Apache Phoenix (SQL on HBase) Installation

Tao Wu, 06/18/2015

1 What is Apache Phoenix

Apache Phoenix is a relational database layer over HBase delivered as a client-embedded JDBC driver targeting low latency queries over HBase data. Apache Phoenix takes your SQL query, compiles it into a series of HBase scans, and orchestrates the running of those scans to produce regular JDBC result sets. The table metadata is stored in an HBase table and versioned, such that snapshot queries over prior versions will automatically use the correct schema. Direct use of the HBase API, along with coprocessors and custom filters, results in performance on the order of milliseconds for small queries, or seconds for tens of millions of rows.

https://phoenix.apache.org/

2 Who is using Apache Phoenix

It is open-sourced by Saleforce.com, now is top-level apache project, and Cloudera announced their support on Apache Phoenix in their labs. Hortonworks also integrates Phoenix in HDP.

https://phoenix.apache.org/who_is_using.html

http://blog.cloudera.com/blog/2015/05/apache-phoenix-joins-cloudera-labs/

3 Installation and Short Try

3.1 Prepare package.

3.1.1 Checkout the Cloudera version of Phoenix

https://github.com/cloudera-labs/phoenix/tree/master

Checkout the commit c870bd8e1cb27d7d8e2bc954a6ff1b528a9177bd for version CLOUDERA-BUILD Fixing the incompats against CDH5.4 HBase

git checkout c870bd8e1cb27d7d8e2bc954a6ff1b528a9177bd

3.1.2 Maven Build

mvn package –Dskiptests

Fix the maven build problem.

```
[ERROR] /home/taowu/git-newegg/phoenix/phoenix-core/src/it/java/org/apache/hadoop/hbase/regionserver/wal/WALReplayWithIndexWritesAndCompressedWALIT.java:[101,49] cannot access org.apache.hadoop.hdfs.DistributedFileSystem
  class file for org.apache.hadoop.hdfs.DistributedFileSystem not found
```

add Hadoop-hdfs dependency in pom.xml to fix this problem

```
+    <dependency>
+      <groupId>org.apache.hadoop</groupId>
+      <artifactId>hadoop-hdfs</artifactId>
+      <version>${hadoop-two.version}</version>
+     </dependency>
```

3.2 Deployment

3.2.1 Deploy phoenix jar to region servers.

Copy these 2 jars to hbase lib folder

phoenix-4.3.0-cdh5.4.0-SNAPSHOT-server.jar
phoenix-core-4.3.0-cdh5.4.0-SNAPSHOT.jar

The HBase lib folder should be like this for Cloudera Manager Installation:

/opt/cloudera/parcels/CDH-5.4.0-1.cdh5.4.0.p0.27/lib/hbase/lib
sudo chmod 777 phoenix-.jar*

3.2.2 Restart HBase cluster.

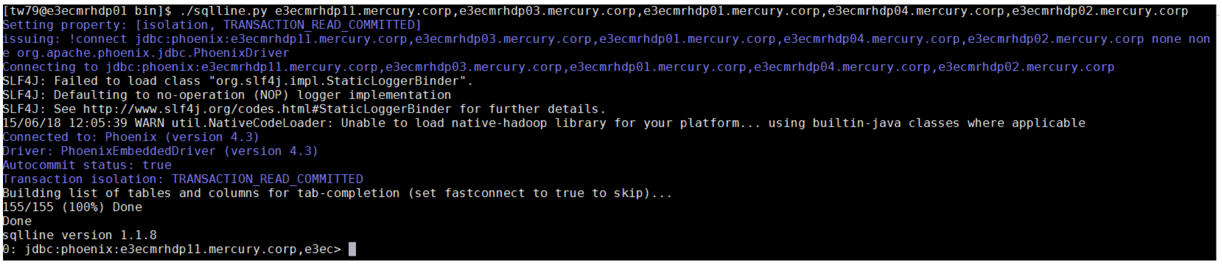
3.3 Command Line Client Deployment

Note: Should run this client by JDK 7

untar the phoenix-4.3.0-cdh5.4.0.tar.gz

3.3.1 Try sqlline.py to verify the installation.

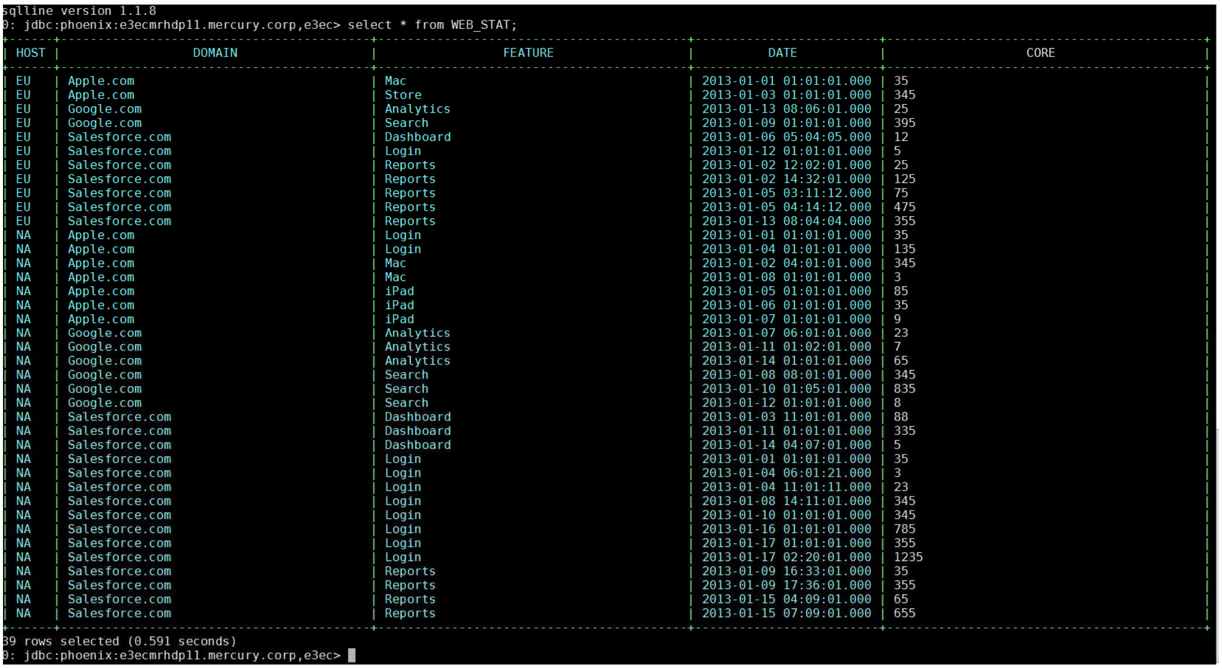
./sqlline.py server11,server03,server01,server04,server02



```
[tw79@e3ecmrhdp01 bin]$ ./sqlline.py e3ecmrhdp11.mercury.corp,e3ecmrhdp03.mercury.corp,e3ecmrhdp01.mercury.corp,e3ecmrhdp04.mercury.corp,e3ecmrhdp02.mercury.corp
Setting property: [isolation, TRANSACTION_READ_COMMITTED]
issuing: !connect jdbc:phoenix:e3ecmrhdp11.mercury.corp,e3ecmrhdp03.mercury.corp,e3ecmrhdp01.mercury.corp,e3ecmrhdp04.mercury.corp,e3ecmrhdp02.mercury.corp none non
e org.apache.phoenix.jdbc.PhoenixDriver
Connecting to jdbc:phoenix:e3ecmrhdp11.mercury.corp,e3ecmrhdp03.mercury.corp,e3ecmrhdp01.mercury.corp,e3ecmrhdp04.mercury.corp,e3ecmrhdp02.mercury.corp
SLF4J: Failed to load class "org.slf4j.impl.StaticLoggerBinder".
SLF4J: Defaulting to no-operation (NOP) logger implementation
SLF4J: See http://www.slf4j.org/codes.html#StaticLoggerBinder for further details.
15/06/18 12:05:39 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
Connected to: Phoenix (version 4.3)
Driver: PhoenixEmbeddedDriver (version 4.3)
Autocommit status: true
Transaction isolation: TRANSACTION_READ_COMMITTED
Building list of tables and columns for tab-completion (set fastconnect to true to skip)...
155/155 (100%) Done
Done
sqlline version 1.1.8
0: jdbc:phoenix:e3ecmrhdp11.mercury.corp,e3ec>
```

3.3.2 Try psql.py to import data to do test.

./psql.py server01,server02,server03,server04,server11 ../examples/WEB_STAT.sql ../examples/WEB_STAT.csv ../examples/WEB_STAT_QUERIES.sql



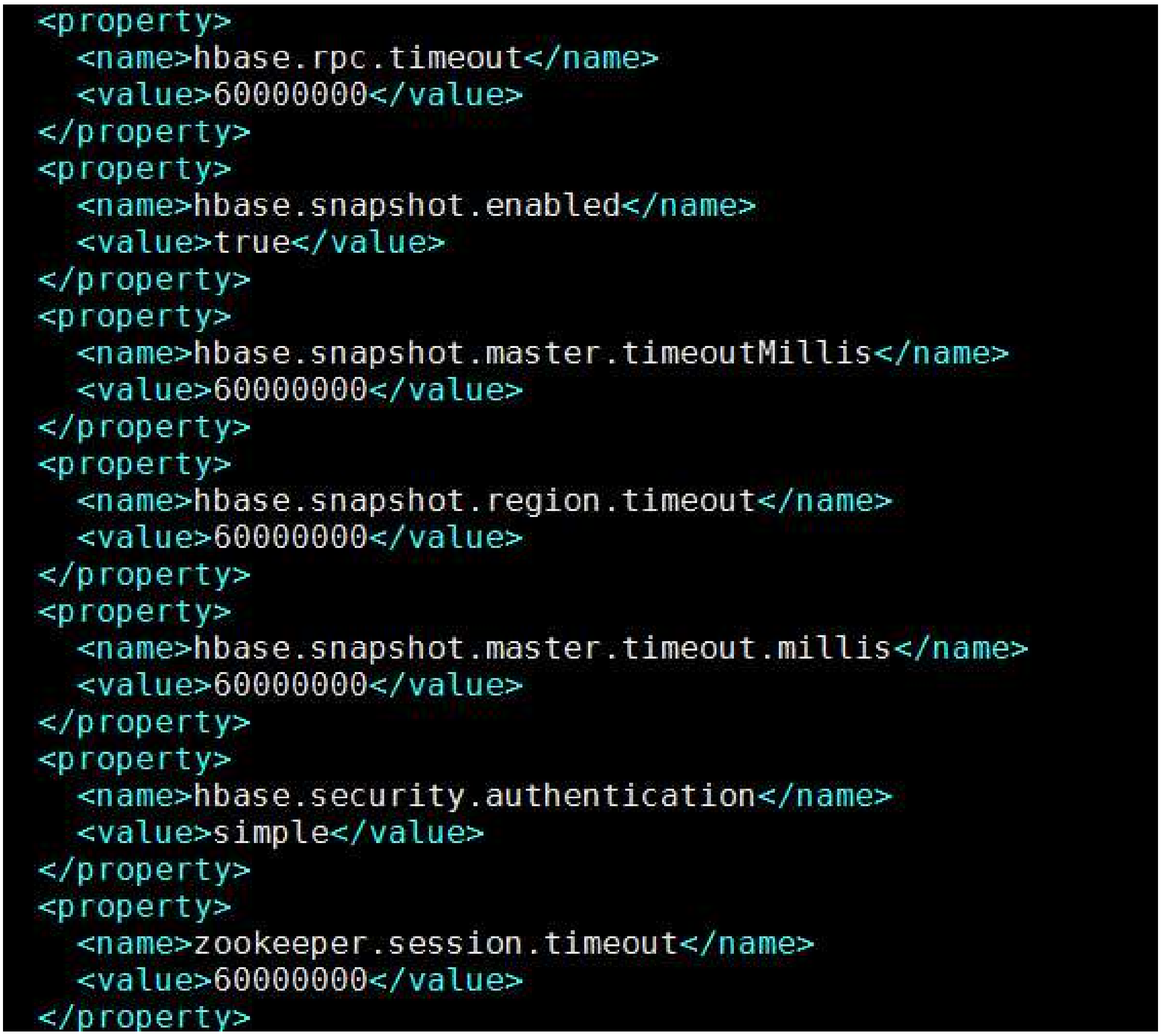
```
sqlline version 1.1.8
0: jdbc:phoenix:e3ecmrhdp11.mercury.corp,e3ec> select * from WEB_STAT;
+------+------------------------+------------------------+--------------------------+------------------------+
| HOST |         DOMAIN         |        FEATURE         |           DATE           |          CORE          |
+------+------------------------+------------------------+--------------------------+------------------------+
| EU   | Apple.com              | Mac                    | 2013-01-01 01:01:01.000  | 35                     |
| EU   | Apple.com              | Store                  | 2013-01-03 01:01:01.000  | 345                    |
| EU   | Google.com             | Analytics              | 2013-01-13 08:06:01.000  | 25                     |
| EU   | Google.com             | Search                 | 2013-01-09 01:01:01.000  | 395                    |
| EU   | Salesforce.com         | Dashboard              | 2013-01-06 05:04:05.000  | 12                     |
| EU   | Salesforce.com         | Login                  | 2013-01-12 01:01:01.000  | 5                      |
| EU   | Salesforce.com         | Reports                | 2013-01-02 12:02:01.000  | 25                     |
| EU   | Salesforce.com         | Reports                | 2013-01-02 14:32:01.000  | 125                    |
| EU   | Salesforce.com         | Reports                | 2013-01-05 03:11:12.000  | 75                     |
| EU   | Salesforce.com         | Reports                | 2013-01-05 04:14:12.000  | 475                    |
| EU   | Salesforce.com         | Reports                | 2013-01-13 08:04:04.000  | 355                    |
| NA   | Apple.com              | Login                  | 2013-01-01 01:01:01.000  | 35                     |
| NA   | Apple.com              | Login                  | 2013-01-04 01:01:01.000  | 135                    |
| NA   | Apple.com              | Mac                    | 2013-01-02 04:01:01.000  | 345                    |
| NA   | Apple.com              | Mac                    | 2013-01-08 01:01:01.000  | 3                      |
| NA   | Apple.com              | iPad                   | 2013-01-05 01:01:01.000  | 85                     |
| NA   | Apple.com              | iPad                   | 2013-01-06 01:01:01.000  | 35                     |
| NA   | Apple.com              | iPad                   | 2013-01-07 01:01:01.000  | 9                      |
| NA   | Google.com             | Analytics              | 2013-01-07 06:01:01.000  | 23                     |
| NA   | Google.com             | Analytics              | 2013-01-11 01:02:01.000  | 7                      |
| NA   | Google.com             | Analytics              | 2013-01-14 01:01:01.000  | 65                     |
| NA   | Google.com             | Search                 | 2013-01-08 08:01:01.000  | 345                    |
| NA   | Google.com             | Search                 | 2013-01-10 01:05:01.000  | 835                    |
| NA   | Google.com             | Search                 | 2013-01-12 01:01:01.000  | 8                      |
| NA   | Salesforce.com         | Dashboard              | 2013-01-03 11:01:01.000  | 88                     |
| NA   | Salesforce.com         | Dashboard              | 2013-01-11 01:01:01.000  | 335                    |
| NA   | Salesforce.com         | Dashboard              | 2013-01-14 04:07:01.000  | 5                      |
| NA   | Salesforce.com         | Login                  | 2013-01-01 01:01:01.000  | 35                     |
| NA   | Salesforce.com         | Login                  | 2013-01-04 06:01:21.000  | 3                      |
| NA   | Salesforce.com         | Login                  | 2013-01-04 11:01:11.000  | 23                     |
| NA   | Salesforce.com         | Login                  | 2013-01-08 14:11:01.000  | 345                    |
| NA   | Salesforce.com         | Login                  | 2013-01-10 01:01:01.000  | 345                    |
| NA   | Salesforce.com         | Login                  | 2013-01-16 01:01:01.000  | 785                    |
| NA   | Salesforce.com         | Login                  | 2013-01-17 01:01:01.000  | 355                    |
| NA   | Salesforce.com         | Login                  | 2013-01-17 02:20:01.000  | 1235                   |
| NA   | Salesforce.com         | Reports                | 2013-01-09 16:33:01.000  | 35                     |
| NA   | Salesforce.com         | Reports                | 2013-01-09 17:36:01.000  | 355                    |
| NA   | Salesforce.com         | Reports                | 2013-01-15 04:09:01.000  | 65                     |
| NA   | Salesforce.com         | Reports                | 2013-01-15 07:09:01.000  | 655                    |
+------+------------------------+------------------------+--------------------------+------------------------+
39 rows selected (0.591 seconds)
0: jdbc:phoenix:e3ecmrhdp11.mercury.corp,e3ec>
```

3.3.3 Create a phoenix view for existing HBase Table.

Create View IM_ItemPrice for Testing

```
CREATE VIEW "data:basetable" ( pk VARCHAR PRIMARY KEY,
"Info"."AITMark" VARCHAR,
"Info"."Active" VARCHAR,
"Info"."Buyer" VARCHAR,
"Info"."ComboReservedQ4S" VARCHAR,
"Info"."CompanyCode" VARCHAR,
"Info"."CountryCode" VARCHAR,
"Info"."CurrencyCode" VARCHAR,
"Info"."DefaultShipVia" VARCHAR,
"Info"."DefaultShippingCharge" VARCHAR,
"Info"."DisableAutoActivateFlag" VARCHAR,
"Info"."DiscountInstant" VARCHAR,
"Info"."EggSaverMark" VARCHAR,
"Info"."EggSaverMaxQty" VARCHAR,
"Info"."EggSaverShippingCharge" VARCHAR,
"Info"."EggSaverShippingType" VARCHAR,
"Info"."GiftWrapItem" VARCHAR,
"Info"."ItemNumber" VARCHAR,
"Info"."LastEditDate" VARCHAR,
"Info"."LastEditUser" VARCHAR,
"Info"."LimitQuantity" VARCHAR,
"Info"."MAPPrice" VARCHAR,
"Info"."MAPPriceMark" VARCHAR,
"Info"."ManufacturerWarrantyMark" VARCHAR,
"Info"."MinShippingCharge" VARCHAR,
"Info"."MinimumQuantity" VARCHAR,
"Info"."PremierMark" VARCHAR,
"Info"."PriceAutoAdjustMark" VARCHAR,
"Info"."PriceHideMark" VARCHAR,
"Info"."ProductManager" VARCHAR,
"Info"."PromotionPrice1" VARCHAR,
"Info"."PromotionPrice2" VARCHAR,
"Info"."PromotionPrice3" VARCHAR,
"Info"."PromotionPrice4" VARCHAR,
"Info"."PromotionPrice5" VARCHAR,
"Info"."PromotionQTY1" VARCHAR,
"Info"."PromotionQTY2" VARCHAR,
"Info"."PromotionQTY3" VARCHAR,
"Info"."PromotionQTY4" VARCHAR,
"Info"."PromotionQTY5" VARCHAR,
"Info"."PromotionShipping1" VARCHAR,
"Info"."PromotionShipping2" VARCHAR,
"Info"."PromotionShipping3" VARCHAR,
"Info"."PromotionShipping4" VARCHAR,
"Info"."PromotionShipping5" VARCHAR,
"Info"."PurolatorCANShippingCharge" VARCHAR,
"Info"."PurolatorCANShippingType" VARCHAR,
"Info"."PurolatorUSAShippingCharge" VARCHAR,
"Info"."PurolatorUSAShippingType" VARCHAR,
"Info"."RepackMark" VARCHAR,
"Info"."RestrictedItemMark" VARCHAR,
"Info"."SameDayShippingCharge" VARCHAR,
"Info"."SameDayShippingMark" VARCHAR,
"Info"."SameDayShippingType" VARCHAR,
"Info"."ShipByNewegg" VARCHAR,
"Info"."ShippingPromotionGroupID" VARCHAR,
"Info"."ShippingType" VARCHAR,
"Info"."ShopRunnerMark" VARCHAR,
"Info"."SignatureRequiredMark" VARCHAR,
"Info"."UnitPrice" VARCHAR,
"Info"."WarrantyCode" VARCHAR,
"Info"."WebsiteBlockMark" VARCHAR
);
```

3.3.4 Enlarge the time out seconds for HBase client

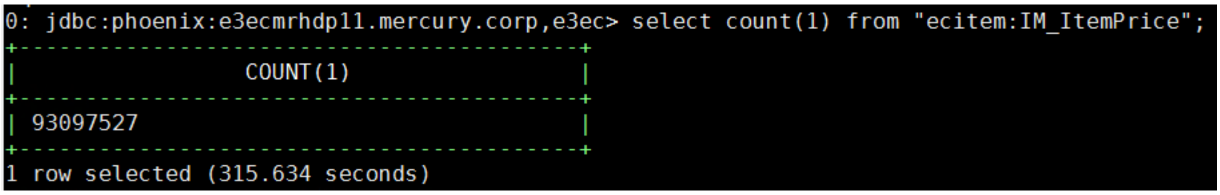


```
<property>
  <name>hbase.rpc.timeout</name>
  <value>60000000</value>
</property>
<property>
  <name>hbase.snapshot.enabled</name>
  <value>true</value>
</property>
<property>
  <name>hbase.snapshot.master.timeoutMillis</name>
  <value>60000000</value>
</property>
<property>
  <name>hbase.snapshot.region.timeout</name>
  <value>60000000</value>
</property>
<property>
  <name>hbase.snapshot.master.timeout.millis</name>
  <value>60000000</value>
</property>
<property>
  <name>hbase.security.authentication</name>
  <value>simple</value>
</property>
<property>
  <name>zookeeper.session.timeout</name>
  <value>60000000</value>
</property>
```

3.3.5 Testing on ItemPriceSetting data

Count IM_ItemPrice for 93097527 records in 315 seconds (5 minutes)

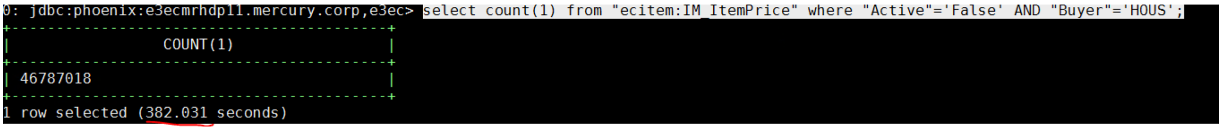
select count(1) from "data:basetable";



```
0: jdbc:phoenix:e3ecmrhdp11.mercury.corp,e3ec> select count(1) from "ecitem:IM_ItemPrice";
+------------------------------------------+
|                 COUNT(1)                 |
+------------------------------------------+
| 93097527                                 |
+------------------------------------------+
1 row selected (315.634 seconds)
```

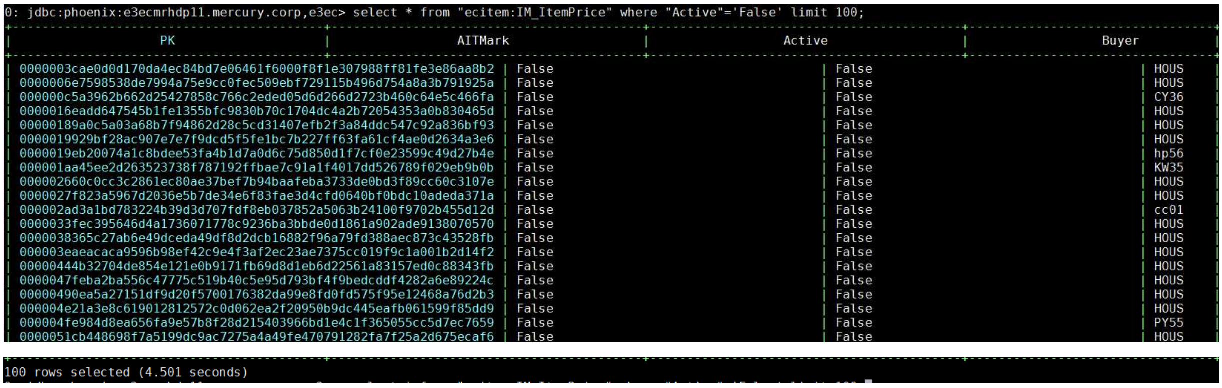
Filter entire table data on specific column in 6 minutes.

select count(1) from "data:basetable" where "Active"='False' AND "Buyer"='HOUS';



```
0: jdbc:phoenix:e3ecmrhdp11.mercury.corp,e3ec> select count(1) from "ecitem:IM_ItemPrice" where "Active"='False' AND "Buyer"='HOUS';
+------------------------------------------+
|                 COUNT(1)                 |
+------------------------------------------+
| 46787018                                 |
+------------------------------------------+
1 row selected (382.031 seconds)
```

*select * from "data:basetable" where "Active"='False' limit 100;*



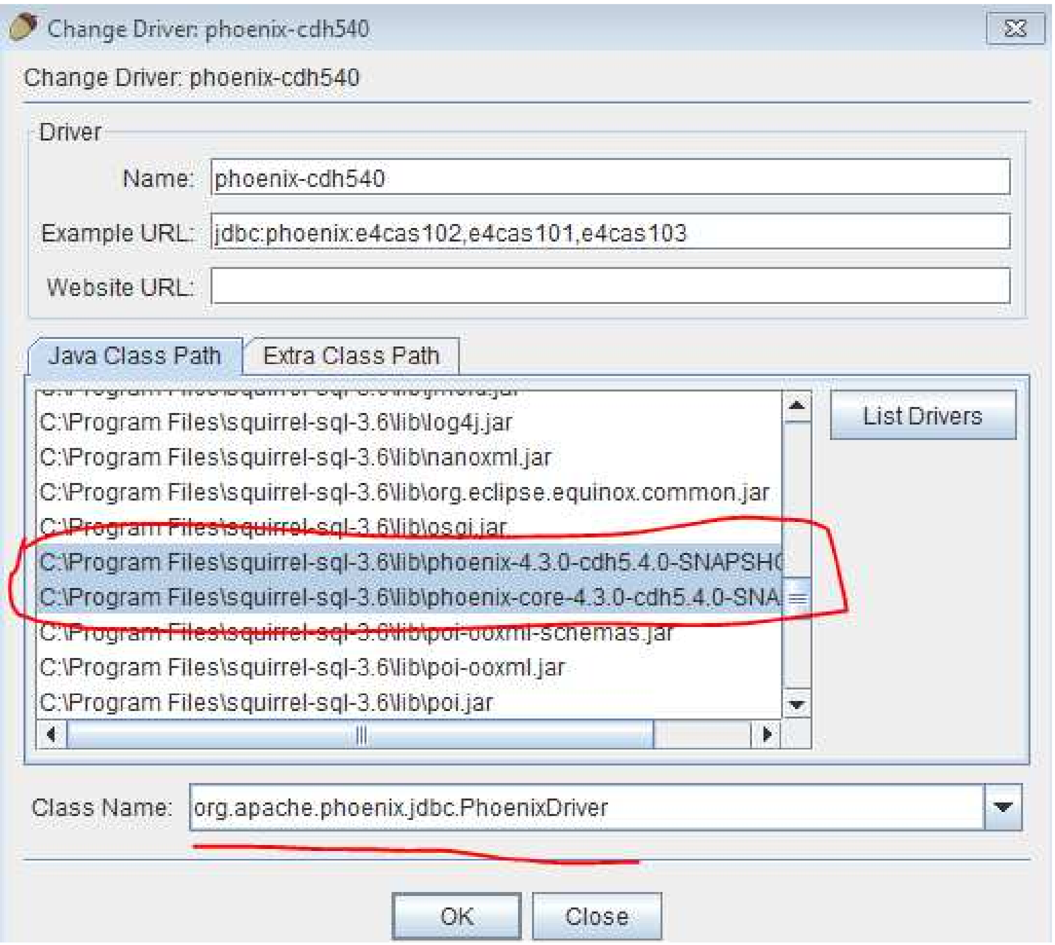
```
0: jdbc:phoenix:e3ecmrhdp11.mercury.corp,e3ec> select * from "ecitem:IM_ItemPrice" where "Active"='False' limit 100;
+------------------------------------------------------------------+----------+----------+----------+
|                                PK                                | AITMark  |  Active  |  Buyer   |
+------------------------------------------------------------------+----------+----------+----------+
| 0000003cae0d0d170da4ec84bd7e06461f6000f8f1e307988ff81fe3e86aa8b2 | False | False | HOUS |
| 0000006e7598538de7994a75e9cc0fec509ebf729115b496d754a8a3b791925a | False | False | HOUS |
| 000000c5a3962b662d25427858c766c2eded05d6d266d2723b460c64e5c466fa | False | False | CY36 |
| 0000016eadd647545b1fe1355bfc9830b70c1704dc4a2b72054353a0b830465d | False | False | HOUS |
| 00000189a0c5a03a68b7f94862d28c5cd31407efb2f3a84ddc547c92a836bf93 | False | False | HOUS |
| 0000019929bf28ac907e7e7f9dcd5f5fe1bc7b227ff63fa61cf4ae0d2634a3e6 | False | False | HOUS |
| 0000019eb20074a1c8bdee53fa4b1d7a0d6c75d850d1f7cf0e23599c49d27b4e | False | False | hp56 |
| 000001aa45ee2d263523738f787192ffbae7c91a1f4017dd526789f029eb9b0b | False | False | KW35 |
| 000002660c0cc3c2861ec80ae37bef7b94baafeba3733de0bd3f89cc60c3107e | False | False | HOUS |
| 0000027f823a5967d2036e5b7de34e6f83fae3d4cfd0640bf0bdc10adeda371a | False | False | HOUS |
| 000002ad3a1bd783224b39d3d707fdf8eb037852a5063b24100f9702b455d12d | False | False | cc01 |
| 0000033fec395646d4a1736071778c9236ba3bbde0d1861a902ade9138070570 | False | False | HOUS |
| 0000038365c27ab6e49dceda49df8d2dcb16882f96a79fd388aec873c43528fb | False | False | HOUS |
| 000003eaeacaca9596b98ef42c9e4f3af2ec23ae7375cc019f9c1a001b2d14f2 | False | False | HOUS |
| 00000444b32704de854e121e0b9171fb69d8d1eb6d22561a83157ed0c88343fb | False | False | HOUS |
| 0000047feba2ba556c47775c519b40c5e95d793bf4f9bedcddf4282a6e89224c | False | False | HOUS |
| 00000490ea5a27151df9d20f5700176382da99e8fd0fd575f95e12468a76d2b3 | False | False | HOUS |
| 000004e21a3e8c619012812572c0d062ea2f20950b9dc445eafb061599f85dd9 | False | False | HOUS |
| 000004fe984d8ea656fa9e57b8f28d215403966bd1e4c1f365055cc5d7ec7659 | False | False | PY55 |
| 0000051cb448698f7a5199dc9ac7275a4a49fe470791282fa7f25a2d675ecaf6 | False | False | HOUS |
+------------------------------------------------------------------+----------+----------+----------+
100 rows selected (4.501 seconds)
```

3.4 Use Squirrel Client

3.4.1 Add Phoenix Driver

Put phoenix-*-client.jar and phoenix-core-*.jar in <Squirrel Path>/lib

If you need to customize the hbase-site.xml /hdfs-site.xml / core-site/xml, you can also put them in <Squirrel Path>/lib path.



Change Driver: phoenix-cdh540

Driver

Name: phoenix-cdh540

Example URL: jdbc:phoenix:e4cas102,e4cas101,e4cas103

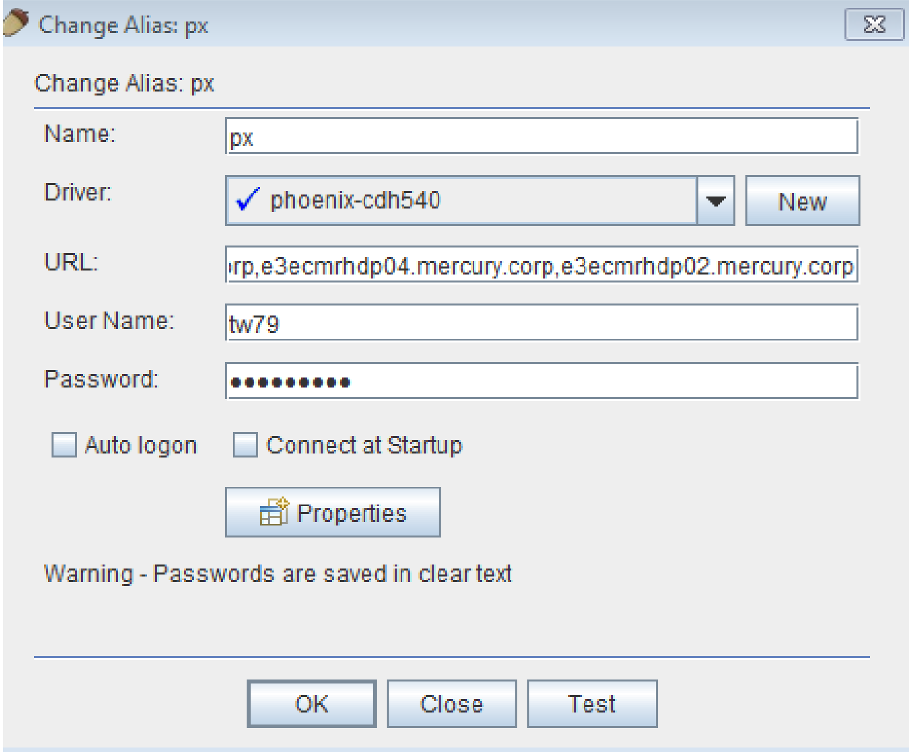
Website URL:

```
C:\Program Files\squirrel-sql-3.6\lib\log4j.jar
C:\Program Files\squirrel-sql-3.6\lib\nanoxml.jar
C:\Program Files\squirrel-sql-3.6\lib\org.eclipse.equinox.common.jar
C:\Program Files\squirrel-sql-3.6\lib\osgi.jar
C:\Program Files\squirrel-sql-3.6\lib\phoenix-4.3.0-cdh5.4.0-SNAPSH
C:\Program Files\squirrel-sql-3.6\lib\phoenix-core-4.3.0-cdh5.4.0-SNA
C:\Program Files\squirrel-sql-3.6\lib\poi-ooxml-schemas.jar
C:\Program Files\squirrel-sql-3.6\lib\poi-ooxml.jar
C:\Program Files\squirrel-sql-3.6\lib\poi.jar
```

Class Name: org.apache.phoenix.jdbc.PhoenixDriver

3.4.2 Add Alias for Phoenix Client:

Enter ZK Server List for URL.



Change Alias: px

Name: px

Driver: ✓ phoenix-cdh540

URL: ırp,e3ecmrhdp04.mercury.corp,e3ecmrhdp02.mercury.corp

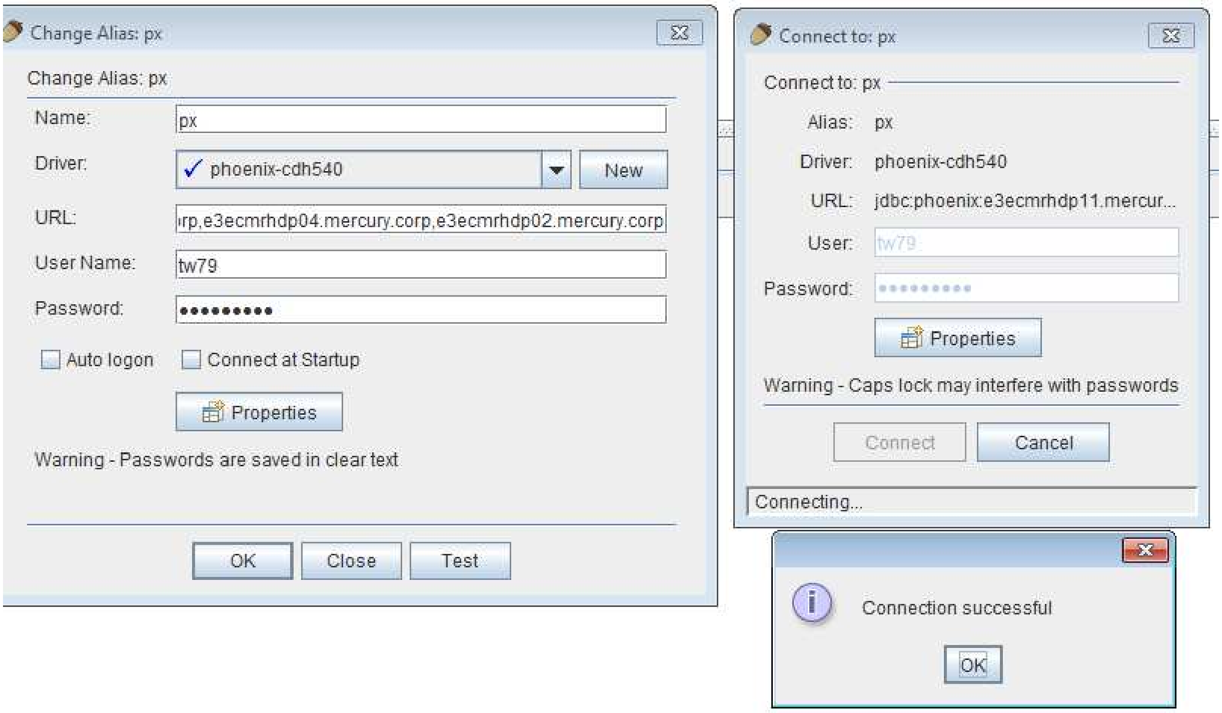
User Name: tw79

Password: ●●●●●●●●●

☐ Auto logon ☐ Connect at Startup

Warning - Passwords are saved in clear text

You can do a test for connection by click “Test” button.



Change Alias: px

Name: px

Driver: ✓ phoenix-cdh540

URL: ırp,e3ecmrhdp04.mercury.corp,e3ecmrhdp02.mercury.corp

User Name: tw79

Password: ●●●●●●●●●

☐ Auto logon ☐ Connect at Startup

Warning - Passwords are saved in clear text

Connect to: px

Alias: px

Driver: phoenix-cdh540

URL: jdbc:phoenix:e3ecmrhdp11.mercur...

User: tw79

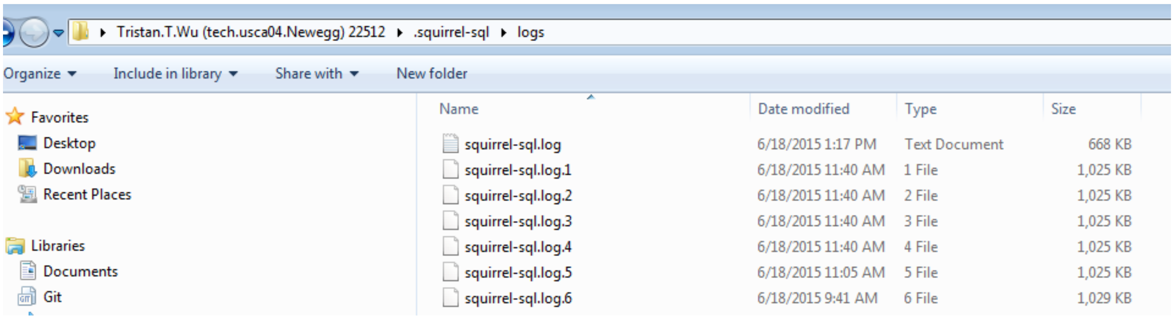
Password: ●●●●●●●●●

Warning - Caps lock may interfere with passwords

Connecting...

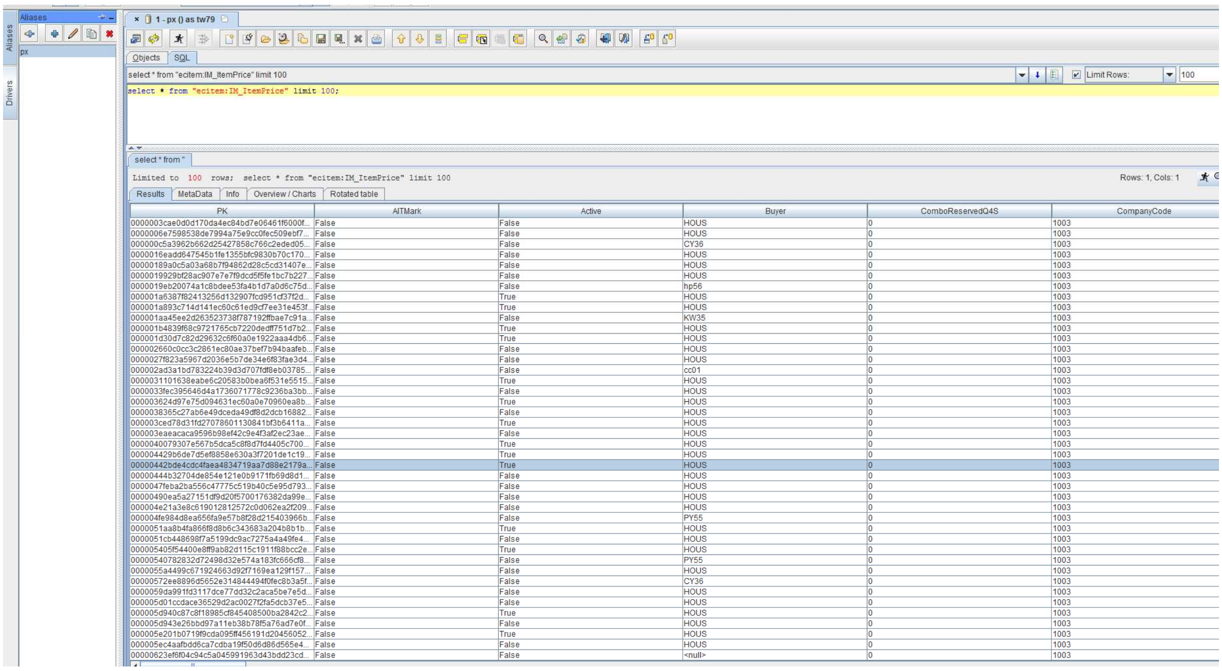
Connection successful

You can check the logs from you <home folder>\.squirrel-sql\logs.



Name	Date modified	Type	Size
squirrel-sql.log	6/18/2015 1:17 PM	Text Document	668 KB
squirrel-sql.log.1	6/18/2015 11:40 AM	1 File	1,025 KB
squirrel-sql.log.2	6/18/2015 11:40 AM	2 File	1,025 KB
squirrel-sql.log.3	6/18/2015 11:40 AM	3 File	1,025 KB
squirrel-sql.log.4	6/18/2015 11:40 AM	4 File	1,025 KB
squirrel-sql.log.5	6/18/2015 11:05 AM	5 File	1,025 KB
squirrel-sql.log.6	6/18/2015 9:41 AM	6 File	1,029 KB

3.4.3 Write a SQL to query phoenix table.



select * from "ecitem:IM_ItemPrice" limit 100 ☑ Limit Rows: 100

```
select * from "ecitem:IM_ItemPrice" limit 100;
```

```
Limited to 100 rows; select * from "ecitem:IM_ItemPrice" limit 100
```

PK	AlTMark	Active	Buyer	ComboReservedQ4S	CompanyCode
0000003cae0d0d170da4ec84bd7e06461f6000f...	False	False	HOUS	0	1003
0000006e7598538de7994a75e9cc0fec509ebf7...	False	False	HOUS	0	1003
000000c5a3962b662d25427858c766c2eded05...	False	False	CY36	0	1003
0000016eadd647545b1fe1355bfc9830b70c170...	False	False	HOUS	0	1003
00000189a0c5a03a68b7f94862d28c5cd31407e...	False	False	HOUS	0	1003
0000019929bf28ac907e7e7f9dcd5f5fe1bc7b227...	False	False	HOUS	0	1003
0000019eb20074a1c8bdee53fa4b1d7a0d6c75d...	False	False	hp56	0	1003
000001a6387f82413256d132907fcd951cf37f2d...	False	True	HOUS	0	1003
000001a893c714d141ec60c61ed9cf7ee31e453f...	False	True	HOUS	0	1003
000001aa45ee2d263523738f787192ffbae7c91a...	False	False	KW35	0	1003
000001b4839f68c9721765cb7220dedff751d7b2...	False	True	HOUS	0	1003
000001d30d7c82d29632c6f60a0e1922aaa4db6...	False	True	HOUS	0	1003
000002660c0cc3c2861ec80ae37bef7b94baafeb...	False	False	HOUS	0	1003
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4 Summary

In my opinion, Apache Phoenix can only be used for ad-hoc queries in offline HBase.

4.1 Positive

- Apache Phoenix can support Ad-Hoc Query on HBase. The performance on 90 million PRD item data is 5-6 minutes.
- Apache Phoenix provides JDBC Driver, easy to use it.
- Apache Phoenix supports ANSI SQL.

4.2 Negative

- Apache Phoenix on Cloudera needs to build against CDH5.4.0 by source code.

- Apache Phoenix is powered by HBase Coprocessor, which means scan / aggregate entire data on each region data. It cost lots of CPU. It is high risk for online HBase Cluster, only can use it in offline cluster.
- Not robust engine, and no rich use experience in community.