# Spark SQL

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# Spark SQL

## DataFrame

A distributed collection of rows organied into named columns.

An abstraction for selecting, filtering, aggregating, and plotting structured data.

Previously => SchemaRDD

Creating and running Spark program faster

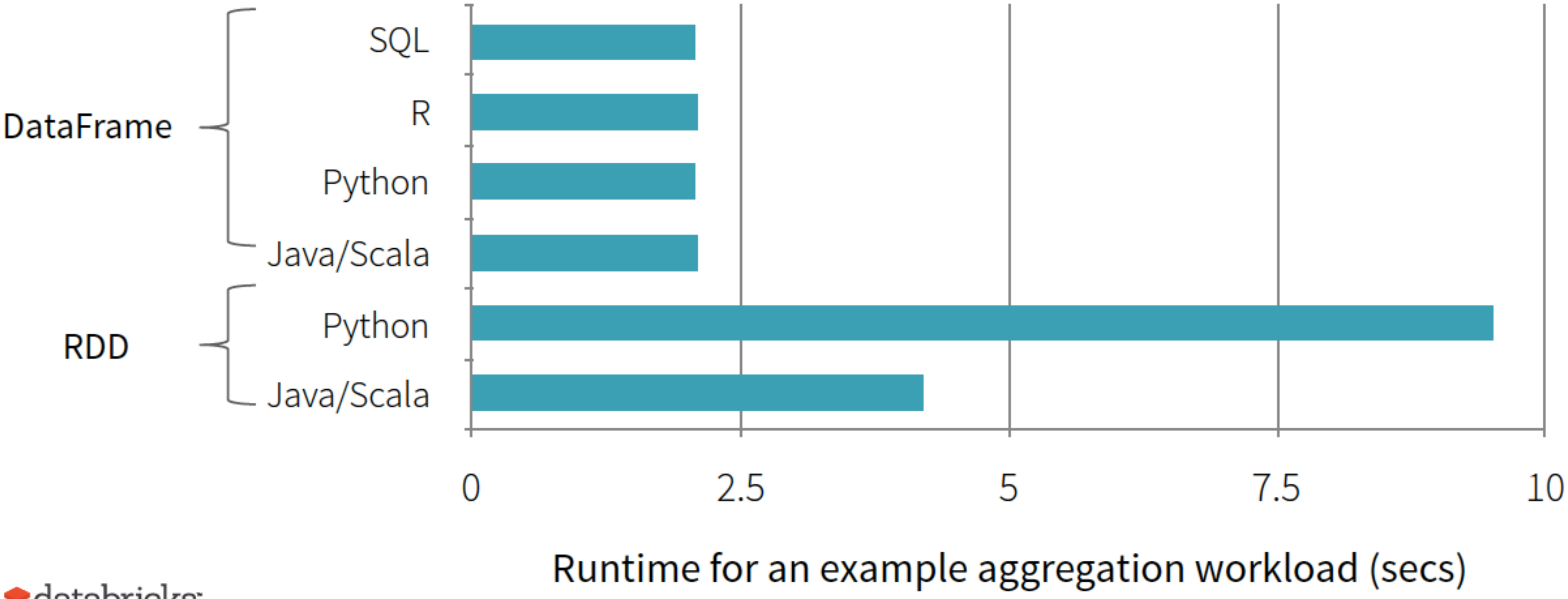
– Write less code

– Read less data

– Let the optimizer do the hard work

Spark SQL
is about more than SQL.

# Benefit of Logical Plan:
# Performance Parity Across Languages



Source: Jump start into Apache Spark and Databricks

# SparkSQL can leverage the Hive metastore

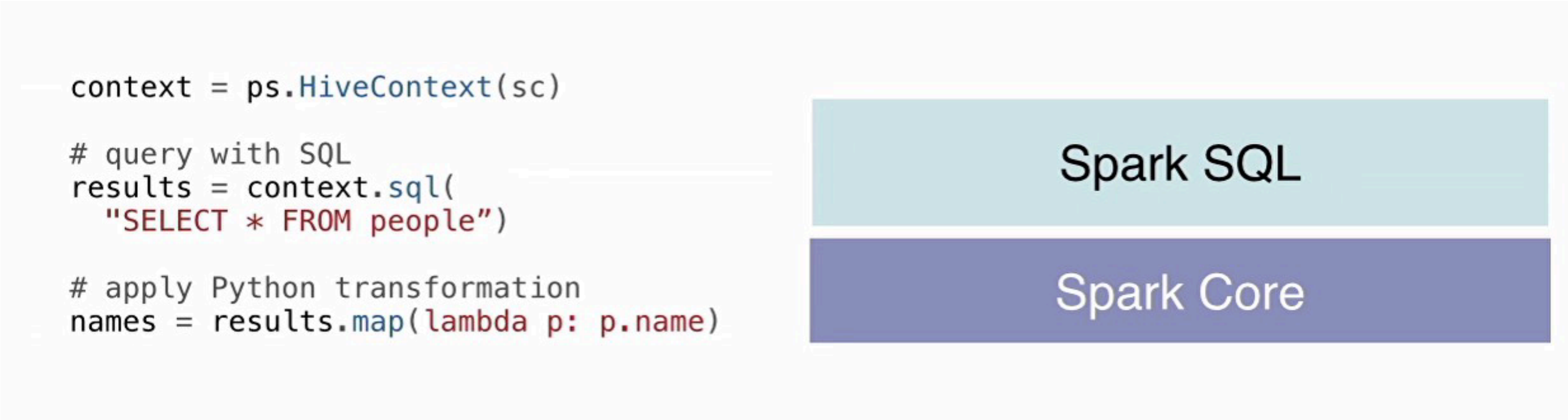
Hive Metastore can also be leveraged by a wide array of applications

– Spark

– Hive

– Impala

Available from HiveContext



```
context = ps.HiveContext(sc)

# query with SQL
results = context.sql(
  "SELECT * FROM people”)

# apply Python transformation
names = results.map(lambda p: p.name)
```

# Unified interface for structured data

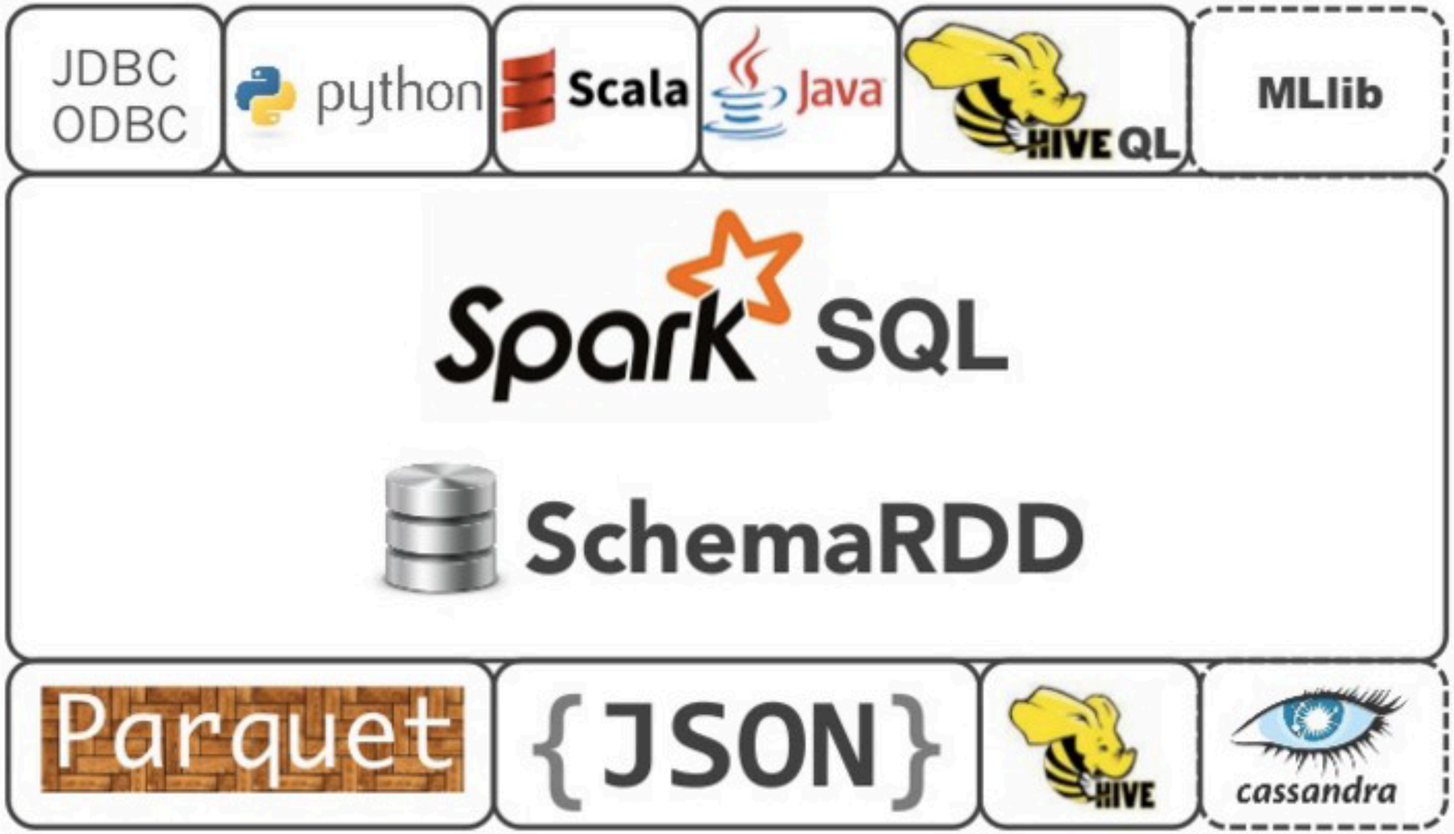


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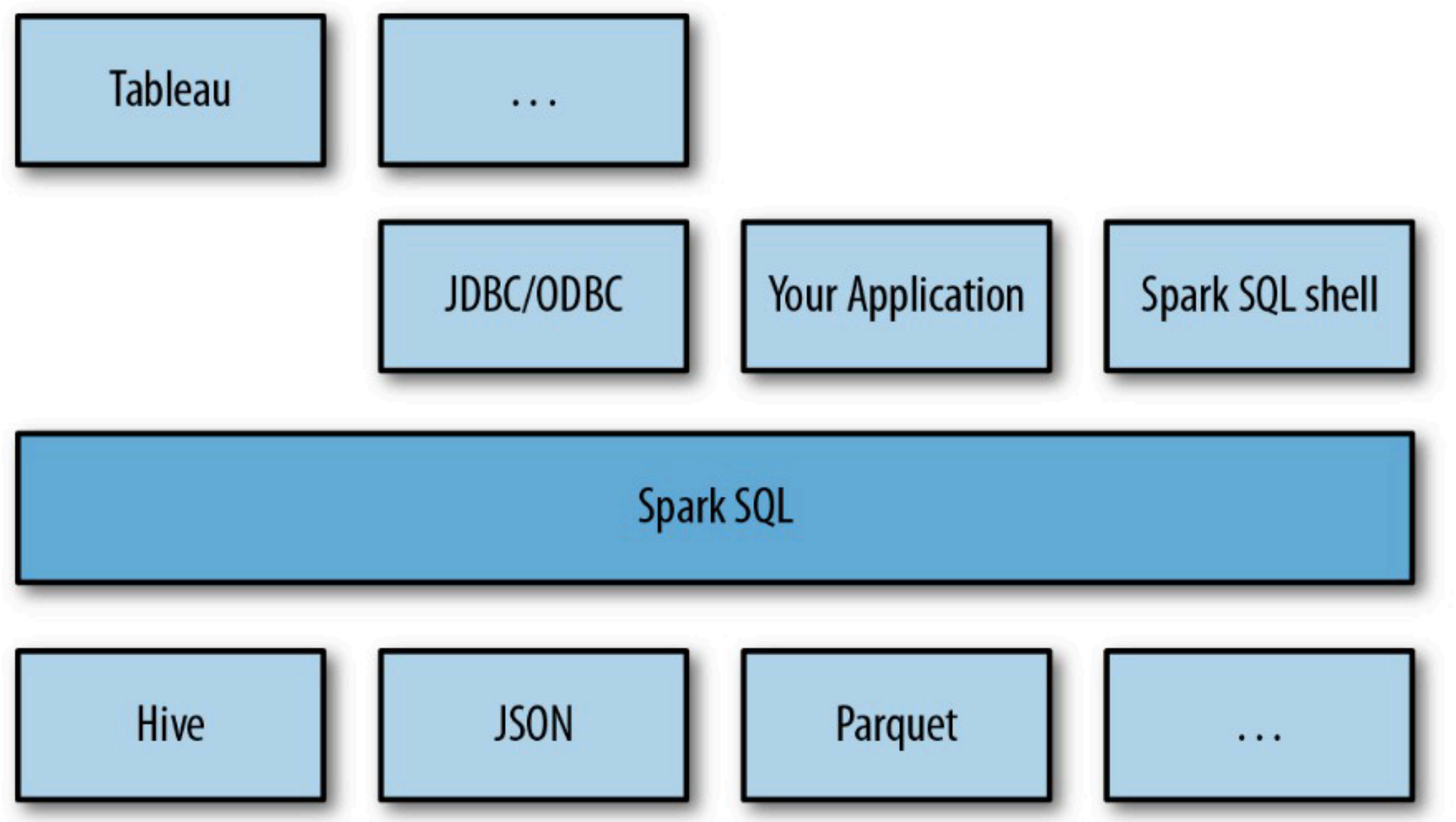
Image credit: http://barrymieny.deviantart.com/

# Spark SQL usage



Source: Learning Spark, O'Reilly Media, Inc.

# Link Hive Metastore with Spark-Shell

$ spark-shell --jars mysql-connector-java-5.1.23.jar

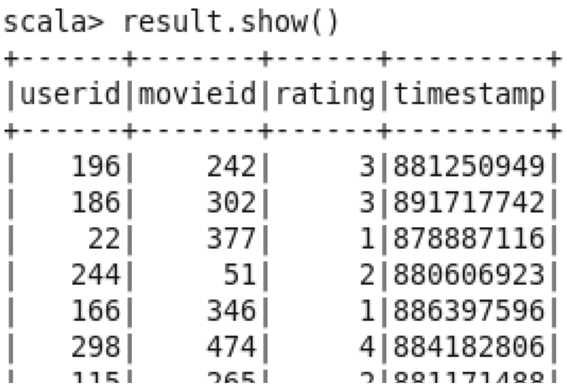
scala > val sqlContext = new org.apache.spark.sql.hive.HiveContext(sc)

scala> sqlContext.sql("CREATE TABLE IF NOT EXISTS movie(userid STRING, movieid STRING, rating INT, timestamp STRING) ROW FORMAT DELIMITED FIELDS TERMINATED BY '\t' LINES TERMINATED BY '\n'")

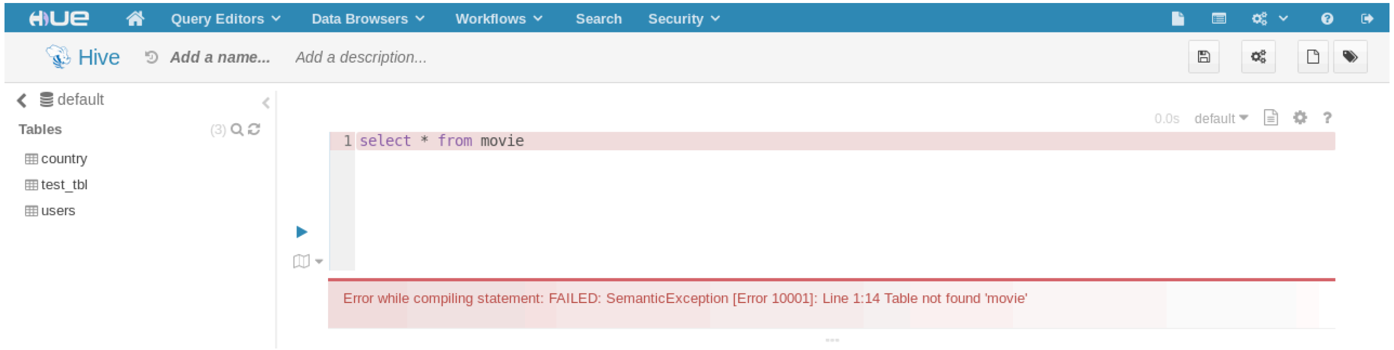
scala> sqlContext.sql("LOAD DATA LOCAL INPATH '/home/cloudera/movielens_dataset/ml-100k/u.data' INTO TABLE movie")

scala> val result = sqlContext.sql("SELECT * FROM movie")

scala> result.show()



```
scala> result.show()
+------+-------+------+---------+
|userid|movieid|rating|timestamp|
+------+-------+------+---------+
|   196|    242|     3|881250949|
|   186|    302|     3|891717742|
|    22|    377|     1|878887116|
|   244|     51|     2|880606923|
|   166|    346|     1|886397596|
|   298|    474|     4|884182806|
|   115|    265|     2|881171488|
```



```
select * from movie
```

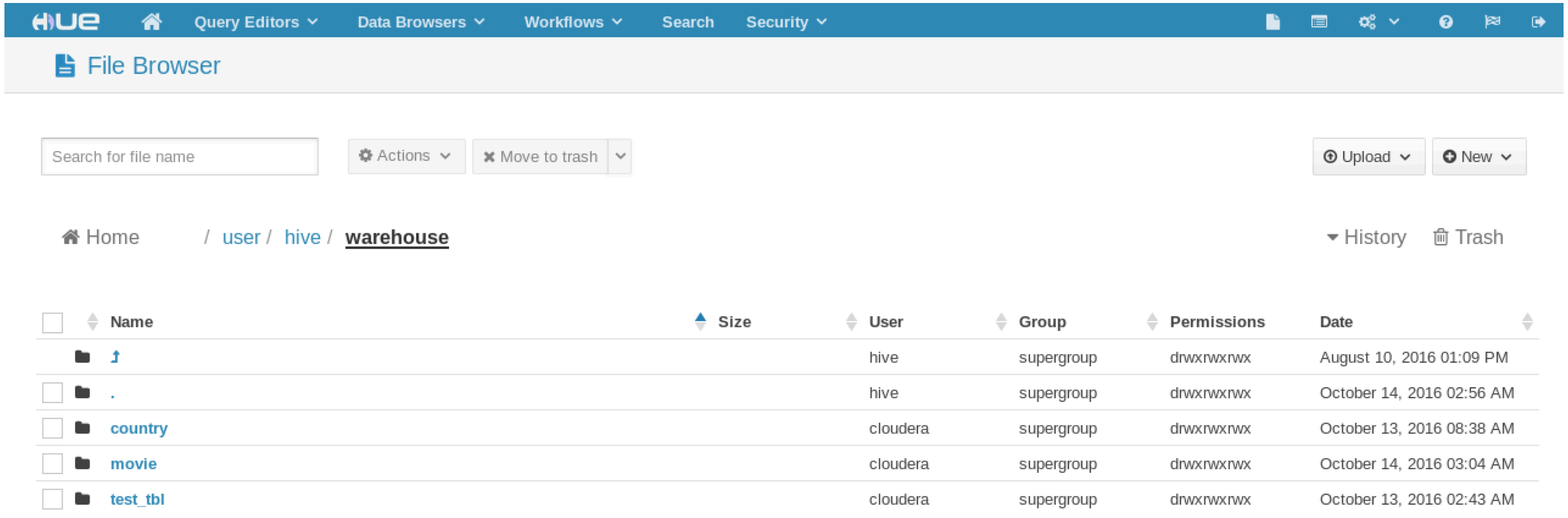
Error while compiling statement: FAILED: SemanticException [Error 10001]: Line 1:14 Table not found 'movie'

# Link Hive Metastore with Spark-Shell

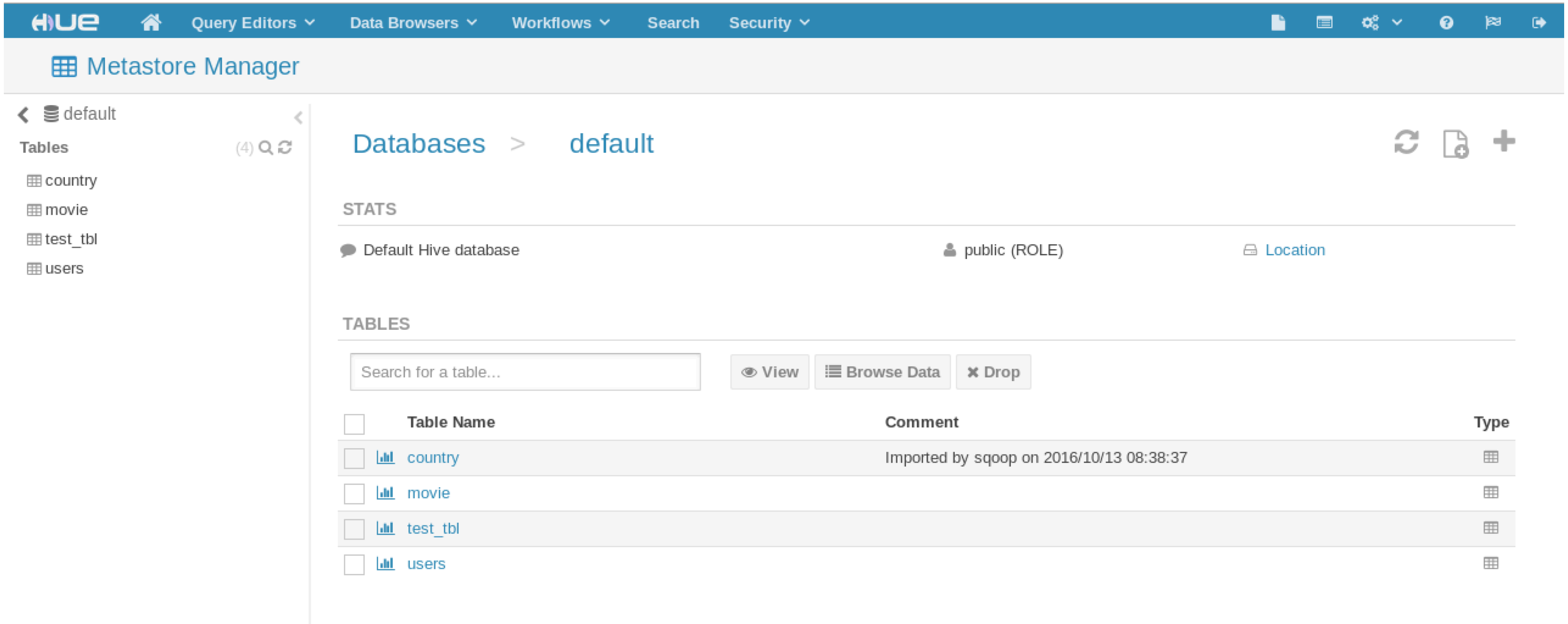
Copy the configuration file

```
$sudo cp /usr/lib/hive/conf/hive-site.xml /usr/lib/spark/conf/
```

```
$ spark-shell
scala > val sqlContext = new org.apache.spark.sql.hive.HiveContext(sc)
scala> sqlContext.sql("CREATE TABLE IF NOT EXISTS movie(userid
STRING, movieid STRING, rating INT, timestamp STRING) ROW FORMAT
DELIMITED FIELDS TERMINATED BY '\t' LINES TERMINATED BY '\n'")
scala> sqlContext.sql("LOAD DATA LOCAL INPATH '/home/cloudera/
movielens_dataset/ml-100k/u.data' INTO TABLE movie")
scala> val result = sqlContext.sql("SELECT * FROM movie")
scala> result.show()
```



| □ | Name | Size | User | Group | Permissions | Date |
|---|---|---|---|---|---|---|
|  | ↥ |  | hive | supergroup | drwxrwxrwx | August 10, 2016 01:09 PM |
| □ | . |  | hive | supergroup | drwxrwxrwx | October 14, 2016 02:56 AM |
| □ | country |  | cloudera | supergroup | drwxrwxrwx | October 13, 2016 08:38 AM |
| □ | movie |  | cloudera | supergroup | drwxrwxrwx | October 14, 2016 03:04 AM |
| □ | test_tbl |  | cloudera | supergroup | drwxrwxrwx | October 13, 2016 02:43 AM |



| □ | Table Name | Comment | Type |
|---|---|---|---|
| □ | country | Imported by sqoop on 2016/10/13 08:38:37 | ▦ |
| □ | movie |  | ▦ |
| □ | test_tbl |  | ▦ |
| □ | users |  | ▦ |

# Spark SQL Meals Data

## Upload a data to HDFS

```
$ wget https://github.com/bobbylovemovie/trainbigdata/raw/
master/Spark/events.txt
$ wget https://github.com/bobbylovemovie/trainbigdata/raw/
master/Spark/meals.txt
$ hadoop fs -put events.txt /user/cloudera/input
$ hadoop fs -put meals.txt /user/cloudera/input
```

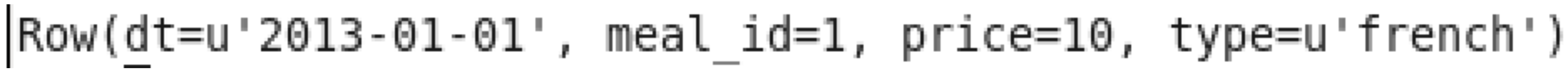
# Spark SQL : Preparing data

```
$ pyspark
>>> meals_rdd =sc.textFile("hdfs:///user/cloudera/input/meals.txt")
>>> events_rdd =sc.textFile("hdfs:///user/cloudera/input/events.txt")
>>> header_meals = meals_rdd.first()
>>> header_events = events_rdd.first()
>>> meals_no_header = meals_rdd.filter(lambda row:row != header_meals)
>>> events_no_header =events_rdd.filter(lambda row:row != header_events)
>>> meals_json = meals_no_header.map(lambda
row:row.split(';')).map(lambda row_list:dict(zip(header_meals.split(';'),
row_list)))
>>> events_json = events_no_header.map(lambda
row:row.split(';')).map(lambda row_list:dict(zip(header_events.split(';'),
row_list)))
```

```
>>> import json
>>> def type_conversion(d, columns) :
...     for c in columns:
...          d[c] = int(d[c])
...     return d
...
>>> meal_typed = meals_json.map(lambda
j:json.dumps(type_conversion(j, ['meal_id','price'])))
>>> event_typed = events_json.map(lambda
j:json.dumps(type_conversion(j, ['meal_id','userid'])))
```

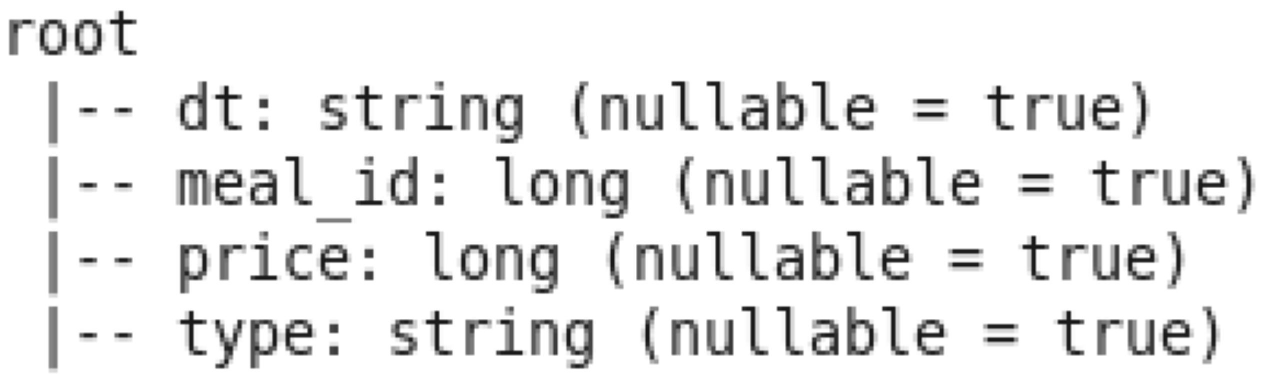
# Spark SQL : Create DataFrame

```
>>> meals_dataframe = sqlContext.jsonRDD(meal_typed)
>>> events_dataframe = sqlContext.jsonRDD(event_typed)
>>> meals_dataframe.head()
```



```
Row(dt=u'2013-01-01', meal_id=1, price=10, type=u'french')
```

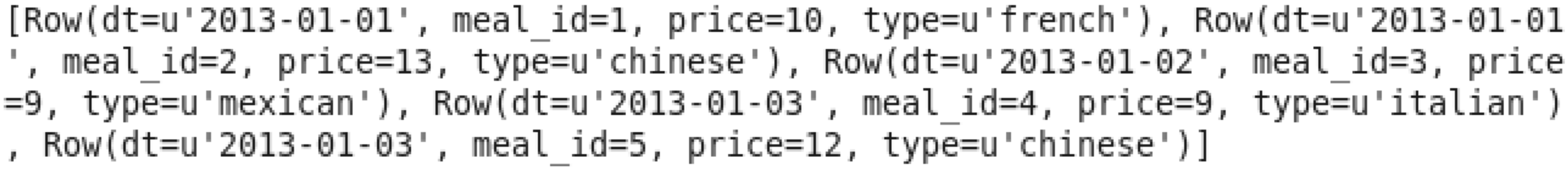
```
>>> meals_dataframe.printSchema()
```



```
root
 |-- dt: string (nullable = true)
 |-- meal_id: long (nullable = true)
 |-- price: long (nullable = true)
 |-- type: string (nullable = true)
```

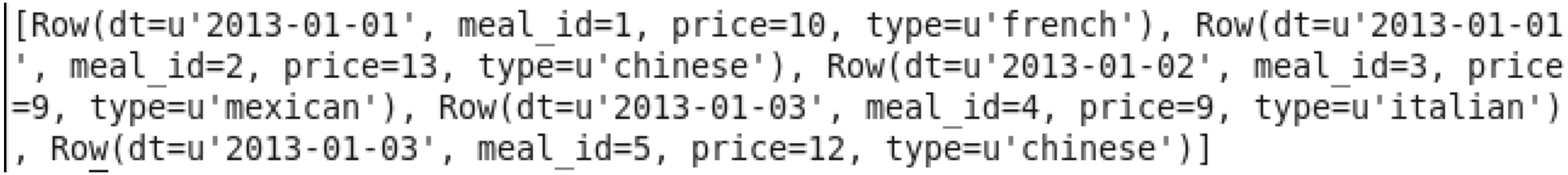
# Running SQL Query

```
>>> meals_dataframe.registerTempTable('meals')
>>> events_dataframe.registerTempTable('events')
>>> sqlContext.sql("SELECT * FROM meals LIMIT 5").collect()
```



```
[Row(dt=u'2013-01-01', meal_id=1, price=10, type=u'french'), Row(dt=u'2013-01-01
', meal_id=2, price=13, type=u'chinese'), Row(dt=u'2013-01-02', meal_id=3, price
=9, type=u'mexican'), Row(dt=u'2013-01-03', meal_id=4, price=9, type=u'italian')
, Row(dt=u'2013-01-03', meal_id=5, price=12, type=u'chinese')]
```

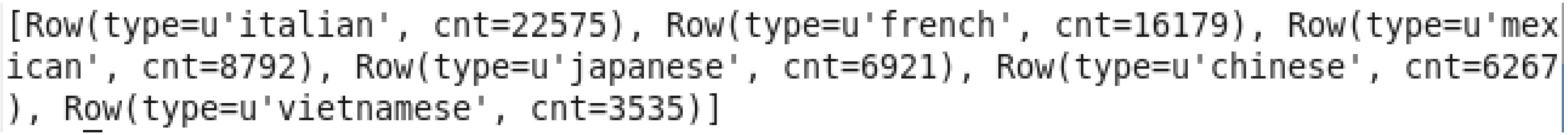
```
>>> meals_dataframe.take(5)
```



```
[Row(dt=u'2013-01-01', meal_id=1, price=10, type=u'french'), Row(dt=u'2013-01-01
', meal_id=2, price=13, type=u'chinese'), Row(dt=u'2013-01-02', meal_id=3, price
=9, type=u'mexican'), Row(dt=u'2013-01-03', meal_id=4, price=9, type=u'italian')
, Row(dt=u'2013-01-03', meal_id=5, price=12, type=u'chinese')]
```

# Spark SQL : More complex query

```
>>> sqlContext.sql("""
    SELECT type, COUNT(type) AS cnt FROM
    meals
    INNER JOIN
    events on meals.meal_id = events.meal_id
    WHERE
    event = 'bought'
    GROUP BY
    type
    ORDER BY cnt DESC
    """).collect()
```



```
[Row(type=u'italian', cnt=22575), Row(type=u'french', cnt=16179), Row(type=u'mex
ican', cnt=8792), Row(type=u'japanese', cnt=6921), Row(type=u'chinese', cnt=6267
), Row(type=u'vietnamese', cnt=3535)]
```