HIVE

JPA Solutions
Center Of Excellence

Introduction

- An Abstraction on top of MapReduce
- Allows users to query data in the Hadoop

cluster without knowing Java or MapReduce

- Structured Data in HDFS logically into Tables
- Uses the HiveQL Language
- Very similar to SQL
- Turns HiveQL into MapReduce Jobs

Installation

- Download http://hive.apache.org
- tar -xvf hive-*x.y.z*-dev.tar.gz
- export HADOOP_HOME=/<HADOOP DIR>
- bin/hive

Create Database

- bin/hive
- show databases;
- create database training;
- show databases;
- use training;
- show tables;

Hive Shell - Examples

- bin/hive
- Show tables
- Create table patient(pid INT, pname STRING, drug STRING,gender STRING, tot_amt INT) row format delimited fields terminated by ',' stored as textfile;
- load data inpath '/home/senthil/pfile.txt' into table patient;
- select count(*) from patient;
- select sum(tot_amt) from patient where drug = 'paracetamol';
- select max(tot_amt) from patient group by drug;
- show tables;
- desc patient;
- desc extended patient;
- show functions;
- insert overwrite local directory '/home/senthil/results' select * from patient
- select * from patient where drug in ('avil','metacin');

Some more

- create table drug(drugname STRING) row format delimited fields terminated by ‘,’ stored as textfile;
- load data local inpath ‘/home/senthil/drug_file.txt‘ into table drug;
- select * from patient join drug on patient.drug=drug.drug;
- select patient.* from patient left outer join drug on patient.drug = drug.drugname where drug.drugname is NULL;
- create table drug_ new(drug STRING) row format delimited fields terminated by ‘,’ stored as textfile;
- insert overwrite table drug_new select * from drug;
- select * from drug_new;
- insert into table drug_new select * from drug;
- select * from drug_new;

External Table

- create EXTERNAL table patient_external(pid INT, pname STRING, drug STRING,gender STRING,tot_amt INT) row format delimited fields terminated by ',' stored as textfile LOCATION '/patient_external';
- LOAD DATA INPATH '/data10.txt' INTO table patient_external;
- drop table patient_external;
- "chech the table in hdfs path"

Partitions

- A way of dividing table into multiple parts based upon a column value such as Date
- defined at table creation time using the PARTITIONED BY clause
- *create table patient (pid INT, pname STRING, drug STRING, tot_amt INT) partitioned by (dt STRING, country STRING)row format delimited fields terminated by ',' stored as textfile;*
- *LOAD DATA LOCAL INPATH '/tmp/file_ind.txt' INTO TABLE logs PARTITION*
- *(dt='2012-11-01', country='IND');*
- Above code creates a sub partition called country in date
- Please look at the directory structure in the HDFS
- Our data in the files should not contain the columns used for
- partitioning

Partition Querys

- create table patient_partition_1(pid INT, pname STRING, drug STRING,gender STRING,tot_amt INT)partitioned by(country STRING)row format delimited fields terminated by ',' stored as textfile;
- LOAD DATA LOCAL INPATH '/home/username/Desktop/patient_file.txt' INTO TABLE patient_partition_1 PARTITION (country='IND');
- **Check the /user/hive/warehouse/patient_partition_1 directory in HDFS**
- create table patient_partition_2 (pid INT, pname STRING, drug STRING,gender STRING,tot_amt INT) partitioned by (dt STRING, country STRING)row formatdelimited fields terminated by ',' stored as textfile;
- desc patient_partition_2;
- LOAD DATA LOCAL INPATH '/home/username/Desktop/patient_file.txt' INTO TABLE patient_partition_2 PARTITION (dt='2012-11-01', country='IND');
- **Check the /user/hive/warehouse/ patient_partition_2**
- Select * from patient_partition_1;
- Select * from patient_partition_2;

Buckets

- To enable map side join effectively
- To do sampling

- *CREATE TABLE bucketed_patient (pid INT, pname STRING, drug STRING,genter STRING, tot_amt INT) CLUSTERED BY (pid) INTO 4 BUCKETS;*
- *hive.enforce.bucketing = true;*
- *INSERT OVERWRITE TABLE bucketed_patient SELECT * FROM patient;*
- *Can contain multiple fields for bucketing.*

Partition With Bucket

```
CREATE TABLE partition_bucketed(pid INT, pname STRING, drug STRING,
gender STRING, tot_amt STRING)PARTITIONED BY(country
STRING)CLUSTERED BY(pid)
INTO 4 BUCKETS;

set hive.enforce.bucketing = true;

LOAD DATA LOCAL INPATH
'/home/saravanan/Desktop/datagen_10.txt' INTO TABLE
partition_bucketed PARTITION (country='IND');

INSERT OVERWRITE TABLE partition_bucketed PARTITION (country='us')
SELECT* FROM patient;

select * from partition_bucketed where country= 'IND';

select * from partition_bucketed where country= 'us';
```

Some more queries

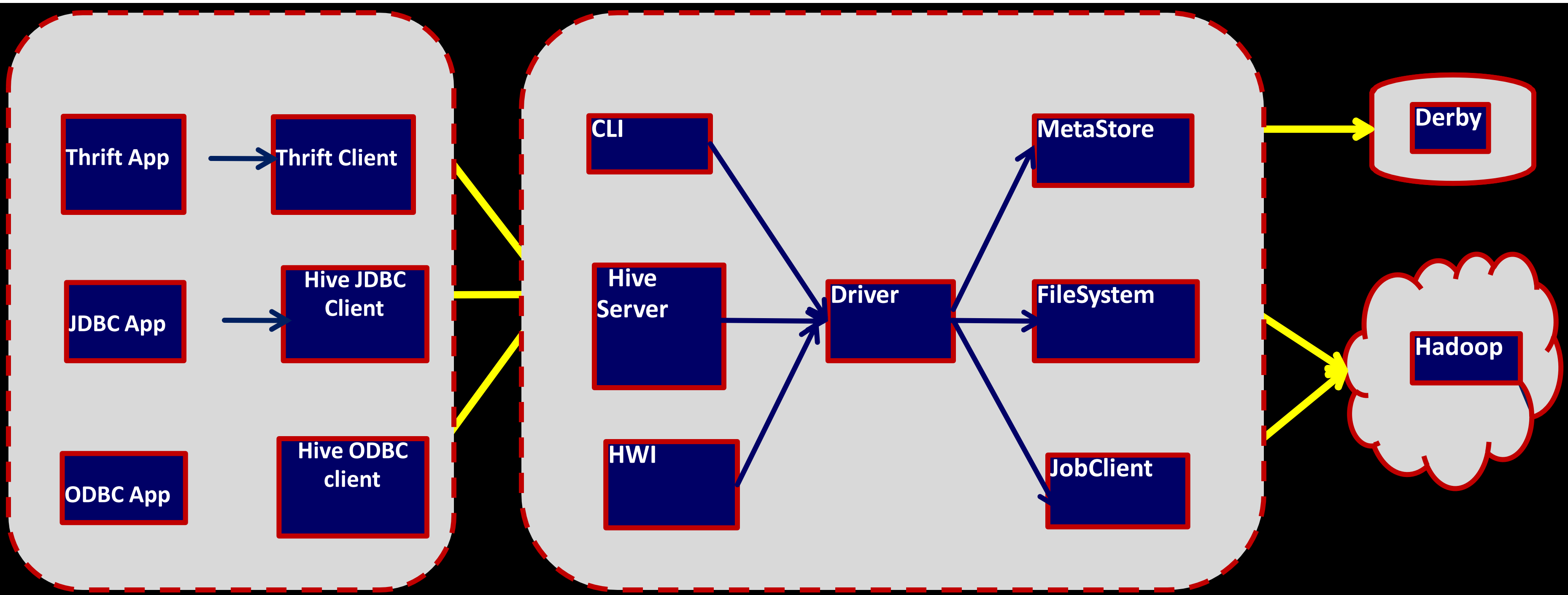
- Alter Table patient RENAME TO patient_new;
- ALTER TABLE patient_new ADD COLUMNS (extra STRING);
- Sub Queries
- Views

Data Types

- Primitive types
  - ✓ Integers: TINYINT, SMALLINT, INT, BIGINT.
  - ✓ Boolean: BOOLEAN.
  - ✓ Floating point numbers: FLOAT, DOUBLE .
  - ✓ String: STRING.
- Complex types
  - ✓ Structs: {a INT; b INT}.
  - ✓ Maps: M['group'].
  - ✓ Arrays: ['a', 'b', 'c'], A[1] returns 'b'.

Date Format ?

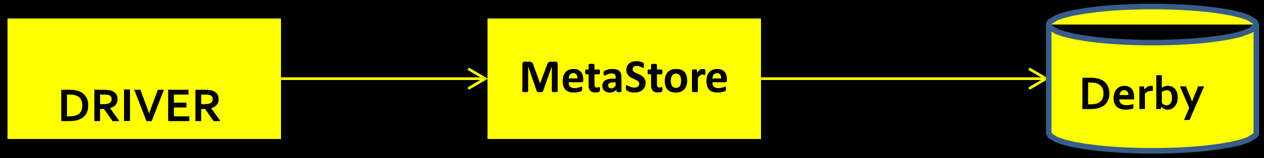
Hive Architecture



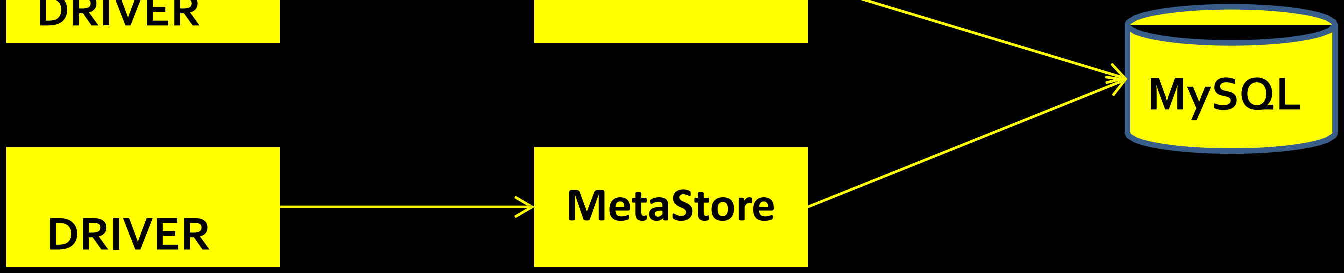
Metastore

central repository of Hive metadata

Embedded MetaStore



Local MetaStore



JOINS

- SELECT a.* FROM a JOIN b ON (a.id = b.id)
- Join on multiple columns
  - ✓ SELECT a.* FROM a JOIN b ON (a.id = b.id AND a.department = b.department)
- Join on Multiple tables
  - ✓ SELECT a.val, b.val, c.val FROM a JOIN b ON (a.key = b.key1) JOIN c ON (c.key = b.key1)
  - ✓ SELECT a.val, b.val, c.val FROM a JOIN b ON (a.key = b.key1) JOIN c ON (c.key = b.key2)
- LEFT, RIGHT, and FULL OUTER joins – available in HiveQL
  - ✓ SELECT a.val, b.val FROM a LEFT OUTER JOIN b ON (a.key=b.key)
  - ✓ provides more control over ON clauses for which there is no match
- WHERE clause available using JOIN
- SELECT a.val, b.val FROM a LEFT OUTER JOIN b ON (a.key=b.key) WHERE a.ds='2009-07-07' AND b.ds='2009-07-07'

Built in operators

- Arithmetic Operators
    - +, -, *, /,%, |,^,~
- Relational Operators
    - = , <=> , !=, <>, < , >, <=, =>, IS NULL, IS NOT NULL, LIKE, RLIKE, REGEXP, BETWEEN , NOT BETWEEN
- Logical Operators
    - AND, OR, &&, ||, NOT, !

Built-in Functions

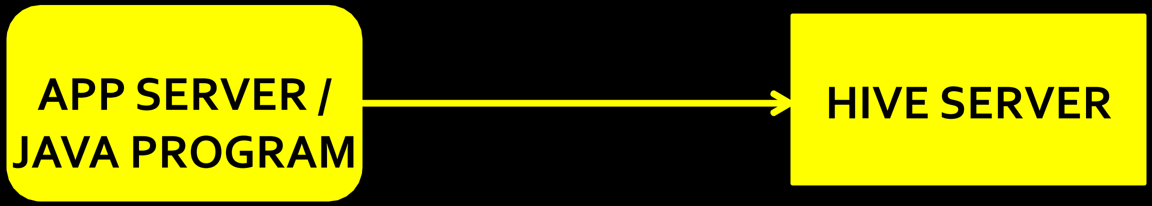
- Mathematical: round, floor, ceil, rand, exp...
- Collection: size, map_keys, map_values, array_contains.
- Type Conversion: cast.
- Date: from_unixtime, to_date, year, datediff...
- Conditional: if, case, coalesce.
- String: length, reverse, upper, trim...

Hive Web Interface

- Configuration – hive-site.xml
  - ✓ hive.hwi.listen.port -- 0.0.0.0
  - ✓ hive.hwi.listen.host -- 9999
  - ✓ hive.hwi.warfile -- /lib/hive_hwi.war
- bin/hive --service hwi
- Features
  - ✓ Schema Browsing
  - ✓ Detached query execution
  - ✓ No local installation
  - ✓ Results are stored locally in hive server machine

HIVE JDBC

- bin/hive –service hiveserver
- uri is just “jdbc:hive://localhost:10000/default”



Other Clients

ODBC

- Thrift Clients
  - A software framework, for scalable cross-language services development, combines a software stack with a code generation engine to build services that work efficiently and seamlessly between C++, Java, Python, PHP, Ruby, Erlang, Perl, Haskell, C#, Cocoa, JavaScript, Node.js, Smalltalk, OCaml and Delphi and other languages
- Python, PHP, Java, C++

Custom User Defined Functions

```
package com.example.hive.udf;
import org.apache.hadoop.hive.ql.exec.UDF;
import org.apache.hadoop.io.Text;
public final class Lower extends UDF
{
        public Text evaluate(final Text s){
                    if (s == null)
                                        { return null; }
                   return new Text(s.toString().toLowerCase());
        }
}
```

UDF operates on a single row and produces a single row as its output.

UDF Continued…

- hive> add jar my_jar.jar;
- hive> listjars;
- hive> create temporary function my_lower as ‘com.example.hive.udf.Lower’;
- hive> select my_lower(title), sum(freq) from titles group by my_lower(title)

UDAF

- works on multiple input rows
- It may either creates a single output row or create a multiple output rows
- Methods to override

  init, iterate, terminatePartial, merge, terminate

Storage Formats

- Default
  - delimited - Control-A character with a row per line
- Two dimensions – row format & file formats
- Use ROW FORMAT or STORED AS FOR THE ABOVE TWO
- ROW format uses Serde
  - Serde – serializers and deserializers
- Binary FileFormats
  - SequenceFile
  - RCFILE
    - Default in industry
    - CREATE TABLE ... ROW FORMAT SERDE

    'org.apache.hadoop.hive.serde2.columnar.ColumnarSerDe‘ STORED AS RCFILE;

RC File Format

- create table patient_new(pid INT, pname STRING, drug STRING,gender STRING,tot_amt INT) row format delimited fields terminated by ',' stored as textfile;
- load data local inpath '/home/saravanan/Desktop/data_30l.txt' into table patient_new;
- create table patient_rc(pid INT, pname STRING, drug STRING,gender STRING,tot_amt INT) ROW FORMAT SERDE'org.apache.hadoop.hive.serde2.columnar.ColumnarSerDe' STORED AS RCFILE;
- insert overwrite table patient_rc select * from patient_new;
- select pid from patient_new where tot_amt =110;
- select pid from patient_rc where tot_amt =110;
- Look at the time differrence betweeen two.

Map Reduce Scripts in HIVE

- add file bin/test.py;
- Insert overwrite local directory '/tmp/result.txt' **transform** (rx.id) using 'python test.py' as (k,v) from (select pid as id from patient) rx;
- Similarly you can use **MAP** and **REDUCE**
- *Please refer to the example code available*

Hive – Hbase integration

- Create a Hbase table “testtable” with column family “data” and column Qualifies “name”
- Replace the hbase-*.jar , zookeeper-*.jar,guava-*.jar in hive-*/lib from hbase-*/lib
- Copy the all the jars from hbase-*/lib folder to HADOOP_HOME/lib folder
- bin/hive
- *set hbase.zookeeper.quorum=localhost;*
- *create external TABLE hbase_table(key int, value string) STORED BY 'org.apache.hadoop.hive.hbase.HBaseStorageHandler' WITH SERDEPROPERTIES ("hbase.columns.mapping" = ":key,data:name") TBLPROPERTIES ("hbase.table.name" = “testtable");*
- *insert overwrite table hbase_table select pid, pname from patient;*
- *select * from hbase_table;*

THANK YOU!!