Cloudera Runtime 7.2.11

Accessing Apache HBase

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Contents

Use the HBase shell

You can use the HBase Shell from the command line interface to communicate with HBase. In CDP, you can create a namespace and manage it using the HBase shell. Namespaces contain collections of tables and permissions, replication settings, and resource isolation.

In CDP, you need to SSH into an HBase node before you can use the HBase Shell. For example, to SSH into an HBase node with the IP address 10.10.10.10, you must use the command:

```
ssh <username>@10.10.10.10
```

Note: You must use your IPA password for authentication.

After you have started HBase, you can access the database in an interactive way by using the HBase Shell, which is a command interpreter for HBase which is written in Ruby. Always run HBase administrative commands such as the HBase Shell, hbck, or bulk-load commands as the HBase user (typically hbase).

```
hbase shell
```

You can use the following commands to get started with the HBase shell:

- To get help and to see all available commands, use the help command.
- To get help on a specific command, use help "command". For example:

  ```
  hbase> help "create"
  ```

- To remove an attribute from a table or column family or reset it to its default value, set its value to nil. For example, use the following command to remove the KEEP_DELETED_CELLS attribute from the f1 column of the users table:

  ```
  hbase> alter 'users', { NAME => 'f1', KEEP_DELETED_CELLS => nil }
  ```

- To exit the HBase Shell, type quit.

Virtual machine options for HBase Shell

You can set variables for the virtual machine running HBase Shell, by using the HBASE_SHELL_OPTS environment variable. This example sets several options in the virtual machine.

This example sets several options in the virtual machine.

```
$ HBASE_SHELL_OPTS="-verbose:gc -XX:+PrintGCApplicationStoppedTime -
XX:+Prin tGCDateStamps
      -XX:+PrintGCDetails -Xloggc:$HBASE_HOME/logs/gc-hbase.log" ./bin/hbase
 shell
```

Script with HBase Shell

You can use HBase shell in your scripts. You can also write Ruby scripts for use with HBase Shell. Example Ruby scripts are included in the hbase-examples/src/main/ruby/ directory.

The non-interactive mode allows you to use HBase Shell in scripts, and allow the script to access the exit status of the HBase Shell commands. To invoke non-interactive mode, use the -n or --non-interactive switch. This small example script shows how to use HBase Shell in a Bash script.

```
#!/bin/bash
echo 'list' | hbase shell -n
status=$?
if [$status -ne 0]; then
  echo "The command may have failed."
fi
```

Successful HBase Shell commands return an exit status of 0. However, an exit status other than 0 does not necessarily indicate a failure, but should be interpreted as unknown. For example, a command may succeed, but while waiting for the response, the client may lose connectivity. In that case, the client has no way to know the outcome of the command. In the case of a non-zero exit status, your script should check to be sure the command actually failed before taking further action.

You can use the get_splits command, which returns the split points for a given table:

```
hbase> get_splits 't2'
Total number of splits = 5

=> ["", "10", "20", "30", "40"]
```

Use the HBase command-line utilities

Besides the HBase Shell, HBase includes several other command-line utilities, which are available in the hbase/bin/ directory of each HBase host. This topic provides basic usage instructions for the most commonly used utilities.

PerformanceEvaluation

The PerformanceEvaluation utility allows you to run several preconfigured tests on your cluster and reports its performance. To run the PerformanceEvaluation tool, use the bin/hbase pecommand.

```
$ hbase pe

Usage: java org.apache.hadoop.hbase.PerformanceEvaluation
  \ <OPTIONS> [-D<property=value>]* <command> <nclients>

Options:
 nomapred        Run multiple clients using threads (rather than use mapred
uce)
 rows            Rows each client runs. Default: One million
 size            Total size in GiB. Mutually exclusive with --rows. Default:
 1.0.
 sampleRate      Execute test on a sample of total rows. Only supported by r
andomRead.
                 Default: 1.0
 traceRate       Enable HTrace spans. Initiate tracing every N rows. Defaul
t: 0
 table           Alternate table name. Default: 'TestTable'
 multiGet        If >0, when doing RandomRead, perform multiple gets instead
 of single
                 gets.
                 Default: 0
 compress        Compression type to use (GZ, LZO, ...). Default: 'NONE'
 flushCommits    Used to determine if the test should flush the table. Defau
lt: false
 writeToWAL      Set writeToWAL on puts. Default: True
 autoFlush       Set autoFlush on htable. Default: False
 oneCon          all the threads share the same connection. Default: False
 presplit        Create presplit table. Recommended for accurate perf analy
sis (see
                 guide). Default: disabled
 inmemory        Tries to keep the HFiles of the CF inmemory as far as possi
ble. Not
                 guaranteed that reads are always served from memory.  Defa
ult: false
 usetags         Writes tags along with KVs. Use with HFile V3. Default:
false
 numoftags       Specify the no of tags that would be needed. This works o
nly if usetags
                 is true.
 filterAll       Helps to filter out all the rows on the server side there
by not returning
                 anything back to the client.  Helps to check the server si
de performance.
                 Uses FilterAllFilter internally.
 latency         Set to report operation latencies. Default: False
 bloomFilter     Bloom filter type, one of [NONE, ROW, ROWCOL]
 valueSize       Pass value size to use: Default: 1024
 valueRandom     Set if we should vary value size between 0 and 'valueSiz
e'; set on read
                 for stats on size: Default: Not set.
 valueZipf       Set if we should vary value size between 0 and 'valueSize'
 in zipf form:
                 Default: Not set.
 period          Report every 'period' rows: Default: opts.perClientRunRo
ws / 10
 multiGet        Batch gets together into groups of N. Only supported by ran
domRead.
                 Default: disabled
 addColumns      Adds columns to scans/gets explicitly. Default: true
 replicas        Enable region replica testing. Defaults: 1.
 splitPolicy     Specify a custom RegionSplitPolicy for the table.
 randomSleep     Do a random sleep before each get between 0 and entered v
alue. Defaults: 0
 columns         Columns to write per row. Default: 1
 caching         Scan caching to use. Default: 30

 Note: -D properties will be applied to the conf used.
  For example:
   -Dmapreduce.output.fileoutputformat.compress=true
   -Dmapreduce.task.timeout=60000
Command:
 append          Append on each row; clients overlap on keyspace so some c
oncurrent
                 operations
 checkAndDelete  CheckAndDelete on each row; clients overlap on keyspace so
 some concurrent
                 operations
 checkAndMutate  CheckAndMutate on each row; clients overlap on keyspace so
 some concurrent
                 operations
 checkAndPut     CheckAndPut on each row; clients overlap on keyspace so s
ome concurrent
                 operations
 filterScan      Run scan test using a filter to find a specific row based
 on it's value
                 (make sure to use --rows=20)
 increment       Increment on each row; clients overlap on keyspace so some
 concurrent
                 operations
 randomRead       Run random read test
 randomSeekScan   Run random seek and scan 100 test
 randomWrite      Run random write test
 scan             Run scan test (read every row)
 scanRange10      Run random seek scan with both start and stop row (max 10
rows)
 scanRange100     Run random seek scan with both start and stop row (max 100
 rows)
 scanRange1000    Run random seek scan with both start and stop row (max 1000
 rows)
 scanRange10000   Run random seek scan with both start and stop row (max 1
0000 rows)
 sequentialRead   Run sequential read test
 sequentialWrite  Run sequential write test
Args:
 nclients         Integer. Required. Total number of clients (and HRegionS
ervers)
                  running: 1 <= value <= 500
Examples:
 To run a single client doing the default 1M sequentialWrites:
 $ bin/hbase org.apache.hadoop.hbase.PerformanceEvaluation sequentialWrite 1
 To run 10 clients doing increments over ten rows:
 $ bin/hbase org.apache.hadoop.hbase.PerformanceEvaluation --rows=10 --
noma pred increment 10
```

LoadTestTool

The LoadTestTool utility load-tests your cluster by performing writes, updates, or reads on it. To run the LoadTest Tool, use the bin/hbase ltt command. To print general usage information, use the -h option.

```
$ bin/hbase ltt -h

Options:
 -batchupdate                     Whether to use batch as opposed to separate
 updates for every column
                                  in a row
 -bloom <arg>                     Bloom filter type, one of [NONE, ROW, ROWC
OL]
 -compression <arg>               Compression type, one of [LZO, GZ, NONE, SN
APPY, LZ4]
 -data block encoding <arg>       Encoding algorithm (e.g. prefix compress
ion) to use for data blocks
                                  in the test column family, one of
                                  [NONE, PREFIX, DIFF, FAST DIFF, PREFIX T
REE].
 -deferredlogflush                Enable deferred log flush.
 -encryption <arg>                Enables transparent encryption on the test
 table, one of [AES]
 -families <arg>                  The name of the column families to use se
parated by comma
 -generator <arg>                 The class which generates load for the too
l. Any args for this class
                                  can be passed as colon separated after c
lass name
 -h,--help                        Show usage
 -in memory                       Tries to keep the HFiles of the CF inmemory
 as far as possible.  Not
                                  guaranteed that reads are always served fro
m inmemory
 -init only                       Initialize the test table only, don't do
 any loading
 -key window <arg>                The 'key window' to maintain between reads
 and writes for concurrent
                                  write/read workload. The default is 0.
 -max read errors <arg>           The maximum number of read errors to tol
erate before terminating all
                                  reader threads. The default is 10.
 -mob threshold <arg>             Desired cell size to exceed in bytes that
will use the MOB write path
 -multiget batchsize <arg>        Whether to use multi-gets as opposed to sep
arate gets for every
                                  column in a row
 -multiput                        Whether to use multi-puts as opposed to s
eparate puts for every
                                  column in a row
 -num keys <arg>                  The number of keys to read/write
 -num regions per server <arg>    Desired number of regions per region serv
er. Defaults to 5.
 -num tables <arg>                A positive integer number. When a number n
 is specified, load test tool
                                  will load n table parallely. -tn parameter
value becomes table name prefix.
                                  Each table name is in format <tn> 1...<tn>
 n
 -read <arg>                      <verify percent>[:<#threads=20>]
 -reader <arg>                    The class for executing the read requests
 -region replica id <arg>         Region replica id to do the reads from
 -region replication <arg>        Desired number of replicas per region
 -regions per server <arg>        A positive integer number. When a number n
 is specified, load test tool
                                  will create the test table with n regions p
er server
 -skip init                       Skip the initialization; assume test table
 already exists
 -start key <arg>                 The first key to read/write (a 0-based ind
ex). The default value is 0.
 -tn <arg>                        The name of the table to read or write
 -update <arg>                    <update percent>[:<#threads=20>][:<#whether
 to ignore nonce collisions=0>]
 -updater <arg>                   The class for executing the update requests
 -write <arg>                     <avg cols per key>:<avg data size>[:<#thr
eads=20>]
 -writer <arg>                    The class for executing the write requests
 -zk <arg>                        ZK quorum as comma-separated host names w
ithout port numbers
 -zk root <arg>                   name of parent znode in zookeeper
```

wal

The wal utility prints information about the contents of a specified WAL file. To get a list of all WAL files, use the HDFS command hadoop fs -ls -R /hbase/WALs. To run the wal utility, use the bin/hbase wal command. Run it without options to get usage information.

```
hbase wal
usage: WAL <filename...> [-h] [-j] [-p] [-r <arg>] [-s <arg>] [-w <arg>]
 -h,--help                Output help message
 -j,--json                Output JSON
 -p,--printvals           Print values
 -r,--region <arg>        Region to filter by. Pass encoded region name; e.g.
                          '9192caead6a5a20acb4454ffbc79fa14'
 -s,--sequence <arg>      Sequence to filter by. Pass sequence number.
 -w,--row <arg>           Row to filter by. Pass row name.
```

hfile

The hfile utility prints diagnostic information about a specified hfile, such as block headers or statistics. To get a list of all hfiles, use the HDFS command hadoop fs -ls -R /hbase/data. To run the hfile utility, use the bin/hbase hf ilecommand. Run it without options to get usage information.

```
$ hbase hfile

usage: HFile [-a] [-b] [-e] [-f <arg> | -r <arg>] [-h] [-i] [-k] [-m] [-p]
       [-s] [-v] [-w <arg>]
 -a,--checkfamily         Enable family check
 -b,--printblocks         Print block index meta data
 -e,--printkey            Print keys
 -f,--file <arg>          File to scan. Pass full-path; e.g.
                          hdfs://a:9000/hbase/hbase:meta/12/34
 -h,--printblockheaders   Print block headers for each block.
 -i,--checkMobIntegrity   Print all cells whose mob files are missing
 -k,--checkrow            Enable row order check; looks for out-of-order
                          keys
 -m,--printmeta           Print meta data of file
 -p,--printkv             Print key/value pairs
 -r,--region <arg>        Region to scan. Pass region name; e.g.
                          'hbase:meta,,1'
 -s,--stats               Print statistics
 -v,--verbose             Verbose output; emits file and meta data
                          delimiters
 -w,--seekToRow <arg>     Seek to this row and print all the kvs for this
                          row only
```

hbck

The hbck utility checks and optionally repairs errors in HFiles.

Warning: Running hbck with any of the -fix or -repair commands is dangerous and can lead to data loss. Contact Cloudera support before running it.

To run hbck, use the bin/hbase hbck command. Run it with the -h option to get more usage information.

```
-----------------------------------------------------------------------
NOTE: As of HBase version 2.0, the hbck tool is significantly
changed. In general, all Read-Only options are supported and can be
be used safely. Most -fix/ -repair options are NOT supported. Please
see usage below for details on which options are not supported.
-----------------------------------------------------------------------

Usage: fsck [opts] {only tables}
 where [opts] are:
   -help Display help options (this)
   -details Display full report of all regions.
   -timelag <timeInSeconds> Process only regions that have not experienced
 any metadata updates in the last <timeInSeconds> seconds.
   -sleepBeforeRerun <timeInSeconds> Sleep this many seconds before
 checking if the fix worked if run with -fix
   -summary Print only summary of the tables and status.
   -metaonly Only check the state of the hbase:meta table.
   -sidelineDir <hdfs://> HDFS path to backup existing meta.
   -boundaries Verify that regions boundaries are the same between META
 and store files.
   -exclusive Abort if another hbck is exclusive or fixing.

  Datafile Repair options: (expert features, use with caution!)
```

```
   -checkCorruptHFiles      Check all Hfiles by opening them to make sure the
y are valid
   -sidelineCorruptHFiles   Quarantine corrupted HFiles.  implies -checkCorru
ptHFiles

 Replication options
   -fixReplication   Deletes replication queues for removed peers

   Metadata Repair options supported as of version 2.0: (expert features, use
 with caution!)
   -fixVersionFile   Try to fix missing hbase.version file in hdfs.
   -fixReferenceFiles   Try to offline lingering reference store files
   -fixHFileLinks  Try to offline lingering HFileLinks
   -noHdfsChecking   Don't load/check region info from HDFS. Assumes hbas
e:meta region info is good. Won't check/fix any HDFS issue, e.g. hole, orpha
n, or overlap
   -ignorePreCheckPermission  ignore filesystem permission pre-check

NOTE: Following options are NOT supported as of HBase version 2.0+.
  UNSUPPORTED Metadata Repair options: (expert features, use with caution!)
   -fix              Try  to fix region assignments.  This is for backwards
compatiblity
   -fixAssignments   Try  to fix region assignments.  Replaces the old -fix
   -fixMeta          Try  to fix meta problems.  This assumes HDFS region inf
o is good.
   -fixHdfsHoles     Try  to fix region holes in hdfs.
   -fixHdfsOrphans   Try  to fix region dirs with no .regioninfo file in hdfs
   -fixTableOrphans  Try  to fix table dirs with no .tableinfo file in hdfs
 (online mode only)
   -fixHdfsOverlaps  Try  to fix region overlaps in hdfs.
   -maxMerge <n>     When fixing region overlaps, allow at most <n> regions
  to merge. (n=5 by default)
   -sidelineBigOverlaps  When fixing region overlaps, allow to sideline big
overlaps
   -maxOverlapsToSideline <n>  When fixing region overlaps, allow at most <
n> regions to sideline per group. (n=2 by default)
   -fixSplitParents  Try  to force offline split parents to be online.
   -removeParents    Try  to offline and sideline lingering parents and keep
 daughter regions.
   -fixEmptyMetaCells  Try to fix hbase:meta entries not referencing any
region (empty REGIONINFO QUALIFIER rows)

  UNSUPPORTED Metadata Repair shortcuts
   -repair           Shortcut for -fixAssignments -fixMeta -fixHdfsHoles -
fixHdfsOrphans  -fixHdfsOverlaps  -fixVersionFile  -sidelineBigOverlaps  -
fixRef erenceFiles-fixHFileLinks
   -repairHoles      Shortcut for -fixAssignments -fixMeta -fixHdfsHoles
```

clean

After you have finished using a test or proof-of-concept cluster, the hbase clean utility can remove all HBase-related data from ZooKeeper and HDFS.

Warning: The hbase clean command destroys data. Do not run it on production clusters, or unless you are absolutely sure you want to destroy the data.

To run the hbase clean utility, use the bin/hbase clean command. Run it with no options for usage information.

```
$ bin/hbase clean

Usage: hbase clean (--cleanZk|--cleanHdfs|--cleanAll)
Options:
        --cleanZk   cleans hbase related data from zookeeper.
        --cleanHdfs cleans hbase related data from hdfs.
        --cleanAll  cleans hbase related data from both zookeeper and hdfs.
```

Use the HBase APIs for Java

You can use the Apache HBase Java API to communicate with Apache HBase. The Java API is one of the most common ways to communicate with HBase.

The following sample uses Apache HBase APIs to create a table and put a row into that table. The table name, column family name, qualifier (or column) name, and a unique ID for the row are defined. Together, these define a specific cell. Next, the table is created and the text “Hello, World!” is inserted into this cell.

```
import java.io.IOException;
import org.apache.hadoop.conf.Configuration; import
org.apache.hadoop.hbase.HBaseConfiguration; import
org.apache.hadoop.hbase.TableName; import
org.apache.hadoop.hbase.client.*;
import org.apache.hadoop.hbase.util.Bytes;


public class CreateAndPut {
    private static final TableName TABLE_NAME =
TableName.valueOf("test_tabl e_example");
    private static final byte[] CF_NAME = Bytes.toBytes("test_cf"); private
    static final byte[] QUALIFIER = Bytes.toBytes("test_column"); private
    static final byte[] ROW_ID = Bytes.toBytes("row01");
    public static void createTable(final Admin admin) throws IOException
        { if(!admin.tableExists(TABLE_NAME)) {
            TableDescriptor desc = TableDescriptorBuilder.newBuilder(TABLE_
NAME)
                    .setColumnFamily(ColumnFamilyDescriptorBuilder.of(CF_N
AME))
                    .build();
            admin.createTable(desc);
        }
    }

    public static void putRow(final Table table) throws IOException {
        table.put(new Put(ROW_ID).addColumn(CF_NAME, QUALIFIER, Bytes.toByte
s("Hello, World!")));
    }
    public static void main(String[] args) throws IOException {
        Configuration config = HBaseConfiguration.create();

        try (Connection connection = ConnectionFactory.createConnection(co
nfig); Admin admin = connection.getAdmin()) {
            createTable(admin);

            try(Table table = connection.getTable(TABLE_NAME))
                { putRow(table);
            }
        }
    }
}
```

Related Information

HBase API reference documentation

Use the HBase REST server

You can use the Apache HBase REST server to interact with the Apache HBase. This is a very good alternative if you do not want to use the Java API. Interactions happen using URLs and the REST API. REST uses HTTP to perform various actions, and this makes it easy to interface with the operational database using a wide array of programming languages.

You can use the REST server to create, delete tables, and perform other operations that have the REST end-points. You can configure SSL for encryption between the client and the REST server. This helps you to ensure that your operations are secure during data transmission.

Using the REST server enables you access your data across different network boundaries. For example, if you have an CDP operational database Data Hub cluster running inside a private network and don’t want to expose it to your company’s public network, the REST server can work as a gateway between the private and public networks.

Installing the REST Server using Cloudera Manager

You can use the HBase REST API to interact with HBase services, tables, and regions using HTTP endpoints. You must manually install the REST Server only in a CDP Private Cloud Base deployment. The REST Server service is automatically added to the Data Hub cluster in a CDP Public Cloud deployment.

About this task

Install the REST Server using Cloudera Manager in your CDP Private Cloud Base deployment.

Procedure

1. Click the Clusters tab.
2. Select Clusters*HBase*.
3. Click the Instances tab.
4. Click Add Role Instance.
5. Under HBase REST Server, click Select Hosts.
6. Select one or more hosts to serve the HBase Rest Server role. Click Continue.
7. Select the HBase Rest Server roles. Click Actions For Selected Start.

Using the REST API

The HBase REST Server exposes endpoints that provide CRUD (create, read, update, delete) operations for each HBase process, as well as tables, regions, and namespaces.

Background

For a given endpoint, the HTTP verb controls the following type of operations (create, read, update, or delete).

Note: curl Command Examples

The examples in these tables use the curl command, and follow these guidelines:

- The HTTP verb is specified using the -X parameter.
- For GET queries, the Accept header is set to text/xml, which indicates that the client (curl) expects to receive responses formatted in XML. You can set it to application/json to receive JSON responses instead.
- For PUT, POST, and DELETE queries, the Content-Type header should be set only if data is also being sent with the -d parameter. If set, it should match the format of the data being sent, to enable the REST server to deserialize the data correctly.
- If you are using a Data Hub cluster, you must provide the basic authentication parameters in your REST query string to access the REST server end-point. For example, curl -vi -X GET \

  -H "Accept: text/xml" -u "<USER>:<MY_WORKLOAD_PASSWORD>" \

For more details about the curl command, see the documentation for the curl version that ships with your operating system.

In CDP, all REST queries are routed through the Apache Knox gateway. In your REST query, ensure that the hostname points to the gateway node and cdp-proxy-api endpoint as shown in these examples.

Table 1: Cluster-Wide Endpoints

Endpoint	HTTP Verb	Description	Example
/version/cluster	GET	Version of HBase running on this cluster	`curl -L -v \ -u "<MY WORKLOAD USERNAME:MY WORKLOAD PASSWORD>" \ "https://<gateway node>/cdp-proxy-api/hbase/version/cluster"`
/status/cluster	GET	Cluster status	`curl -vi -X GET \ -H "Accept: text/xml" \ -u "<MY WORKLOAD USERNAME:MY WORKLOAD PASSWORD>" \ "https://<gateway node>/cdp-proxy-api/hbase/status/cluster"`
/	GET	List of all nonsystem tables	`curl -vi -X GET \ -H "Accept: text/xml" \ -u "<MY WORKLOAD USERNAME:MY WORKLOAD PASSWORD>" \ "https://<gateway node>/cdp-proxy-api/hbase"`

Table 2: Namespace Endpoints

Endpoint	HTTP Verb	Description	Example

/namespaces	GET	List all namespaces.	`curl -vi -X GET \`
			`-H "Accept: text/xml" \`
			`-u "<MY WORKLOAD USERNAME:MY WORKLOAD PASSWORD>" \`
			`"https://<gateway node>/cdp-proxy-api/hbase/namespaces/"`

/namespaces/namespace	GET	Describe a specific namespace.	`curl -vi -X GET \`
			`-H "Accept: text/xml" \`
			`-u "<MY WORKLOAD USERNAME:MY WORKLOAD PASSWORD>" \`
			`"https://<gateway node>/cdp-proxy-api/hbase/namespaces/special ns"`

/namespaces/namespace	POST	Create a new namespace.	`curl -vi -X POST \`
			`-H "Accept: text/xml" \`
			`-u "<MY WORKLOAD USERNAME:MY WORKLOAD PASSWORD>" \`
			`"https://<gateway node>/cdp-proxy-api/hbase/namespaces/special ns"`

/namespaces/namespace/tables	GET	List all tables in a specific namespace.	`curl -vi -X GET \`
			`-H "Accept: text/xml" \`
			`-u "<MY WORKLOAD USERNAME:MY WORKLOAD PASSWORD>" \`
			`"https://<gateway node>/cdp-proxy-api/hbase/namespaces/special ns/tables"`

/namespaces/namespace	PUT	Alter an existing namespace. Currently not used.	`curl -vi -X PUT \`
			`-H "Accept: text/xml" \`

Table 3: Table Endpoints

Endpoint	HTTP Verb	Description	Example

/table/schema	GET	Describe the schema of the specified table.	`curl -vi -X GET \`
			`-H "Accept: text/xml" \`
			`-u "<MY WORKLOAD USERNAME:MY WORKLOAD PASSWORD>" \`
			`"https://<gateway node>/cdp-proxy-api/hbase/users/schema"`

/table/schema	POST	Create a new table, or replace an existing table's schema with the provided schema.	`curl -vi -X POST \`
			`-H "Accept: text/xml" \`
			`-H "Content-Type: text/xml" \`
			`-d '<?xml version="1.0" encoding="UTF-8"?><TableSchema name="users"><ColumnSchema name="cf" /></TableSchema>' \`
			`-u "<MY WORKLOAD USERNAME:MY WORKLOAD PASSWORD>" \`
			`"https://<gateway node>/cdp-proxy-api/hbase/users/schema"`

/table/schema	UPDATE	Update an existing table with the provided schema fragment.	`curl -vi -X PUT \`
			`-H "Accept: text/xml" \`
			`-H "Content-Type: text/xml" \`
			`-d '<?xml version="1.0" encoding="UTF-8"?><TableSchema name="users"><ColumnSchema name="cf" KEEP_DELETED_CELLS="true" /></TableSchema>' \`
			`-u "<MY WORKLOAD USERNAME:MY WORKLOAD PASSWORD>" \`
			`"https://<gateway node>/cdp-proxy-api/hbase/users/schema"`

/table/schema	DELETE	Delete the table. You must use the table/schema endpoint, not just	`curl -vi -X DELE`

		table/.	`TE \`

Table 4: Endpoints for Get Operations

Endpoint	HTTP Verb	Description	Example
/table/row	GET	Get all columns of a single row. Values are Base-64 encoded. This requires the Accept request header with a type that can hold multiple columns (like xml, json or protobuf)	`curl -vi -X GET \ -H "Accept: text/xml" \ -u "<MY WORKLOAD USERNAME:MY WORKLOAD PASSWORD>" \ "https://<gateway node>/cdp-proxy-api/hbase/users/row1"`
/table/row/column:qualifier/timestamp	GET	Get the value of a single row. Values are Base-64 encoded.	`curl -vi -X GET \ -H "Accept: text/xml" \ -u "<MY WORKLOAD USERNAME:MY WORKLOAD PASSWORD>" \ "https://<gateway node>/cdp-proxy-api/hbase/users/row1/cf:a/1458586888395"`
/table/row/column:qualifier	GET	Get the value of a single column. Values are Base-64 encoded.	`curl -vi -X GET \ -H "Accept: text/xml" \ -u "<MY WORKLOAD USERNAME:MY WORKLOAD PASSWORD>" \ "https://<gateway node>/cdp-proxy-api/hbase/users/row1/cf:a"`
/table/row/column:qualifier/?v=number_of_versions		Multi-Get a specified number of versions of a given cell. Values are Base-64 encoded.	`curl -vi -X GET \ -H "Accept: text/xml" \ -u "<MY WORKLOAD USERNAME:MY WORKLOAD PASSWORD>" \ "https://<gateway node>/cdp-proxy-api/hbase/users/row1/cf:a/?v=2"`

Table 5: Endpoints for Scan Operations

Endpoint	HTTP Verb	Description	Example
/table/scanner/	PUT	Get a Scanner object. Required by all other Scan operations. Adjust the batch parameter to the number of rows the scan should return in a batch. See the next example for adding filters to your Scanner. The scanner endpoint URL is returned as the Location in the HTTP response. The other examples in this table assume that the Scanner endpoint is http://example.com:20550/users/scanner/145869072824375522207.	`curl -vi -X PUT \ -H "Accept: text/xml" \ -H "Content-Type: text/xml" \ -d '<Scanner batch="1"/>' \ -u "<MY WORKLOAD USERNAME:MY WORKLOAD PASSWORD>" \ "https://<gateway node>/cdp-proxy-api/hbase/users/scanner/"`
/table/scanner/	PUT	To supply filters to the Scanner object or configure the Scanner in any other way, you can create a text file and add your filter to the file. For example, to return only rows for which keys start with u123 and use a batch size of 100: `<Scanner batch="100"> <filter> { "type": "PrefixFilter", "value": "u123" } </filter> </Scanner>` Pass the file to the -d argument of the curl request.	`curl -vi -X PUT \ -H "Accept: text/xml" \ -H "Content-Type:text/xml" \ -d @filter.txt \ -u "<MY WORKLOAD USERNAME:MY WORKLOAD PASSWORD>" \ "https://<gateway node>/cdp-proxy-api/hbase/users/scanner/"`
/table/scanner/scanner_id	GET	Get the next batch from the scanner. Cell values are byte-encoded. If the scanner is exhausted, HTTP status 204 is returned.	`curl -vi -X GET \ -H "Accept: text/xml" \ "<MY WORKLOAD USERNAME:MY WORKLOAD PASSWORD>" \ -u "https://<gateway node>/cdp-proxy-api/hbase/users/scanner/145869072824375522207"`
/table/scanner/scanner_id	DELETE	Deletes the scanner and frees the resources it was using.	`curl -vi -X DELETE \ -H "Accept: text/xml" \ -u "<MY WORKLOAD USERNAME:MY WORKLOAD PASSWORD>`

```
" \
```

Table 6: Endpoints for Put Operations

Endpoint	HTTP Verb	Description	Example

/table/row_key/	PUT	Write a row to a table. The row, column qualifier, and value must each be Base-64 encoded. To encode a string, you can use the base64 command-line utility. To decode the string, use base 64 -d. The payload is in the --data argument, so the /users/fakerow value is a placeholder. Insert multiple rows by adding them to the <CellSet> element. You can also save the data to be inserted to a file and pass it to the -d parameter with the syntax -d @filename.txt.	XML:
			`curl -vi -X PUT \`
			`-H "Accept: text/xml" \`
			`-H "Content-Type: text/xml" \`
			`-d '<?xml version="1.0" encoding="UTF-8" standalone="yes"?><CellSet><Row key="cm93NQo="><Cell column="Y2Y6ZQo=">dmFsdWU1Cg==</Cell></Row></CellSet>' \`
			`-u "<MY WORKLOAD USERNAME:MY WORKLOAD PASSWORD>" \`
			`"https://<gateway node>/cdp-proxy-api/hbase/users/`*`fakerow`*`"`
			JSON:
			`curl -vi -X PUT \`
			`-H "Accept: application/json" \`
			`-H "Content-Type: application/json" \`
			`-d '{"Row":[{"key":"cm93NQo=", "Cell": [{"column":"Y2Y6ZQo=", "$":"dmFsdWU1Cg=="}]}]}'' \`

Using the REST proxy API

After configuring and starting HBase on your cluster, you can use the HBase REST Proxy API to stream data into HBase, from within another application or shell script, or by using an HTTP client such as wget or curl.

The REST Proxy API is slower than the Java API and may have fewer features. This approach is simple and does not require advanced development experience to implement. However, like the Java and Thrift Proxy APIs, it uses the full write path and can cause compactions and region splits.

Specified addresses without existing data create new values. Specified addresses with existing data create new versions, overwriting an existing version if the row, column:qualifier, and timestamp all match that of the existing value.

```
curl -H "Content-Type: text/xml"
http://localhost:8000/test/testrow/test:tes tcolumn
```

The REST Proxy API does not support writing to HBase clusters that are secured using Kerberos.

For full documentation and more examples, see the REST Proxy API documentation.

Using the Apache Thrift Proxy API

The Apache Thrift library provides cross-language client-server remote procedure calls (RPCs), using Thrift bindings.

A *Thrift binding* that uses the Apache Thrift Proxy API, is a client code generated by the Apache Thrift compiler for a target language (such as Python) that allows communication between the Thrift server and clients using that client code. HBase includes an Apache Thrift Proxy API, which allows you to write HBase applications in Python, C, C+ +, or another language that Thrift supports. The Thrift Proxy API is slower than the Java API and may have fewer features. To use the Thrift Proxy API, you need to configure and run the HBase Thrift server on your cluster. You also need to install the Apache Thrift compiler on your development system.

Preparing a thrift server and client

Learn how to prepare a Thrift server and client before using a Thrift Proxy API.

Before you begin

Ensure that the thrift server is configured and running.

Procedure

1. Generate *Thrift bindings* for the language of your choice, using an HBase IDL file, named HBase.thrift that is included as part of HBase.
2. Copy the Thrift libraries for your language into the same directory as the generated bindings.
3. Verify that the Thrift compiler version is newer than 0.9.0 by running the `thrift -version` command.
   You need to find the Hbase.thrift file from the HBase node or copy it to co-locate with the Thrift compiler.
   In the following Python example, these libraries provide the thrift.transport and thrift.protocol libraries. These commands show how you might generate the *Thrift bindings* for Python and copy the libraries on a Linux system.

   ```
   mkdir HBaseThrift
   cd HBaseThrift/
   thrift -gen py /path/to/Hbase.thrift
   mv gen-py/* .
   rm -rf gen-py/
   mkdir thrift
   cp -rp ~/Downloads/thrift/lib/py/src/* ./thrift/
   ```

Results

As a result, the HBase thrift Python bindings appears as follows:

```
HbaseThrift/
|-- hbased
|    |-- constants.py
|    |-- Hbase.py
```

```
|   |-- Hbase-remote
|   |-- __init__.py
|   `-- ttypes.py
|-- __init__.py
`-- thrift
    |-- compat.py
    |-- ext
    |   |-- binary.cpp
    |   |-- binary.h
    |   |-- compact.cpp
    |   |-- compact.h
    |   |-- endian.h
    |   |-- module.cpp
    |   |-- protocol.h
    |   |-- protocol.tcc
    |   |-- types.cpp
    |   `-- types.h
    |-- __init__.py
    |-- protocol
    |   |-- __init__.py
    |   |-- TBase.py
    |   |-- TBinaryProtocol.py
    |   |-- TCompactProtocol.py
    |   |-- THeaderProtocol.py
    |   |-- TJSONProtocol.py
    |   |-- TMultiplexedProtocol.py
    |   |-- TProtocolDecorator.py
    |   `-- TProtocol.py
    |-- server
    |   |-- __init__.py
    |   |-- THttpServer.py
    |   |-- TNonblockingServer.py
    |   |-- TProcessPoolServer.py
    |   `-- TServer.py
    |-- Thrift.py
    |-- TMultiplexedProcessor.py
    |-- transport
    |   |-- __init__.py
    |   |-- sslcompat.py
    |   |-- THeaderTransport.py
    |   |-- THttpClient.py
    |   |-- TSocket.py
    |   |-- TSSLSocket.py
    |   |-- TTransport.py
    |   |-- TTwisted.py
    |   `-- TZlibTransport.py
    |-- TRecursive.py
    |-- TSCons.py
    |-- TSerialization.py
    `-- TTornado.py
```

What to do next

List of Thrift API and HBase configurations

References for the right classes and functions along with the right configurations for HBase.

Classes and functions

Transport level

`TBufferedTransport`, `TFramedTransport`, `TSaslTransport`, and `THttpClient`

Protocol level

`TBinaryProtocol` and `TCompactProtocol`

HBase Thrift configurations

HBase thrift configurations

Property	Default value (secured)	Default value (unsecured)	Description
hbase.thrift.support.proxyuser	true	true	Use this to allow proxy users on the thrift gateway, which is mainly needed for `doAs` functionality.
hbase.regionserver.thrift.framed	true	true	Use framed transport. When using the `THsHaServer` or `TNonblockingServer`, framed transport is always used irrespective of this configuration value.
hbase.regionserver.thrift.compact	true	true	Use the `TCompactProtocol` instead of the default `TBinaryProtocol`. `TCompactProtocol` is a binary protocol that is more compact than the default and typically more efficient.
hbase.regionserver.thrift.http	true	true	Use this to enable HTTP server usage on thrift, which is mainly needed for `doAs` functionality.
hbase.thrift.security.qop	auth_conf	none	If this is set, HBase Thrift Server authenticates its clients. HBase Proxy User Hosts and Groups must be configured to allow specific users to access HBase through Thrift Server.
hbase.thrift.ssl.enabled	true	false	Encrypt communication between clients and HBase Thrift Server over HTTP using Transport Layer Security (TLS) (formerly known as Secure Socket Layer (SSL)).

Example for using THttpClient API in secure cluster

Refer to this example of using the THttpClient API in secure cluster.

THttpClient API in secure cluster

Let us consider that the cluster is secured with the configuration properties mentioned in the *HBase thrift configurations* table under the *Default value (secured)* column.

Before proceeding, ensure that the following applications are installed on your system.

- python 3.6.8 and python 3-devel
- pip 21.3.1
- virtualenv 20.17.1

Perform the following steps:

1. Install virtualenv using pip3. `pip3`

```
install virtualenv
```

2. Create a new virtual environment named *py3env*.

```
virtualenv py3env
```

3. Activate the virtual environment.

```
source py3env/bin/activate
```

4. Install the required Python packages and their specific versions. Consider you are inside the python3 virtual environment.

```
pip3 install kerberos==1.3.1 pure-sasl==0.6.2 setuptools==59.6.0 six==1.
16.0 wheel==0.37.1
```

This ensures that you have all the necessary dependencies and packages installed to proceed with your project.

```
from thrift.transport import THttpClient
from thrift.protocol import TBinaryProtocol
from hbase.Hbase import Client
from subprocess import call
import ssl
import kerberos
import os

# Get the env parameters
def get_env_params():
    # Replace with your own parameters
    hostname='your_hbase_thrift_hostname
    ' cert_file="your_cert_file"
    key_file="your_key_file"
    ca_file="your_ca_file"
    key_pw='your_key_pw'
    keytab_file='your_keytab' principal
    = 'your_principal'
    return hostname,cert_file,key_file,ca_file,keytab_file,principal,key_pw

#Check if a valid Kerberos ticket is already present in the
cache def check_kerberos_ticket():
    ccache_file = os.getenv('KRB5CCNAME')
    if ccache_file:
        ccache = CCache.load_ccache(ccache_file)
        if ccache.get_principal() and not ccache.get_principal().is_anonymou
s():
            return True
    return False

# Obtain a Kerberos ticket by running kinit from
keytab def kinit(keytab_file,principal):
    call(['kinit', '-kt', keytab_file, principal])
# Authenticate with Kerberos
def kerberos_auth():
    __, krb_context = kerberos.authGSSClientInit("HTTP")
    kerberos.authGSSClientStep(krb_context, "")
    negotiate_details = kerberos.authGSSClientResponse(krb_context)
    headers = {'Authorization': 'Negotiate ' + negotiate_details, 'Content-T
ype': 'application/binary'}
    return headers

# Initializete an SSL context with certificate verification
enabled def get_ssl_context():
    ssl_context = ssl.create_default_context()
    ssl_context.load_cert_chain(certfile=cert_file,keyfile=key_file,passw
o rd=key_pw)
```

```
    ssl_context.load_verify_locations(cafile=ca_file)
    return ssl_context
if __name__ == '__main__':
    hostname,cert_file,key_file,ca_file,keytab_file,principal,key_pw=get_env
_params()
    # Check if a valid Kerberos ticket is not in the cache, then
    kinit. if not check_kerberos_ticket():
        kinit(keytab_file,principal)

# create a THttpClient instance with the SSL context and custom headers
    httpClient = THttpClient.THttpClient('https://' + hostname + ':9090/', s
sl_context=get_ssl_context())
    httpClient.setCustomHeaders(headers=kerberos_auth())

# Initialize TBinaryProtocol with THttpClient
    protocol = TBinaryProtocol.TBinaryProtocol(httpClient)

# Create HBase client
    client = Client(protocol)
# Retrieve list of HBase tables
    tables = client.getTableNames()
    print(tables)
# Close connection
    httpClient.close(
    )
```

Related Information

List of Thrift API and HBase configurations

Example for using THttpClient API in unsecure cluster

Refer to this example of using the THttpClient API in unsecure cluster.

THttpClient API in unsecure cluster

Let us consider that the cluster is unsecured with the configuration properties mentioned in the *HBase thrift configurations* table under the *Default value (unsecured)* column.

```
from thrift.transport import THttpClient
from thrift.protocol import TBinaryProtocol
from hbase.Hbase import Client
# Replace with your own parameters
hostname = 'your_hbase_thrift_server_hostname'

# Initialize THttpClient
httpClient = THttpClient.THttpClient('http://' + hostname + ':9090/')

# Initialize TBinaryProtocol with THttpClient protocol =
TBinaryProtocol.TBinaryProtocol(httpClient)

# Create HBase client
client = Client(protocol)

# Retrieve  list  of  HBase  tables
tables  =  client.getTableNames()
print(tables)

# Close  connection
httpClient.close()
```

Related Information

List of Thrift API and HBase configurations

Example for using TSaslClientTransport API in secure cluster without HTTP

Refer to this example of using the TSaslClientTransport API in secure cluster without HTTP.

TSaslClientTransport API in secure cluster without HTTP

If you do not use `THttpClient` and want to use `TSaslClientTransport` for legacy compatibility reasons, ensure that you set hbase.regionserver.thrift.http property to false. The other settings could be same as the configuration properties mentioned in the *HBase thrift configurations* table under the *Default value (secured)* column.

```
from thrift.transport import TSocket
from thrift.transport import TTransport
from thrift.protocol import TBinaryProtocol
from thrift.protocol import TCompactProtocol
from hbase import Hbase

'''
Assume you already kinit the hbase principal, or you can use the
 function in example-1 to kinit.
'''
# Replace with your own parameters
thrift_host = 'your_hbase_thrift_server_hostname'
thrift_port = 9090

# Initialize TSocket and TTransport
socket = TSocket.TSocket(thrift_host, thrift_port)
transport=TTransport.TSaslClientTransport(socket,host=thrift_host,service=
' hbase',mechanism='GSSAPI')

# Initialize TCompactProtocol with TTransport
protocol = TCompactProtocol.TCompactProtocol(transport)

# Create HBase client
client = Hbase.Client(protocol)

# Open connection and retrieve list of HBase
tables transport.open()
tables = client.getTableNames()
print(tables)

# Close connection
transport.close()
```

Cloudera recommends you to use the HTTP options (Example-1 and Example-2). You can consider the Example-3 for legacy compatibility issues where some old applications might not rewrite the codes. This is because Hue is using HTTP mode to interact with HBase thrift, and if you disable the HTTP mode, Hue might not work properly with HBase.

Known bugs while using TSaslClientTransport with Kerberos enabled CDP versions

Upstream JIRA HBASE-21652, where a bug is introduced related to Kerberos principal handling. The affected versions are CDP 7.1.6 and earlier. The versions containing the fix are 7.1.7, 7.2.11, and later.

Related Information

List of Thrift API and HBase configurations

Using Apache HBase Hive integration

You can use the HBase Hive integration to create HBase tables and modify Apache HBase tables from Apache Hive.

HBase Hive integration enables you to READ and WRITE to existing HBase tables. Before you can access your data stored in HBase using Hive, ensure that you have completed the configuration that enables Apache Hive to interact with Apache HBase.

Configure Hive to use with HBase

To use Hive with HBase, you must add the HBase service as a dependency to the Hive service in Cloudera Manager.

About this task

The following steps are applicable when both HBase and Hive are in the same cluster.

Procedure

1. Go to Cloudera Manager.
2. Go to the Hive service.
3. Click the Configuration tab.
4. Select the intended HBase service. For example, HBASE-1 as dependency under HBase Service.
5. Click Save Changes.

   Repeat steps 2 to 5 for the HBase on Tez service.
6. Restart the Hive service.

   Restart the Hive on Tez service, when applicable.

Using HBase Hive integration

After you have configured HBase Hive integration, you can create an HBase table from Hive, and access that table from HBase.

About this task

Procedure

1. From the Hive shell, create an HBase table:

   ```
   CREATE EXTERNAL TABLE hbase_hive_table (key int, value string) STORED
   BY 'org.apache.hadoop.hive.hbase.HBaseStorageHandler' WITH
   SERDEPROPERTIES ("hbase.columns.mapping" = ":key,cf1:val")
   TBLPROPERTIES ("hbase.table.name" = "hbase_hive_table",
   "hbase.mapred.o utput.outputtable" = "hbase_hive_table");
   ```

   The hbase.columns.mapping property is mandatory. The hbase.table.name property is optional. The hbase.mapred .output.outputtable property is optional; it is needed, if you plan to insert data to the table.
2. From the HBase shell, access the hbase_hive_table:

   ```
   $ hbase shell
   hbase(main):001:0> list 'hbase_hive_table'

    1 row(s) in 0.0530 seconds
   ```

```
hbase(main):002:0> describe 'hbase_hive_table'
Table hbase_hive_table is ENABLED
hbase_hive_table COLUMN FAMILIES DESCRIPTION{NAME => 'cf',
DATA_BLOCK_ENCO DING => 'NONE', BLOOMFILTER => 'ROW', REPLICATION_SCOPE
=> '0', VERSIONS => '1', COMPRESSION => 'NONE', MIN_VERSIONS => '0', TTL
=> 'FOREVER', K EEP_DELETED_CELLS => 'FALSE', BLOCKSIZE => '65536',
IN_MEMORY => 'false', BLOCKCACHE => 'true'} 1 row(s) in 0.2860 seconds

hbase(main):003:0> scan 'hbase_hive_table'
ROW           COLUMN+CELL

0 row(s) in 0.0060 seconds
```

3. Insert the data into the HBase table through Hive:

```
INSERT OVERWRITE TABLE HBASE_HIVE_TABLE values (98, 'val_98');
```

4. From the HBase shell, verify that the data got loaded:

```
hbase(main):009:0> scan "hbase_hive_table"
ROW                          COLUMN+CELL

 98                          column=cf1:val, timestamp=1267737987733, valu
e=val_98
1 row(s) in 0.0110 seconds
```

5. From Hive, query the HBase data to view the data that is inserted in the hbase_hive_table:

```
hive> select * from HBASE_HIVE_TABLE;
Total MapReduce jobs = 1
Launching Job 1 out of 1
...
OK
98 val_98
Time taken: 4.582 seconds
```

Example

Use the following steps to access the existing HBase table through Hive.

- You can access the existing HBase table through Hive using the CREATE EXTERNAL TABLE:

```
CREATE EXTERNAL TABLE hbase_table_2(key int, value string)
STORED BY 'org.apache.hadoop.hive.hbase.HBaseStorageHandler' WITH
SERDEP ROPERTIES
("hbase.columns.mapping" = ":key,cf1:val")
TBLPROPERTIES("hbase.table.name" = "some_existing_table",
"hbase.mapred.output.outputtable" = "some_existing_table");
```

- You can use different type of column mapping to map the HBase columns to Hive:
  - Multiple Columns and Families To define four columns, the first being the rowkey: “:key,cf:a,cf:b,cf:c”
  - Hive MAP to HBase Column Family When the Hive data type is a Map, a column family with no qualifier might be used. This will use the keys of the Map as the column qualifier in HBase: “cf:”
  - Hive MAP to HBase Column Prefix When the Hive data type is a Map, a prefix for the column qualifier can be provided which will be prepended to the Map keys: “cf:prefix_.*”

    Note: The prefix is removed from the column qualifier as compared to the key in the Hive Map. For example, for the above column mapping, a column of “cf:prefix_a” would result in a key in the Map of “a”.

- You can also define composite row keys. Composite row keys use multiple Hive columns to generate the HBase row key.
    - Simple Composite Row Keys. A Hive column with a datatype of Struct will automatically concatenate all elements in the struct with the termination character specified in the DDL.
    - Complex Composite Row Keys and HBaseKeyFactory Custom logic can be implemented by writing Java code to implement a KeyFactory and provide it to the DDL using the table property key "hbase.composite.key.factory".

Using the HBase-Spark connector

You can use HBase-Spark connector on your secure cluster to perform READ and WRITE operations. The HBase-Spark Connector bridges the gap between the simple HBase Key Value store and complex relational SQL queries and enables users to perform complex data analytics on top of HBase using Spark.

An HBase DataFrame is a standard Spark DataFrame, and is able to interact with any other data sources such as Hive, ORC, Parquet, or JSON.

The following blog post provides additional information about Spark and HBase usage in CDP Public Cloud: How to use Apache Spark with CDP Operational Database Experience.

Configure HBase-Spark connector using Cloudera Manager

Learn how to configure HBase-Spark connector using Cloudera Manager.

Procedure

1. Go to the Spark or Spark3 service.
2. Click the Configuration tab.
3. Ensure that the HBase service is selected in Spark Service as a dependency.
4. Select Scope Gateway .
5. Select Category Advanced .
6. Locate the spark-defaults.conf.
    - Spark2: Locate the Spark Client Advanced Configuration Snippet (Safety Valve) for spark-conf/spark-defaults.conf property or search for it by typing its name in the Search box.
    - Spark3: Locate the Spark 3 Client Advanced Configuration Snippet (Safety Valve) for spark3-conf/spark-defaults.conf property or search for it by typing its name in the Search box.
7. Add the required properties to ensure that all required Phoenix and HBase platform dependencies are available on the classpath for the Spark executors and drivers.

    a) Upload all necessary jar files to the distributed filesystem, for example HDFS (it can be GS, ABFS, or S3A). If the CDH version is different on the remote HBase cluster, run the `hbase mapredcp` command on the HBase cluster and copy them to /path/hbase_jars_common location so that the Spark applications can use them.

    - Spark3 related files:

    ```
    hdfs dfs -mkdir /path/hbase_jars_spark3
    ```

    - Spark2 related files:

    ```
    hdfs dfs -mkdir /path/hbase_jars_spark2
    ```

- Common files for both Spark2 and Spark3:

```
hdfs dfs -mkdir /path/hbase_jars_common
hdfs dfs -put `hbase mapredcp | tr : " "` /path/hbase_jars_common
```

b) Download the /etc/hbase/conf/hbase-site.xml from the remote HBase cluster. Create the hbase-site.xml.jar file. The hbase-site.xml is added to the classpath with the spark.jars parameter because it is part of the jar file's root path.

```
jar cf hbase-site.xml.jar hbase-site.xml
hdfs dfs -put hbase-site.xml.jar /path/hbase_jars_common
```

c) Upload the Spark3 related files:

```
hdfs dfs -put /opt/cloudera/parcels/CDH/lib/hbase_connectors_for_spark3/
lib/hbase-spark3.jar /path/hbase_jars_spark3
hdfs dfs -put /opt/cloudera/parcels/CDH/lib/hbase_connectors_for_spark3/
lib/hbase-spark3-protocol-shaded.jar /path/hbase_jars_spark3
```

d) Upload the Spark2 related files:

```
hdfs dfs -put /opt/cloudera/parcels/CDH/lib/hbase_connectors/lib/hbase-
s park.jar /path/hbase_jars_spark2
hdfs dfs -put /opt/cloudera/parcels/CDH/lib/hbase_connectors/lib/hbase-
spark-protocol-shaded.jar /path/hbase_jars_spark2
hdfs dfs -put /opt/cloudera/parcels/CDH/lib/hbase_connectors/lib/scala-
library.jar /path/hbase_jars_spark2
```

e) Add all the Spark version related files and the `hbase mapredcp` files to the spark.jars parameter:

- Spark2:

```
spark.jars=hdfs:///path/hbase_jars_common/hbase-site.xml.jar,hdfs://
/path/hbase_jars_spark2/hbase-spark-protocol-shaded.jar,hdfs:///path
/hbase_jars_spark2/hbase-spark.jar,hdfs:///path/hbase_jars_spark2/sc
ala-library.jar,/path/hbase_jars_common(other common files)...
```

- Spark3:

```
spark.jars=hdfs:///path/hbase_jars_common/hbase-
site.xml.jar,hdfs://                  /path/hbase_jars_spark3/hbase-
spark3.jar,hdfs:///path/hbase_jars_spa    rk3/hbase-spark3-protocol-
shaded.jar,/path/hbase_jars_common(other c ommon files)...
```

8. Enter a Reason for change, and then click Save Changes to commit the changes.

9. Restart the role and service when Cloudera Manager prompts you to restart.

   Perform the following steps while using HBase RegionServer:

   Edit the HBase RegionServer configuration for running Spark Filter. Spark Filter is used when Spark SQL Where clauses are in use.

   a. In Cloudera Manager, select the HBase service.
   b. Click the Configuration tab.
   c. Search for regionserver environment.
   d. Find the RegionServer Environment Advanced Configuration Snippet (Safety Valve).
   e. Click the plus icon to add the following property:

      Key: HBASE_CLASSPATH

      Value:

      ```
      /opt/cloudera/parcels/CDH/lib/hbase_connectors/lib/hbase-spark-***VERSIO
      N NUMBER***-198.jar:/opt/cloudera/parcels/CDH/lib/hbase_connectors/lib/h
      base-spark-protocol-shaded-***VERSION     NUMBER***-198.jar:/opt/cloudera/pa
      rcels/CDH/jars/scala-library-2.11.12.jar
      ```
   f. Ensure that the listed jars have the correct version number in their name.
   g. Click Save Changes.
   h. Restart the Region Server.

What to do next

Build a Spark or Spark3 application using the dependencies that you provide when you run your application. If you follow the previous instructions, Cloudera Manager automatically configures the connector for Spark. If you have not:

- Consider the following example while using a Spark2 application:

  ```
  spark-shell   --conf   spark.jars=hdfs:///path/hbase_jars_common/hbase-site.
  xml.jar,hdfs:///path/hbase_jars_spark2/hbase-spark-protocol-shaded.jar,h
  dfs:///path/hbase_jars_spark2/hbase-spark.jar,hdfs:///path/hbase_jars_sp
  ark2/scala-library.jar,hdfs:///path/hbase_jars_common/hbase-shaded-mapre
  duce-***VERSION     NUMBER***.jar,hdfs:///path/hbase_jars_common/opentelemet
  ry-api-***VERSION     NUMBER***.jar,hdfs:///path/hbase_jars_common/opentelem
  etry-context-***VERSION NUMBER***.jar
  ```
- Consider the following example while using a Spark3 application:

  ```
  spark3-shell       --conf       spark.jars=hdfs:///path/hbase_jars_common/hbase-site
  .xml.jar,hdfs:///path/hbase_jars_spark3/hbase-spark3-protocol-shaded.jar
  ,hdfs:///path/hbase_jars_spark3/hbase-spark3.jar,hdfs:///path/hbase_jars
  _common/hbase-shaded-mapreduce-***VERSION             NUMBER***.jar,hdfs:///path/hba
  se_jars_common/opentelemetry-api-***VERSION             NUMBER***.jar,hdfs:///path/h
  base_jars_common/opentelemetry-context-***VERSION NUMBER***.jar
  ```

Related Information

Configure Phoenix-Spark connector using Cloudera Manager

Example: Using the HBase-Spark connector

Learn how to use the HBase-Spark connector by following an example scenario.

If you follow the instructions mentioned in *Configure HBase-Spark connector using Cloudera Manager* topic, Cloudera Manager automatically configures the connector for Spark. If you have not, add the following parameters to the command line while running `spark-submit`, `spark3-submit`, `spark-shell`, `spark3-shell`, `pyspark`, or `pyspark3` commands.

- Spark2:

```
--conf spark.jars=/path/to/hbase-site.xml.jar,/opt/cloudera/parcels/CDH/
lib/hbase_connectors/lib/hbase-spark.jar,/opt/cloudera/parcels/CDH/lib/h
base_connectors/lib/hbase-spark-protocol-shaded.jar,/opt/cloudera/parcels/
CDH/lib/hbase_connectors/lib/scala-library.jar,`hbase mapredcp | tr : ,`
```

- Spark3:

```
--conf    spark.jars=/path/to/hbase-site.xml.jar,/opt/cloudera/parcels/CDH/
lib/hbase_connectors_for_spark3/lib/hbase-spark3.jar,/opt/cloudera/parce
ls/CDH/lib/hbase_connectors_for_spark3/lib/hbase-spark3-protocol-shaded.
jar,`hbase mapredcp | tr : ,`
```

You can use the following command to create the hbase-site.xml.jar file. The hbase-site.xml is added to the classpath with the spark.jars parameter because it is part of the jar file's root path.

```
jar cf hbase-site.xml.jar hbase-site.xml
```

Schema

In this example we want to store personal data in an HBase table. We want to store name, email address, birth date and height as a floating point number. The contact information (email) is stored in the c column family and personal information (birth date, height) is stored in the p column family. The key in HBase table will be the name attribute.

	Spark	HBase
Type/Table	Person	person
Name	name: String	key
Email address	email: String	c:email
Birth date	birthDate: Date	p:birthDate
Height	height: Float	p:height

Create HBase table

Use the following command to create the HBase table:

```
shell> create 'person', 'p', 'c'
```

Insert data (Scala)

Use the following spark code in spark-shell or spark3-shell to insert data into our HBase table:

```
val sql = spark.sqlContext

import java.sql.Date

case class Person(name: String,
                 email: String,
                 birthDate: Date,
                 height: Float)
var personDS = Seq(
 Person("alice", "alice@alice.com", Date.valueOf("2000-01-01"),
4.5f), Person("bob", "bob@bob.com", Date.valueOf("2001-10-17"), 5.1f)
).toDS

personDS.write.format("org.apache.hadoop.hbase.spark")
 .option("hbase.columns.mapping",
   "name STRING :key, email STRING c:email, " + "birthDate
     DATE p:birthDate, height FLOAT p:height")
 .option("hbase.table", "person")
 .option("hbase.spark.use.hbasecontext", false)
 .save()
```

Insert data (Python)

Use the following spark code in pyspark or pyspark3 to insert data into our HBase table:

```
from datetime import datetime
from pyspark.sql.types import StructType, StructField, StringType,
 DateType, FloatType

data = [("alice","alice@alice.com", datetime.strptime("2000-01-01",'%Y-
%m-%d'), 4.5),
    ("bob","bob@bob.com", datetime.strptime("2001-10-17",'%Y-%m-%d'), 5.1)
  ]

schema = StructType([ \
    StructField("name",StringType(),True), \
    StructField("email",StringType(),True), \
    StructField("birthDate", DateType(),True), \
    StructField("height", FloatType(), True)
  ])

personDS = spark.createDataFrame(data=data,schema=schema)

personDS.write.format("org.apache.hadoop.hbase.spark").option("hbase.colu
mns.mapping", "name STRING :key, email STRING c:email, birthDate DATE
p:birt hDate, height FLOAT p:height").option("hbase.table",
"person").option("hbase .spark.use.hbasecontext", False).save()
```

Scan data

The previously inserted data can be tested with a simple scan:

```
shell> scan ‘person’
ROW  COLUMN+CELL
 alice column=c:email, timestamp=1568723598292, value=alice@alice.com alice
column=p:birthDate, timestamp=1568723598292, value=\x00\x00\x00\xDCl \x87
\x00
 alice column=p:height, timestamp=1568723598292, value=@\x90\x00\x00
 bob column=c:email, timestamp=1568723598521, value=bob@bob.com
 bob column=p:birthDate, timestamp=1568723598521, value=\x00\x00\x00\xE9\
x99u\x95\x80
 bob column=p:height, timestamp=1568723598521, value=@\xA333
2 row(s)
```

Read data back (Scala)

Use the following snippet in spark-shell or spark3-shell to read the data back:

```
val sql = spark.sqlContext

val df = sql.read.format("org.apache.hadoop.hbase.spark")
  .option("hbase.columns.mapping",
    "name STRING :key, email STRING c:email, " + "birthDate
      DATE p:birthDate, height FLOAT p:height")
  .option("hbase.table", "person")
  .option("hbase.spark.use.hbasecontext", false)
```

```
 .load()
df.createOrReplaceTempView("personView")

val results = sql.sql("SELECT * FROM personView WHERE name = 'alice'")
results.show()
```

The result of this snippet is the following Data Frame:

```
-----++------+-------------------------+ +
| name|height|           email| birthDate|
+-----+------+---------------+---------- +
|alice|    4.5|alice@alice.com|2000-01-01|
+-----+------+---------------+---------- +
```

Read data back (Python)

Use the following snippet in pyspark or pyspark3 to read the data back:

```
from pyspark.sql import SparkSession
spark = SparkSession.builder.appName("Test HBase Connector from
Python").ge tOrCreate()
df = spark.read.format("org.apache.hadoop.hbase.spark").option("hbase.colum
ns.mapping", "name STRING :key, email STRING c:email, birthDate DATE
p:birth Date, height FLOAT p:height").option("hbase.table",
"person").option("hbase. spark.use.hbasecontext", False).load()
df.createOrReplaceTempView("personView")
results = spark.sql("SELECT * FROM personView WHERE name = 'alice'")
results.show()
```

Test spark-submit or spark3-submit

Use the following snippet to test spark-submit or spark3-submit commands in Spark cluster mode.

pyspark_app.py:

```
from pyspark.sql import SparkSession
spark = SparkSession.builder.appName("Test HBase Connector from
Python").ge tOrCreate()
df = spark.read.format("org.apache.hadoop.hbase.spark").option("hbase.colum
ns.mapping", "name STRING :key, email STRING c:email, birthDate DATE
p:birth Date, height FLOAT p:height").option("hbase.table",
"person").option("hbase. spark.use.hbasecontext", False).load()
df.createOrReplaceTempView("personView")
results = spark.sql("SELECT * FROM personView WHERE name = 'alice'")
results.show()
spark.stop()
```

Test commands:

- Spark2:

```
spark-submit   --deploy-mode   cluster   --conf   spark.jars=/path/to/hbase-site
.xml.jar,/opt/cloudera/parcels/CDH/lib/hbase_connectors/lib/hbase-spark.
jar,/opt/cloudera/parcels/CDH/lib/hbase_connectors/lib/hbase-spark-proto    col-
shaded.jar,/opt/cloudera/parcels/CDH/lib/hbase_connectors/lib/scala-
library.jar,`hbase mapredcp | tr : ,` pyspark_app.py
```

- Spark3:

```
spark3-submit --deploy-mode cluster --conf spark.jars=/path/to/hbase-sit
e.xml.jar,/opt/cloudera/parcels/CDH/lib/hbase_connectors_for_spark3/lib/
```

```
hbase-spark3.jar,/opt/cloudera/parcels/CDH/lib/hbase_connectors_for_spar
k3/lib/hbase-spark3-protocol-shaded.jar,`hbase mapredcp | tr : ,` pyspar
k_app.py
```

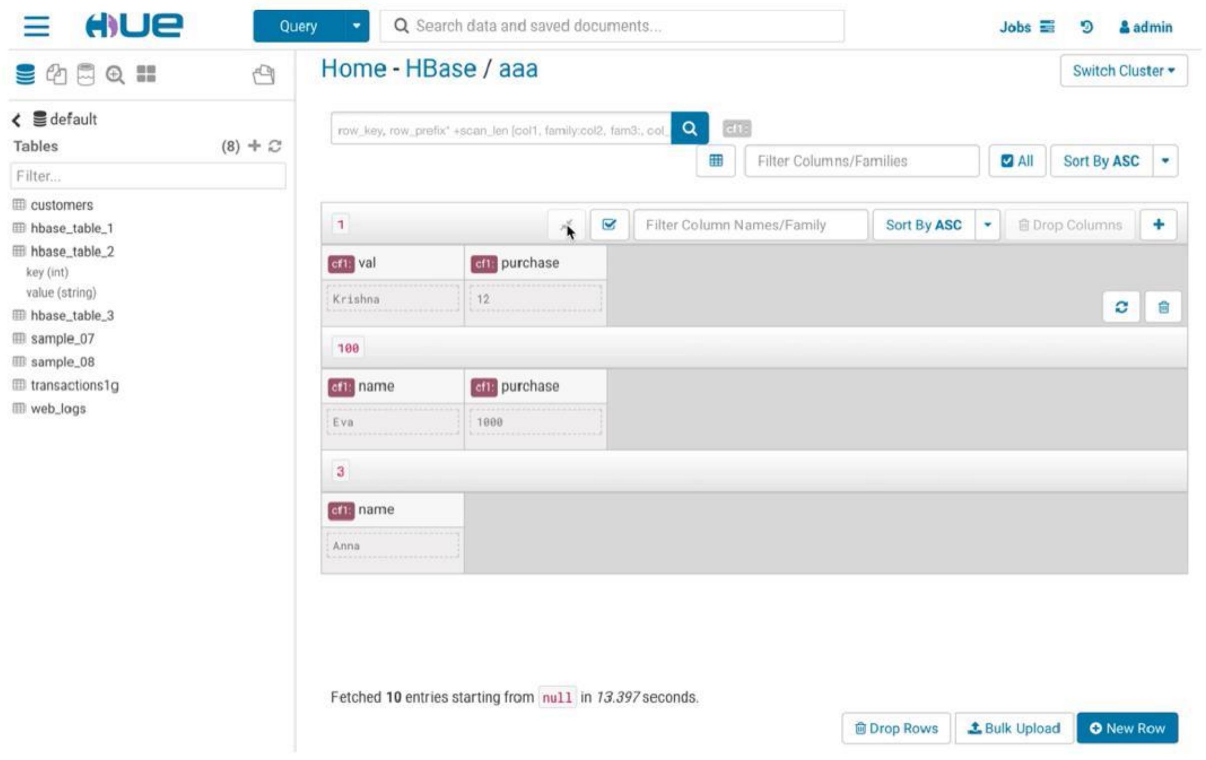
Related Information

Configure HBase-Spark connector using Cloudera Manager

Use the Hue HBase app

Hue is a web-based interactive query editor that enables you to interact with data warehouses. You can use the HBase Browser application in Hue to create and browse HBase tables.

The HBase Hue app enables you to insert a new row or bulk upload CSV files, TSV files, and type data into your table. You can also insert columns into your row. If you need more control or data about your cell, you can use the full editor to edit a cell.



1
cf1: val Krishna
cf1: purchase 12

100
cf1: name Eva
cf1: purchase 1000

3
cf1: name Anna

Fetched 10 entries starting from null in 13.397 seconds.

If you are using the HBase Thrift interface, Hue fits in between the Thrift Server and the HBase client, and the Thrift Server assumes that all HBase operations come from the hue user and not the client. To ensure that users in Hue are only allowed to perform HBase operations assigned to their own credentials, and not those of the hue user, you must enable doAs Impersonation for the HBase Browser Application.

Related Information

Hue

Configure the HBase thrift server role

You must configure the Thrift Server Role to access certain features such as the Hue HBase browser.

About this task

The Thrift Server role is not added by default when you install HBase, but it is required before you can use certain other features such as the Hue HBase browser. To add the Thrift Server role:

Procedure

1. Go to the HBase service.
2. Click the Instances tab.
3. Click the Add Role Instances button.
4. Select the host(s) where you want to add the Thrift Server role (you only need one for Hue) and click Continue. The Thrift Server role should appear in the instances list for the HBase server.
5. Select the Thrift Server role instance.
6. Select Actions for Selected > Start.