

Working with Apache Hive metastore

Date published: 2019-08-21

Date modified: 2021-09-08



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HMS table storage

You need to understand how the Hive metastore (HMS) stores Hive tables when you run a `CREATE TABLE` statement or migrate a table to Cloudera. The success or failure of the statement, the resulting table type, and the table location depends on a number of factors.

HMS table transformations

The HMS includes the following Hive metadata about tables that you create:

- A table definition
- Column names
- Data types
- Comments in a central schema repository

When you use the `EXTERNAL` keyword in the `CREATE TABLE` statement, HMS stores the table as an external table. When you omit the `EXTERNAL` keyword and create a managed table, or ingest a managed table, HMS might translate the table into an external table or the table creation can fail, depending on the table properties. An important table property that affects table transformations is the ACID or Non-ACID table type:

Non-ACID

Table properties do not contain any ACID related properties set to true. For example, the table does not contain such properties `transactional=true` or `insert_only=true`.

ACID

Table properties do contain one or more ACID properties set to true.

Full ACID

Table properties contain `transactional=true` but not `insert_only=true`

Insert-only ACID

Table properties contain `insert_only=true`.

The following matrix shows the table type and whether or not the location property is supported.

ACID	Managed	Location Property	Comments	Action
Non-ACID	Yes	Yes	Migrated to Cloudera, for example from an HDP or CDH cluster.	Table stored as external
Non-ACID	Yes	No	Table location is null	Table stored in subdirectory of external warehouse*

* `metastore.warehouse.external.dir`

HMS detects type of client for interacting with HMS, for example Hive or Spark, and compares the capabilities of the client with the table requirement. HMS performs the following actions, depending on the results of the comparison:

Table requirement	Client meets requirements	Managed Table	ACID table type	Action
Client can write to any type of ACID table	No	Yes	Yes	CREATE TABLE fails
Client can write to full ACID table	No	Yes	<code>insert_only=true</code>	CREATE TABLE fails
Client can write to insert-only ACID table	No	Yes	<code>insert_only=true</code>	CREATE TABLE fails

If, for example, a Spark client does not have the capabilities required, the following type of error message appears:

```
Spark has no access to table `mytable`. Clients can access this table only if
they have the following capabilities: CONNECTORREAD, HIVEFULLACIDREAD, HIVE
FULLACIDWRITE,
HIVEMANAGESTATS, HIVECACHEINVALIDATE, . . .
```

Configuring HMS for high availability

To provide failover to a secondary Hive metastore if your primary instance goes down, you need to know how to add a Metastore role in Cloudera Manager and configure a property.

About this task

Multiple HMS instances run in active/active mode. Load balancing is done at the Hive client side (like HiveServer or Spark) as the HMS client picks an HMS instance randomly. By default, the `hive.metastore.uri.selection` property is set to `RANDOM`. If that HMS instance is down, then the client randomly picks another instance from the list of HMS instances specified through the `hive.metastore.uris` property.

Before you begin

Minimum Required Role: Configurator (also provided by Cluster Administrator, Full Administrator)

Procedure

1. In Cloudera Manager, click **Clusters Hive Configuration**.
2. Take one of the following actions:
 - If you have a cluster secured by Kerberos, search for **Hive Delegation Token Store**, which specifies storage for the Kerberos token as described below.
 - If you have an unsecured cluster, skip the next step.
3. Select `org.apache.hadoop.hive.thrift.DBTokenStore`, and save the change.

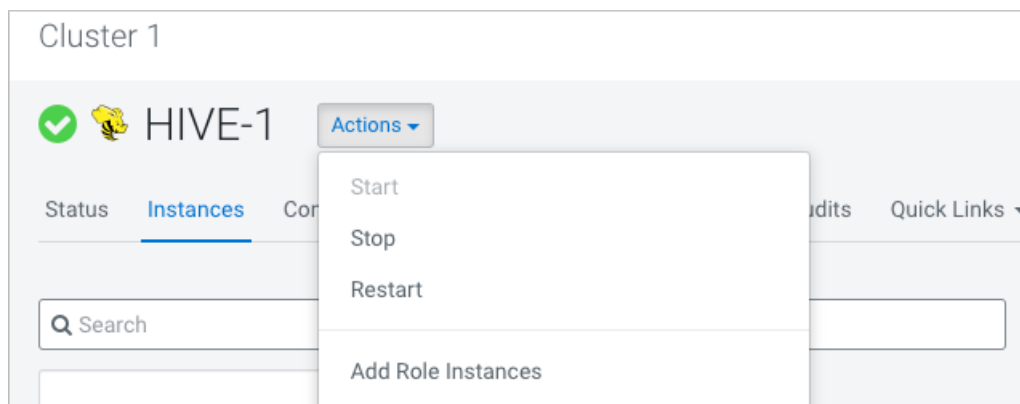
The screenshot shows the configuration interface for the 'Hive Metastore Delegation Token Store'. On the left, the property name 'hive.cluster.delegation.token.store.class' is displayed with a gear icon and a link to 'hive_metastore_delegation_token_store'. On the right, under the heading 'Hive Metastore Server Default Group', there are three radio button options:

- ☐ org.apache.hadoop.hive.thrift.MemoryTokenStore
- ☒ org.apache.hadoop.hive.thrift.DBTokenStore
- ☐ org.apache.hadoop.hive.thrift.ZooKeeperTokenStore

 A 'Show All Descriptions' link is located in the top right corner of the configuration area.

Storage for the Kerberos delegation token is defined by the `hive.cluster.delegation.token.store.class` property. The available choices are Zookeeper, the Metastore, and memory. Cloudera recommends using the database by setting the `org.apache.hadoop.hive.thrift.DBTokenStore` property.

4. Click Instances Actions Add Role Instances



5. In Assign Roles, in Metastore Server, click Select Hosts.

6. In Hosts Selected, scroll and select the host that you want to serve as the backup Metastore, and click OK.

7. Click Continue until you exit the wizard.

8. Start the Metastore role on the host from the Actions menu.

The hive.metastore.uris property is updated automatically. To verify, go to /etc/hive/config directory in your cluster node and look for the updated property in the hive-site.xml file.

9. To check or to change the hive.metastore.uri.selection property, go to Clusters Hive Configurations in Cloudera Manager, and search for 'Hive Service Advanced Configuration Snippet (Safety Valve) for hive-site.xml'.

10. Add the property and value (SEQUENTIAL or RANDOM).

Related Information

[Custom Configuration \(about Cloudera Manager Safety Valve\)](#)

Hive Metastore leader election

To avoid running the same tasks across all Hive Metastore (HMS) instances, you can configure a HMS leader manually or enable dynamic election.

HMS performs housekeeping tasks, such as execution of compaction tasks, auto-discovering partitions for external tables, generation of compaction tasks, and so on. When there are multiple HMS instances, it is essential to have a single leader HMS elected to avoid running the same tasks across all the instances. The elected leader then performs the housekeeping tasks.

The leader is configured through the metastore.housekeeping.leader.hostname property. The value of this property is an empty string by default, which indicates that the current HMS will run the housekeeping tasks. To configure a leader, specify the host name of the HMS service. However, configuring a leader HMS has the following disadvantages:

- Not useful when the leader HMS goes down in some environments
- Configuring a leader HMS in cloud environments is not easy
- All the tasks are expected to be performed by the leader HMS, which can overburden the HMS instance

Dynamic leader election

You can enable dynamic leader election for HMS to overcome the challenges listed above. This feature uses Hive locks to dynamically elect a leader. When a HMS instance owns a lock, it is elected as the leader and performs the housekeeping tasks. The HMS regularly sends heartbeats to prevent the lock from timing out. If the leader loses the lock, the in-progress housekeeping tasks are stopped. The other HMS instances should monitor the lock periodically and acquire the lock to claim leadership.

The leader election event is audited and the details of the leader are stored in a Hive table. There are listeners that keep track of the leader election and notify if a HMS instance wins or loses a leader election.

To enable dynamic leader election for HMS, configure the following properties in Cloudera Manager using the 'Hive Metastore Server Advanced Configuration Snippet (Safety Valve) for hive-site.xml':

Configuration Key	Value	Description
metastore.housekeeping.leader.election	Default: host	By default, HMS chooses a leader based on the configured metastore.housekeeping.leader.hostname. Set the value to 'lock' if you want HMS to use Hive locks to elect a leader.
metastore.housekeeping.leader.auditTable	Default: "" (empty string)	Optional. Specify a Hive table name if you want to capture HMS leader changes in the specified audit table. The table should be of Text format with JSON serialized. The table is created automatically if it does not already exist. In a production environment, it is recommended that you set this property to view the leader change history by running a Hive query against the table.
metastore.housekeeping.leader.newAuditFile	Default: False	Optional. Specifies whether to create a new audit file in response to the new election event when metastore.housekeeping.leader.auditTable is not empty. Set the value to True to create a new file, else set it to False.
metastore.housekeeping.leader.auditFiles.limit	Default: 10	Optional. Enables you to limit the number of small event files. This property is useful when metastore.housekeeping.leader.newAuditFile is set to True or if the underlying file system does not support the append operation. If the number of the event files exceeds the limit, the oldest file is deleted.
metastore.lock.numretries	Default: 100	Optional. The number of times you want to try to get all the locks in case of failure.
metastore.lock.sleep.between.retries	Default: 60 seconds	Optional. The maximum sleep time between various retries in case of failure.

Additionally, ensure that you enable the following properties to support the HMS dynamic leader election feature:

- hive.compactor.initiator.on=true

- `hive.metastore.housekeeping.threads.on=true`

Look for the above properties in Cloudera Manager under Clusters Hive Metastore Configuration .

- `hive.compactor.cleaner.on=true`

Set this property using the 'Hive Metastore Server Advanced Configuration Snippet (Safety Valve) for hive-site.xml' in Cloudera Manager.