCode       : NONE
pendingErrorEventId    : NONE
pendingErrorSeqno      : -1
pendingExceptionMessage: NONE
pipelineSource         : /var/lib/mysql
relativeLatency        : 98.798
resourceJdbcDriver     : org.drizzle.jdbc.DrizzleDriver
resourceJdbcUrl        :
jdbc:mysql:thin://db1:13306/${DBNAME}?jdbcCompliantTruncation=false&zeroDateTimeBehavior=convertToNull&tinyInt1isBit=false&allowMultiQueries=true&yearIsDateType=false
resourceVendor         : mysql
rmiPort                : 10000
role                   : master
seqnoType              : java.lang.Long
```

trepctl status

```
masterConnectUri        : thl://localhost:/
masterListenUri         : thl://db1:2112/
maximumStoredSeqNo      : 34
minimumStoredSeqNo      : 0
offlineRequests         : NONE
pendingError            : NONE
pendingErrorCode        : NONE
pendingErrorEventId     : NONE
pendingErrorSeqno       : -1
pendingExceptionMessage: NONE
pipelineSource          : /var/lib/mysql
relativeLatency         : 98.798
resourceJdbcDriver      : org.drizzle.jdbc.DrizzleDriver
resourceJdbcUrl         :
jdbc:mysql:thin://db1:13306/${DBNAME}?jdbcCompliantTruncation=false&zeroDateTimeBehavior=convertToNull&tinyInt1isBit=false&allowMultiQueries=t
rue&yearIsDateType=false
resourceVendor          : mysql
rmiPort                 : 10000
role                    : master
seqnoType               : java.lang.Long
```

masterConnectUri shows the source THL server we are connected to

masterListenUri shows the THL server listener protocol, host and port information for replicas to connect with

trepctl status

```
masterConnectUri       : thl://localhost:/
masterListenUri        : thl://db1:2112/
maximumStoredSeqNo     : 34
minimumStoredSeqNo     : 0
offlineRequests        : NONE
pendingError           : NONE
pendingErrorCode       : NONE
pendingErrorEventId    : NONE
pendingErrorSeqno      : -1
pendingExceptionMessage: NONE
pipelineSource         : /var/lib/mysql
relativeLatency        : 98.798
resourceJdbcDriver     : org.drizzle.jdbc.DrizzleDriver
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jdbc:mysql:thin://db1:13306/${DBNAME}?jdbcCompliantTruncation=false&zeroDateTimeBehavior=convertToNull&tinyInt1isBit=false&allowMultiQueries=t
rue&yearIsDateType=false
resourceVendor         : mysql
rmiPort                : 10000
role                   : master
seqnoType              : java.lang.Long
```

When the Replicator goes into an `OFFLINE:ERROR` state, these fields will show all the associated information. Always check the `trepsvc.log` file for more detail as needed.

trepctl status

```
masterConnectUri       : thl://localhost:/
masterListenUri        : thl://db1:2112/
maximumStoredSeqNo     : 34
minimumStoredSeqNo     : 0
offlineRequests        : NONE
pendingError           : NONE
pendingErrorCode       : NONE
pendingErrorEventId    : NONE
pendingErrorSeqno      : -1
pendingExceptionMessage: NONE
pipelineSource         : /var/lib/mysql
relativeLatency        : 98.798
resourceJdbcDriver     : org.drizzle.jdbc.DrizzleDriver
resourceJdbcUrl        :
jdbc:mysql:thin://db1:13306/${DBNAME}?jdbcCompliantTruncation=false&zeroDateTimeBehavior=convertToNull&tinyInt1isBit=false&allowMultiQueries=t
rue&yearIsDateType=false
resourceVendor         : mysql
rmiPort                : 10000
role                   : master
seqnoType              : java.lang.Long
```

The current source of THL. Replicas will show same as the masterConnectUri (unless using an Active/Active) topology. A Primary will show the binary log directory.

trepctl status

```
masterConnectUri       : thl://localhost:/
masterListenUri        : thl://db1:2112/
maximumStoredSeqNo     : 34
minimumStoredSeqNo     : 0
offlineRequests        : NONE
pendingError           : NONE
pendingErrorCode       : NONE
pendingErrorEventId    : NONE
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relativeLatency        : 98.798
resourceJdbcDriver     : org.drizzle.jdbc.DrizzleDriver
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jdbc:mysql:thin://db1:13306/${DBNAME}?jdbcCompliantTruncation=false&zeroDateTimeBehavior=convertToNull&tinyIntlisBit=false&allowMultiQueries=t
rue&yearIsDateType=false
resourceVendor         : mysql
rmiPort                : 10000
role                   : master
seqnoType              : java.lang.Long
```

Latency between *NOW* and the timestamp of the last event in the local THL.

trepctl status

```
masterConnectUri       : thl://localhost:/
masterListenUri        : thl://db1:2112/
maximumStoredSeqNo     : 34
minimumStoredSeqNo     : 0
offlineRequests        : NONE
pendingError           : NONE
pendingErrorCode       : NONE
pendingErrorEventId    : NONE
pendingErrorSeqno      : -1
pendingExceptionMessage: NONE
pipelineSource         : /var/lib/mysql
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resourceJdbcDriver     : org.drizzle.jdbc.DrizzleDriver
resourceJdbcUrl        :
jdbc:mysql:thin://db1:13306/${DBNAME}?jdbcCompliantTruncation=false&zeroDateTimeBehavior=convertToNull&tinyInt1isBit=false&allowMultiQueries=t
rue&yearIsDateType=false
resourceVendor         : mysql
rmiPort                : 10000
role                   : master
seqnoType              : java.lang.Long
```

Current role : master, slave or relay

trepctl status

```
serviceName             : alpha
serviceType             : local
simpleServiceName       : alpha
siteName                : default
sourceId                : db1
state                   : ONLINE
timeInStateSeconds      : 903.913
timezone                : GMT
transitioningTo         :
uptimeSeconds           : 922.688
useSSLConnection        : false
version                 : Tungsten Clustering 8.0.0 build 286
Finished status command...
```

trepctl status

```
serviceName             : alpha
serviceType             : local
simpleServiceName       : alpha
siteName                : default
sourceId                : db1
state                   : ONLINE
timeInStateSeconds      : 903.913
timezone                : GMT
transitioningTo         :
uptimeSeconds           : 922.688
useSSLConnection        : false
version                 : Tungsten Clustering 8.0.0 build 286
Finished status command...
```

Current State, can be :

- ONLINE
- ONLINE:DEGRADED
- ONLINE:DEGRADED-BINLOG-FULLY-READ
- OFFLINE:NORMAL
- SUSPECT
- OFFLINE:ERROR
- GOING-ONLINE:SYNCHRONISING
- GOING-ONLINE:RESTORING
- GOING-ONLINE:PROVISIONING

Applied Latency vs Relative Latency

The appliedLatency is the latency between the commit time of the **source** event and the time the last committed transaction reached the end of the corresponding pipeline within the replicator.

Within a **primary**, this indicates the latency between the transaction commit time and when it was written to the THL.

In a **replica**, it indicates the latency between the commit time on the **primary** database and when the transaction has been committed to the destination database.

Clocks must be synchronized across hosts for this information to be accurate. The latency is measured in seconds.

Increasing latency may indicate that the destination database is unable to keep up with the transactions from the primary. In replicators that are operating with parallel apply, appliedLatency indicates the latency of the trailing channel. Because the parallel apply mechanism does not update all channels simultaneously, the figure shown may trail significantly from the actual latency.

The relativeLatency is the latency between **now** and timestamp of the last event written into the local THL.

This information gives an indication of how fresh the incoming THL information is.

On a **primary**, it indicates whether the primary is keeping up with transactions generated on the primary database.

On a **replica**, it indicates how up to date the THL read from the extractor is.

A large value can either indicate that the database is not busy, that a large transaction is currently being read from the source database or from the primary replicator, or that the replicator has stalled for some reason.

An increasing relativeLatency on the replica may indicate that the replicator may have stalled and stopped applying changes to the database.

thl

- Interface for viewing the contents of the THL
- `thl help` to view all command options
- `thl info` – Show a summary of the THL available on disk
- `thl list` will product a lot of output, always use with options to filter the result set
  - `-low|from` *`SEQ`* – Start from supplied seqno
  - `-high|to` *`SEQ`* – Stop at supplied seqno
  - `-first` – Show first seqno available
  - `-first` *`N`* – Show first *N* entries
  - `-last` – Show last seqno available
  - `-last` *`N`* – Show last *N* entries
- `thl index` – re-index THL – can help to speed up replicator restarts
- `thl purge` – Use with **CARE** since this command will **REMOVE** ALL THL on disk for that service

thl

```
SEQ# = 6 / FRAG# = 0 (last frag)
- FILE = thl.data.0000000001
- TIME = 2025-04-09 13:51:22.0
- EPOCH# = 0
- EVENTID = mysql-bin.000013:0000000000001904;895
- SOURCEID = db1
- METADATA =
[mysql_server_id=10;mysql_thread_id=895;unsafe_for_block_commit;dbms_type=mysql;tz_aware=true
;service=alpha;shard=hr]
- TYPE = com.continuent.tungsten.replicator.event.ReplDBMSEvent
- OPTIONS = [##charset = UTF-8, autocommit = 1, sql_auto_is_null = 0, foreign_key_checks = 1,
unique_checks = 1, sql_mode =
'NO_ENGINE_SUBSTITUTION,ONLY_FULL_GROUP_BY,STRICT_TRANS_TABLES,ERROR_FOR_DIVISION_BY_ZERO,IGN
ORE_SPACE,NO_ZERO_DATE,NO_ZERO_IN_DATE', character_set_client = 33, collation_connection =
33, collation_server = 255]
- SCHEMA = hr
- SQL(0) = CREATE TABLE countries
    ( country_id      CHAR(2) NOT NULL PRIMARY KEY
    , country_name    VARCHAR(40)
    , region_id       INT
    )
```

thl

SEQ# = 6 / FRAG# = 0 (last frag) ← Global Sequence number for the event

```
- FILE = thl.data.0000000001
- TIME = 2025-04-09 13:51:22.0
- EPOCH# = 0
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thl

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```

Associated THL File on Disk

thl

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```

Commit time to Binary Logs

thl

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```

Associated Binary Log File and Position

thl

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ORE_SPACE,NO_ZERO_DATE,NO_ZERO_IN_DATE', character_set_client = 33, collation_connection =
33, collation_server = 255]
- SCHEMA = hr
- SQL(0) = CREATE TABLE countries
    ( country_id      CHAR(2) NOT NULL PRIMARY KEY
    , country_name    VARCHAR(40)
    , region_id       INT
    )
```

Source of transaction (Should be a Primary!)

thl

```
SEQ# = 6 / FRAG# = 0 (last frag)
- FILE = thl.data.0000000001
- TIME = 2025-04-09 13:51:22.0
- EPOCH# = 0
- EVENTID = mysql-bin.000013:0000000000001904;895
- SOURCEID = db1
- METADATA =
[mysql_server_id=10;mysql_thread_id=895;unsafe_for_block_commit;dbms_type=mysql;tz_aware=true
;service=alpha;shard=hr]
- TYPE = com.continuent.tungsten.replicator.event.ReplDBMSEvent
- OPTIONS = [##charset = UTF-8, autocommit = 1, sql_auto_is_null = 0, foreign_key_checks = 1,
unique_checks = 1, sql_mode =
'NO_ENGINE_SUBSTITUTION,ONLY_FULL_GROUP_BY,STRICT_TRANS_TABLES,ERROR_FOR_DIVISION_BY_ZERO,IGN
ORE_SPACE,NO_ZERO_DATE,NO_ZERO_IN_DATE', character_set_client = 33, collation_connection =
33, collation_server = 255]
- SCHEMA = hr
- SQL(0) = CREATE TABLE countries
    ( country_id      CHAR(2) NOT NULL PRIMARY KEY
    , country_name    VARCHAR(40)
    , region_id       INT
    )
```

Metadata

thl

```
SEQ# = 6 / FRAG# = 0 (last frag)
- FILE = thl.data.0000000001
- TIME = 2025-04-09 13:51:22.0
- EPOCH# = 0
- EVENTID = mysql-bin.000013:0000000000001904;895
- SOURCEID = db1
- METADATA =
[mysql_server_id=10;mysql_thread_id=895;unsafe_for_block_commit;dbms_type=mysql;tz_aware=true
;service=alpha;shard=hr]
- TYPE = com.continuent.tungsten.replicator.event.ReplDBMSEvent
- OPTIONS = [##charset = UTF-8, autocommit = 1, sql_auto_is_null = 0, foreign_key_checks = 1,
unique_checks = 1, sql_mode =
'NO_ENGINE_SUBSTITUTION,ONLY_FULL_GROUP_BY,STRICT_TRANS_TABLES,ERROR_FOR_DIVISION_BY_ZERO,IGN
ORE_SPACE,NO_ZERO_DATE,NO_ZERO_IN_DATE', character_set_client = 33, collation_connection =
33, collation_server = 255]
- SCHEMA = hr
- SQL(0) = CREATE TABLE countries
    ( country_id      CHAR(2) NOT NULL PRIMARY KEY
    , country_name    VARCHAR(40)
    , region_id       INT
    )
```

The database schema that the following SQL is being applied to

thl

```
SEQ# = 6 / FRAG# = 0 (last frag)
- FILE = thl.data.0000000001
- TIME = 2025-04-09 13:51:22.0
- EPOCH# = 0
- EVENTID = mysql-bin.000013:0000000000001904;895
- SOURCEID = db1
- METADATA =
[mysql_server_id=10;mysql_thread_id=895;unsafe_for_block_commit;dbms_type=mysql;tz_aware=true
;service=alpha;shard=hr]
- TYPE = com.continuent.tungsten.replicator.event.ReplDBMSEvent
- OPTIONS = [##charset = UTF-8, autocommit = 1, sql_auto_is_null = 0, foreign_key_checks = 1,
unique_checks = 1, sql_mode =
'NO_ENGINE_SUBSTITUTION,ONLY_FULL_GROUP_BY,STRICT_TRANS_TABLES,ERROR_FOR_DIVISION_BY_ZERO,IGN
ORE_SPACE,NO_ZERO_DATE,NO_ZERO_IN_DATE', character_set_client = 33, collation_connection =
33, collation_server = 255]
- SCHEMA = hr
- SQL(0) = CREATE TABLE countries
    ( country_id      CHAR(2) NOT NULL PRIMARY KEY
    , country_name    VARCHAR(40)
    , region_id       INT
    )
```

Statement (DDL, or if binlog format is STATEMENT or MIXED)

thl

```
SEQ# = 17 / FRAG# = 0 (last frag)
- FILE = thl.data.0000000001
- TIME = 2025-04-09 13:52:44.0
- EPOCH# = 0
- EVENTID = mysql-bin.000013:0000000000005702;895
- SOURCEID = db1
- METADATA =
[mysql_server_id=10;mysql_thread_id=895;dbms_type=mysql;tz_aware=true;service=alpha;shard=hr]
- GLOBAL OPTIONS =
[autocommit=1;sql_auto_is_null=0;foreign_key_checks=1;unique_checks=1;sql_mode='NO_ENGINE_SUBSTITUTION
,ONLY_FULL_GROUP_BY,STRICT_TRANS_TABLES,ERROR_FOR_DIVISION_BY_ZERO,IGNORE_SPACE,NO_ZERO_DATE,NO_ZERO_I
N_DATE';character_set_client=33;collation_connection=33;collation_server=255]
- TYPE = com.continuent.tungsten.replicator.event.ReplDBMSEvent
- OPTIONS = [foreign_key_checks = 1, unique_checks = 1, time_zone = '+00:00', ##charset = UTF-8]
- SQL(0) =
 - ACTION = INSERT
 - SCHEMA = hr
 - TABLE = countries
 - ROW# = 0
  - COL(1: ) (size = 2) = CN
  - COL(2: ) (size = 5) = China
  - COL(3: ) (size = 1) = 3
```

Row Change Data when binlog format is ROW or MIXED

Other Useful Tools

- `dsctl`
  - Advanced method to reset replicator position
- `tungsten_find_position`
  - Can be used to interrogate THL for a specific binary log position and return a `dsctl` command to reposition a replicator
- `tungsten_find_seqno`
  - Works in the same way as `tungsten_find_position` but searches based on a sequence number
- `multi_trepctl`
  - Useful for Active-Active deployments

Summary

What we have learnt today

- How to use the command line tools
  - `tpm`
  - `cctrl`
  - `trepctl`
  - `thl`
- How to interpret status output

Thank you for listening

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Presented by Chris Parker

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