Apache Hive – Best Practices

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Logistics

- Hadoop and Hive installed
  - Method 1: Demo VM at https://bitly.com/PDfLKp
  - Method 2: Install Hadoop + Hive (>= 0.7)
- Dataset downloaded
- All instructions at github.com/markgrover/bdtc-hive

Agenda

- Interactive
- Frequent breaks and conversations!
- Learn a little about Hive

My request to you
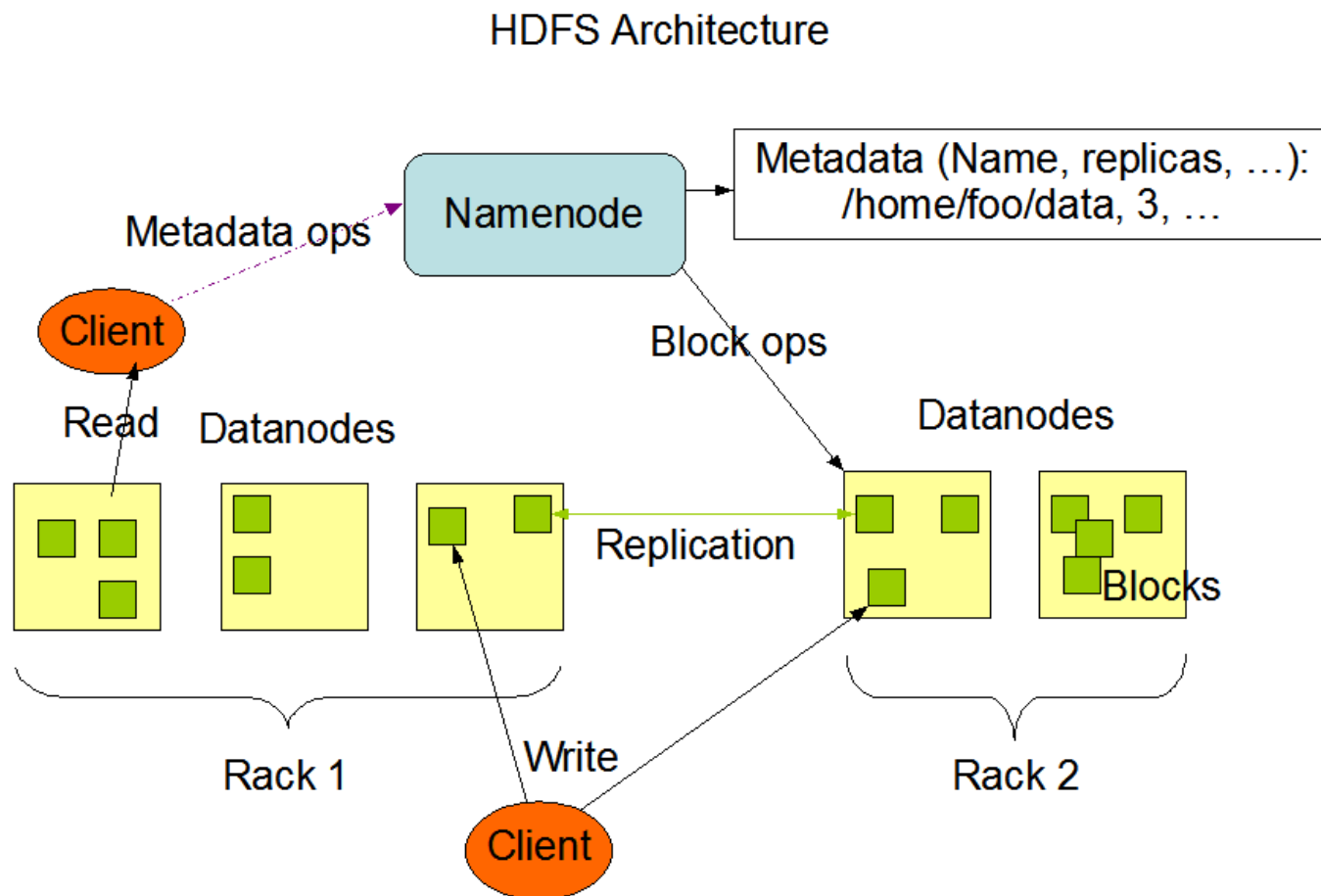
- Follow along
- Ask questions, any questions

Hive

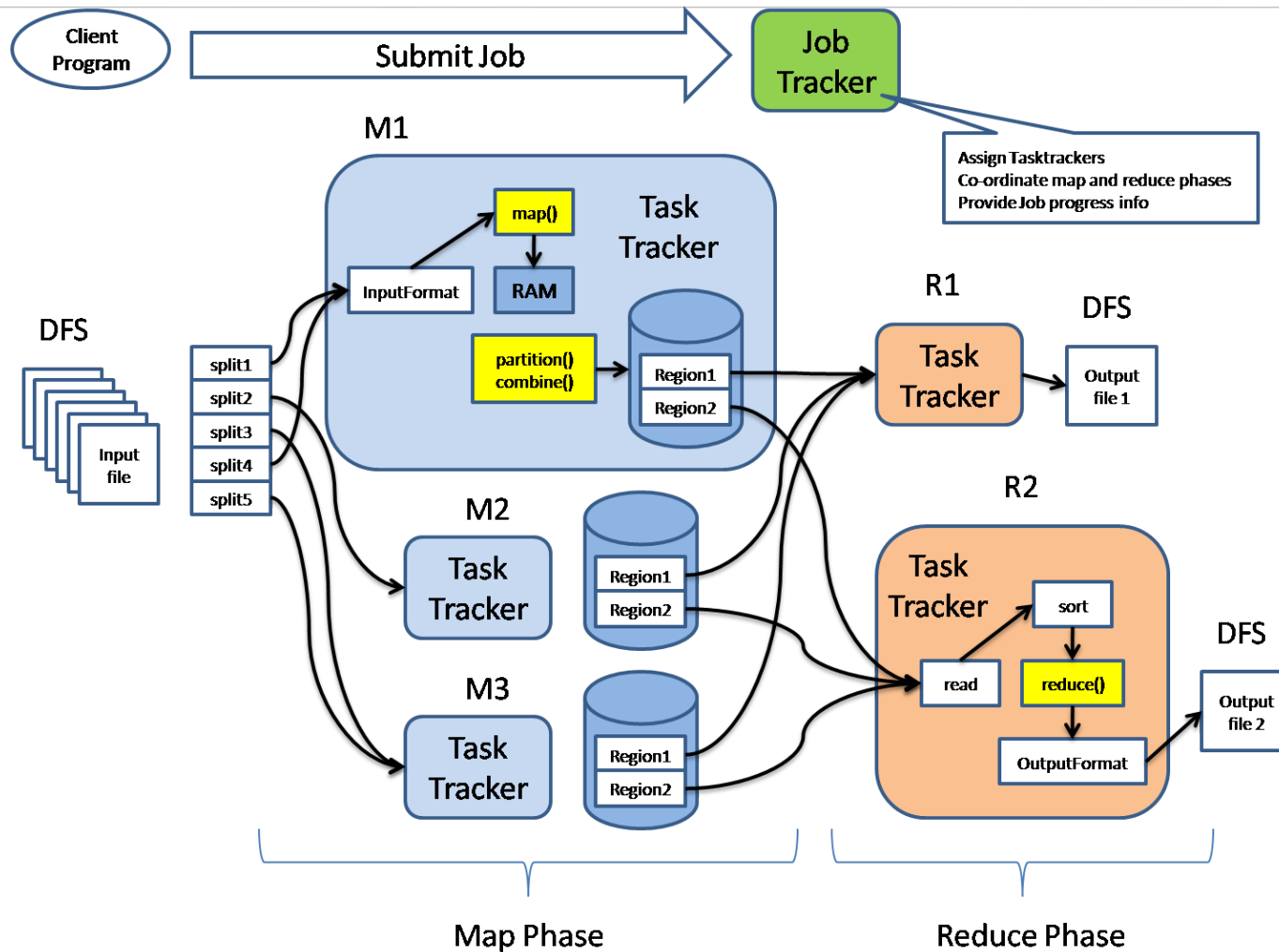- What is Hive?
- SQL-like queries for processing Hadoop data

Hadoop

- What is Hadoop?
- Run some example MR jobs

HDFS Architecture

HDFS Architecture

http://hadoop.apache.org/docs/stable/hdfs_design.html

How Hadoop (MR1) works

http://architects.dzone.com/articles/how-hadoop-mapreduce-works

The problem with MapReduce

- Catered towards developers

- No higher level abstraction

- Grouping, sorting, joining is very common but MR is tedious to write

Hive

- Why use Hive?
- Scalable
- Select, where clause, group by, order by, joins
- Pluggable User Defined Functions - UDFs (e.g from_unixtime)
- Pluggable User Defined Aggregate Functions - UDAFs (e.g. count, avg)
- Pluggable User Defined Table Generating Functions - UDTFs (e.g. explode)

Hive...2

- Pluggable custom Input/Output format
- Pluggable Serialization Deserialization libraries (SerDes)
- Pluggable custom map/reduce scripts
- There is no HiveFormat!

What Hive does NOT currently support

- OLTP workloads - low latency
- Correlated subqueries

HiveFormat

- There is none!

HiveFormat

- There is none!

- One more time – there is none!

- Text files, SequenceFiles

- NoSQL (HBase, MongoDB)

- Custom input formats

- Virtual Input formats

  - Google docs!

  - SearchBotInputFormat

Let's get started

- Load the data on HDFS

- Create a Hive table

- Run some queries

- Connecting to Hive

  o Shell

  o JDBC

  o ODBC

  o Thrift client

Inside Hive

- Configuring Hive
- Hive metastore
- Partitioning
- Dynamic partitioning
- Bucketing
- Joins
- UDFs/UDAFs
- Custom map/reduce scripts
- Hive HBase Integration

Scalar Data types in Hive

- TINYINT
- SMALLINT
- INT
- BIGINT
- FLOAT
- DOUBLE
- DECIMAL (Note: Only available starting with Hive 0.11.0)
- TIMESTAMP (Note: Only available starting with Hive 0.8.0)
- DATE (Note: Only available starting with Hive 0.12.0)
- BOOLEAN
- STRING
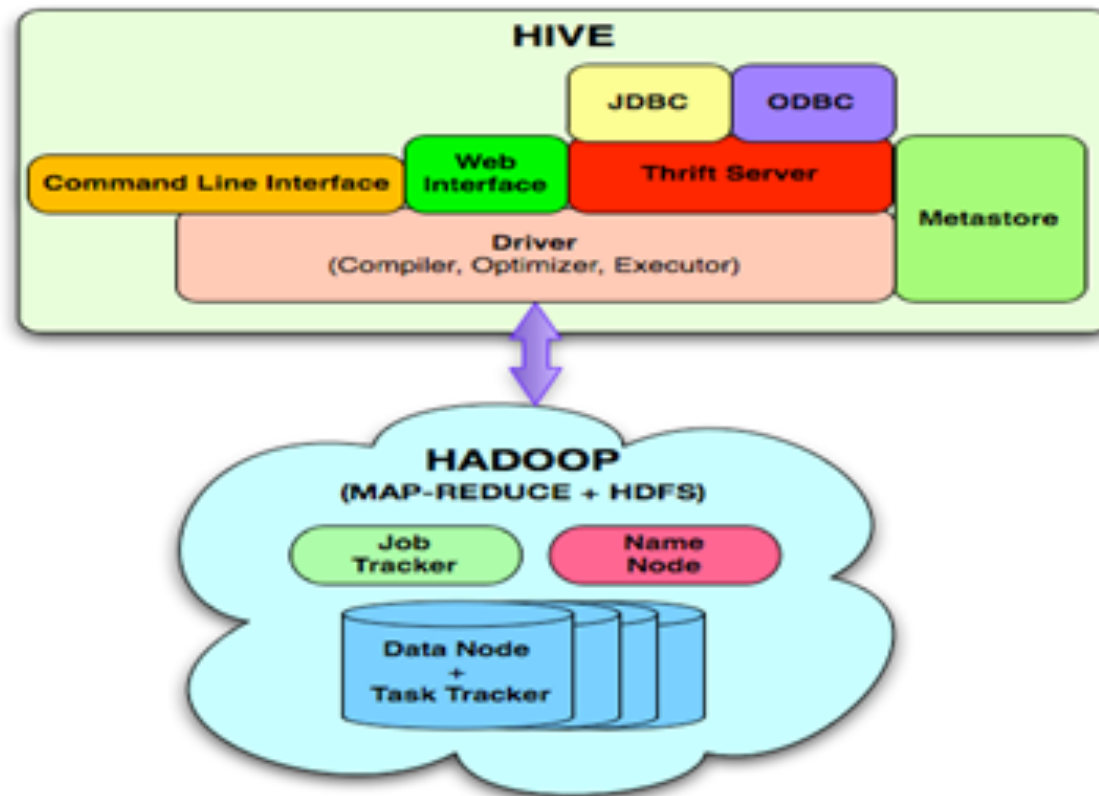- BINARY (Note: Only available starting with Hive 0.8.0)

Complex data types in Hive

- Arrays
- Structs
- Maps
- Union

Configuring Hive

- hive-default.xml
- hive-site.xml (/etc/hive/conf/hive-site.xml)
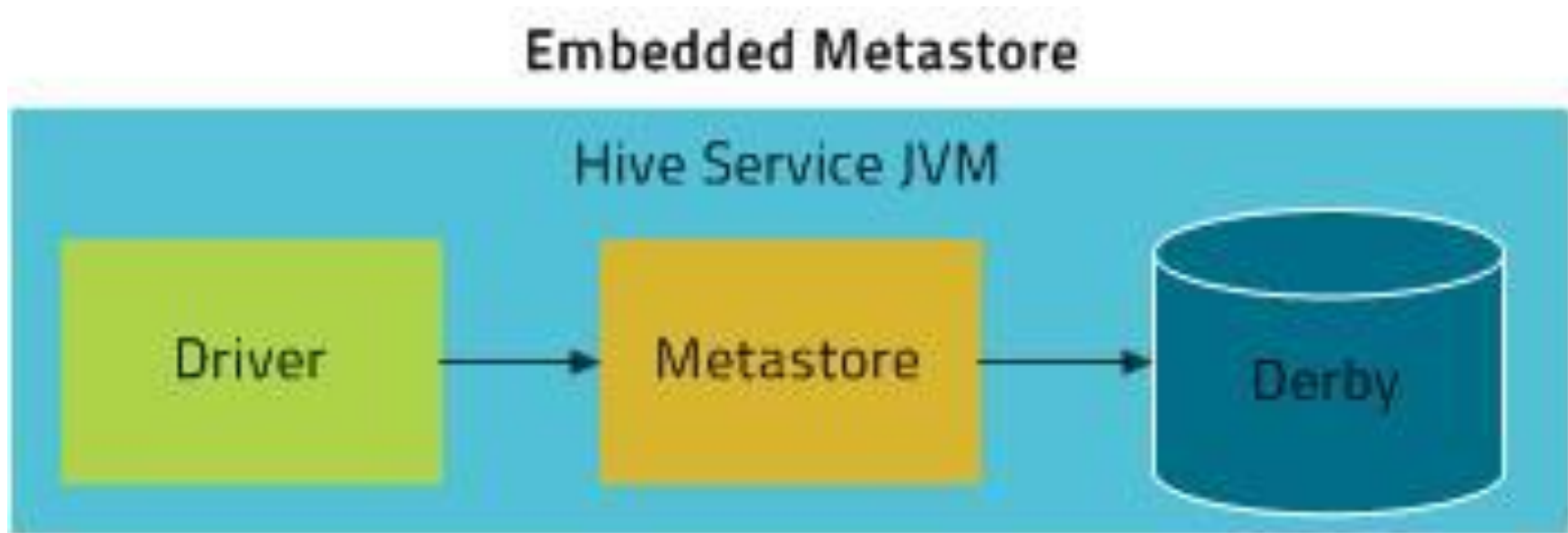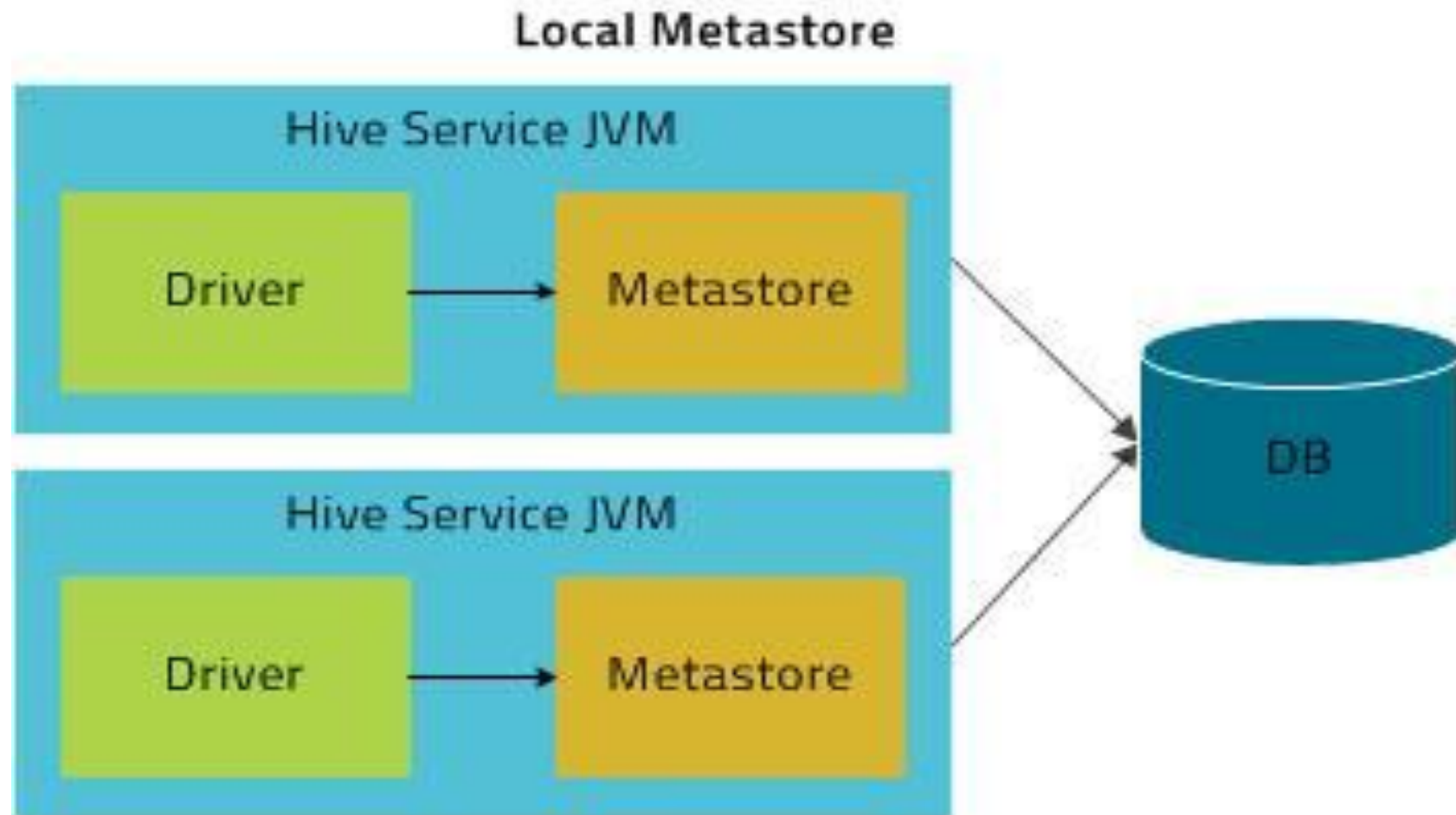
Hive Architecture

Hive metastore

- What is metastore?
- Vocabulary
  - Metastore
  - Metastore server (or datastore)
- Metastore service runs in different modes
  - Embedded
  - Local
  - Remote
- Default is embedded derby
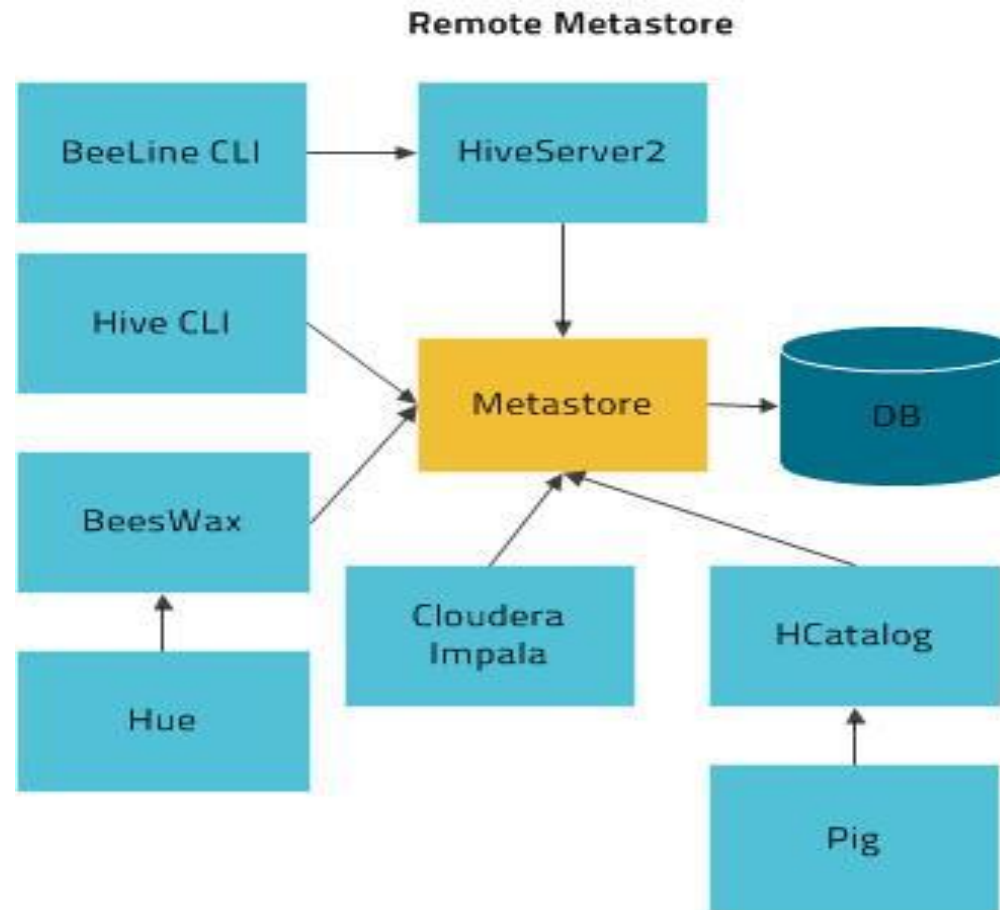 - Not recommended for anything non-trivial

Embedded Metastore Server

Local Metastore Server

Remote Metastore Server

Configuring Hive metastore

- Default - embedded derby

```
<property>
 <name>javax.jdo.option.ConnectionURL</name>
<value>jdbc:derby:;databaseName=metastore_db;create=true</value>
 <description>JDBC connect string for a JDBC metastore</description>
</property>
```

Partitions in Hive

- Sub-directories under table directories
- Partition pruning

Partitions in Hive

- Create a partitioned table
- Run a query on the partitioned table and compare the time with non-partitioned table

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Ask Bigger Questions

Partitioning best practices

- Why/When to partition?
  - WHERE, GROUP BY, JOINS benefit
- Which column to partition by?
- How many partitions?
  - Don't overload the metastore (<10,000 partitions)
  - Don't run into small files problem

Dynamic partitioning

- Populate a partitioned table using Dynamic Partitioning

Joins in Hive

- Regular (aka common) joins
  - Reduce side
- Map joins
- Bucketed Map joins
- Sorted Bucketed Merge (SMB) joins

Joins: best practices

- When to use which join?
- If your data is sorted and bucketed
  - SMB join
- If your data is bucketed
  - Bucketed Map Join
- If all but one tables in the join can fit in memory of each node
  - Map join
- Regular join, otherwise

Bucketing in Hive

- Hash based bucketing within a partition
- For faster joins
- For sampling
- Sorted buckets

Sampling in Hive

- You only want a sample of the data
- Sampled on a particular column

Bucketing in Hive

- Create a bucketed table
- Perform a sampling query on this table

Bucketing best practices

- When to use bucketing?
- Which columns to bucket on?
- How many buckets to use?

UDFs/UDAFs

- What is a UDF?
- Custom Functionality
  - written in Java

Custom MR scripts

- Plug in custom MapReduce scripts in Hive queries

Custom plugin best practices

- When to use UDF and when to use custom MR scripts?
- Comparison between UDFs/UDAFs and custom MR scripts

Hive-HBase Integration

- Read from and write to HBase tables using Hive queries

Contact info

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Don't Forget:

Ryan Blue's tutorial on Hadoop App development this
afternoon!