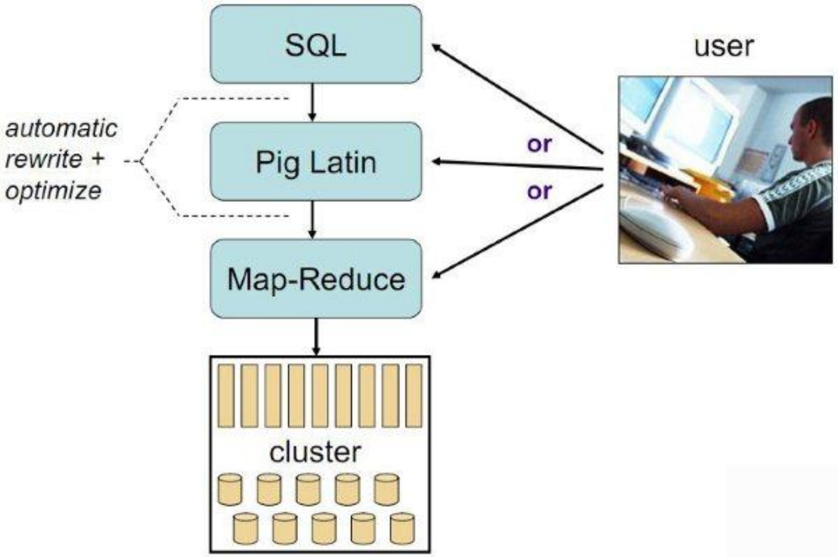
Hadoop数据分析平台 第9周

2012.11.11

Pig

- Hadoop客户端
- 使用类似于SQL的面向数据流的语言Pig Latin
- Pig Latin可以完成排序，过滤，求和，聚组，关联等操作，可以支持自定义函数
- Pig自动把Pig Latin映射为Map-Reduce作业上传到集群运行，减少用户编写Java程序的苦恼
- 三种运行方式：Grunt shell，脚本方式，嵌入式



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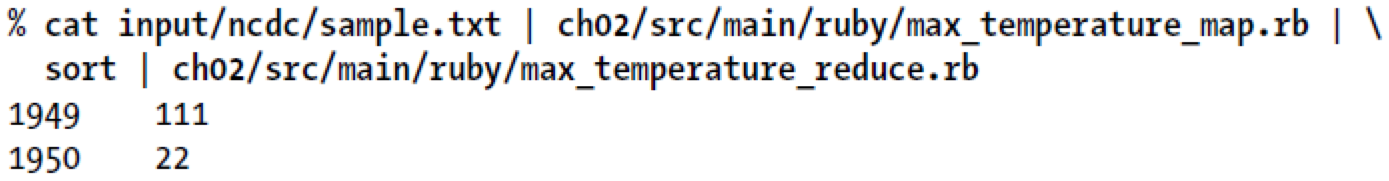
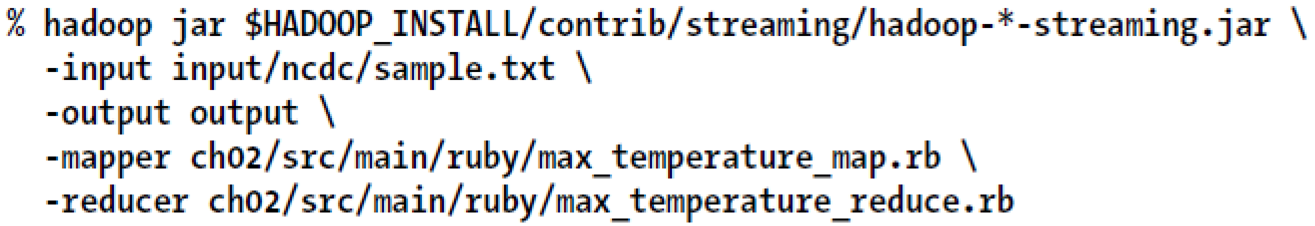
Hadoop流：最简便的M-R



```
% cat input/ncdc/sample.txt | ch02/src/main/ruby/max_temperature_map.rb | \
  sort | ch02/src/main/ruby/max_temperature_reduce.rb
1949    111
1950    22
```



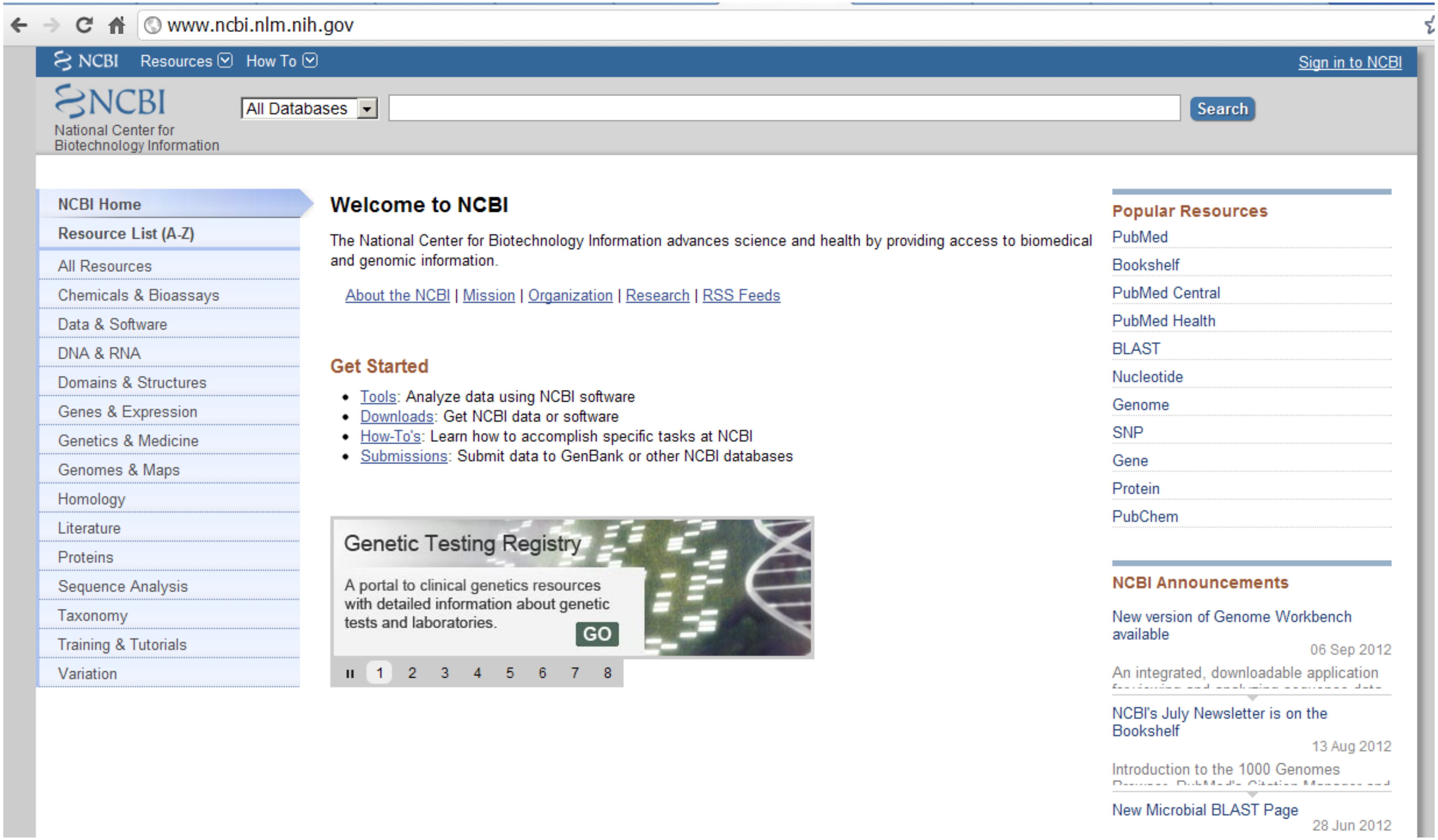
```
% hadoop jar $HADOOP_INSTALL/contrib/streaming/hadoop-*-streaming.jar \
  -input input/ncdc/sample.txt \
  -output output \
  -mapper ch02/src/main/ruby/max_temperature_map.rb \
  -reducer ch02/src/main/ruby/max_temperature_reduce.rb
```

Wordcount的例子

```
bin/hadoop jar contrib/streaming/hadoop-0.20.2-streaming.jar -input
   input -output output -mapper /bin/cat -reducer /usr/bin/wc
```

注意，命令一定要写完整的路径

一个案例：生物数据库



NCBI
National Center for Biotechnology Information

- NCBI Home
- Resource List (A-Z)
- All Resources
- Chemicals & Bioassays
- Data & Software
- DNA & RNA
- Domains & Structures
- Genes & Expression
- Genetics & Medicine
- Genomes & Maps
- Homology
- Literature
- Proteins
- Sequence Analysis
- Taxonomy
- Training & Tutorials
- Variation

Welcome to NCBI

The National Center for Biotechnology Information advances science and health by providing access to biomedical and genomic information.

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- Downloads: Get NCBI data or software
- How-To's: Learn how to accomplish specific tasks at NCBI
- Submissions: Submit data to GenBank or other NCBI databases

Genetic Testing Registry

A portal to clinical genetics resources with detailed information about genetic tests and laboratories.

GO

1 2 3 4 5 6 7 8

Popular Resources

- PubMed
- Bookshelf
- PubMed Central
- PubMed Health
- BLAST
- Nucleotide
- Genome
- SNP
- Gene
- Protein
- PubChem

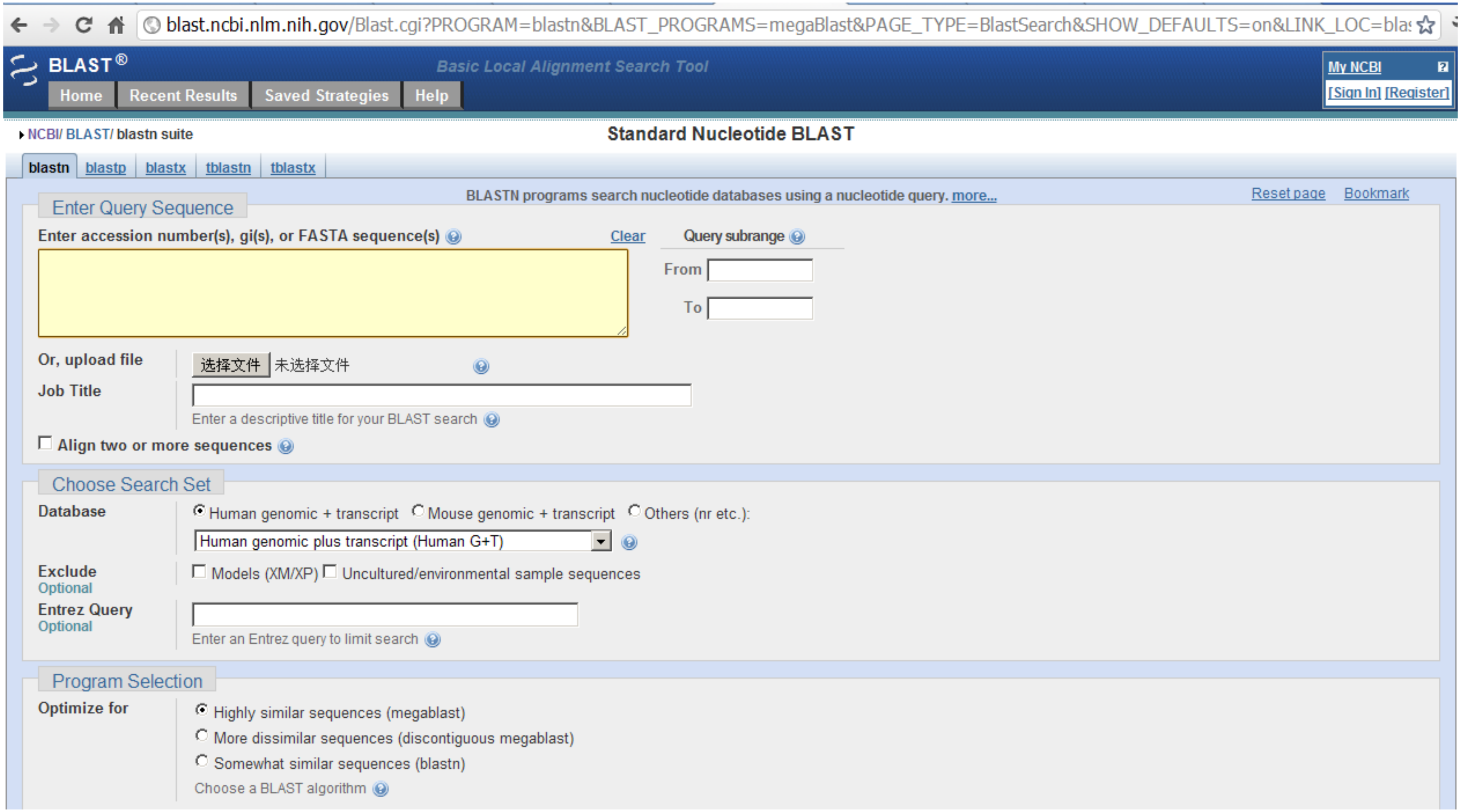
NCBI Announcements

New version of Genome Workbench available
06 Sep 2012
An integrated, downloadable application

NCBI's July Newsletter is on the Bookshelf
13 Aug 2012
Introduction to the 1000 Genomes

New Microbial BLAST Page
28 Jun 2012

BLAST



blast.ncbi.nlm.nih.gov/Blast.cgi?PROGRAM=blastn&BLAST_PROGRAMS=megaBlast&PAGE_TYPE=BlastSearch&SHOW_DEFAULTS=on&LINK_LOC=bla

NCBI/ BLAST/ blastn suite

Standard Nucleotide BLAST

BLASTN programs search nucleotide databases using a nucleotide query. more...

Enter Query Sequence

Enter accession number(s), gi(s), or FASTA sequence(s)

Query subrange

From

To

Or, upload file 未选择文件

Job Title

Enter a descriptive title for your BLAST search

□ Align two or more sequences

Choose Search Set

Database ● Human genomic + transcript ○ Mouse genomic + transcript ○ Others (nr etc.):

Human genomic plus transcript (Human G+T)

Exclude Optional □ Models (XM/XP) □ Uncultured/environmental sample sequences

Entrez Query Optional

Enter an Entrez query to limit search

Program Selection

Optimize for

● Highly similar sequences (megablast)

○ More dissimilar sequences (discontiguous megablast)

○ Somewhat similar sequences (blastn)

Choose a BLAST algorithm

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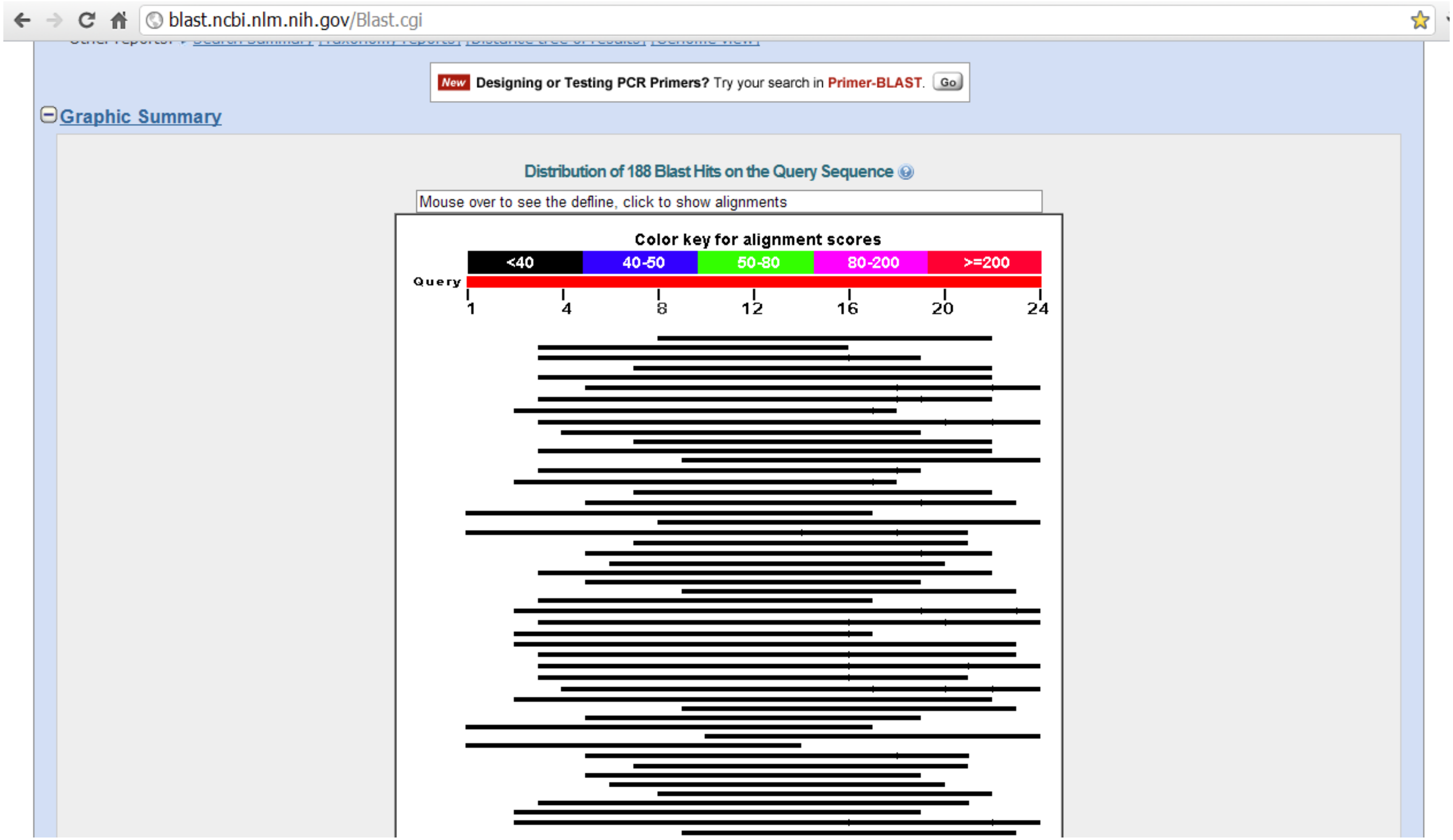
BLAST



blast.ncbi.nlm.nih.gov/Blast.cgi

Other reports: ▸ Search Summary [Taxonomy reports] [Distance tree of results] [Genome view]

New Designing or Testing PCR Primers? Try your search in Primer-BLAST.

Distribution of 188 Blast Hits on the Query Sequence

Mouse over to see the defline, click to show alignments

BLAST的Map-Reduce化

- BLAST比对算法，只涉及独立的一条基因信息，没有交叉计算，非常适合M-R
- BLAST算法用c实现，代码庞大，修改困难
- 权宜之计可以使用hadoop stream快速实现

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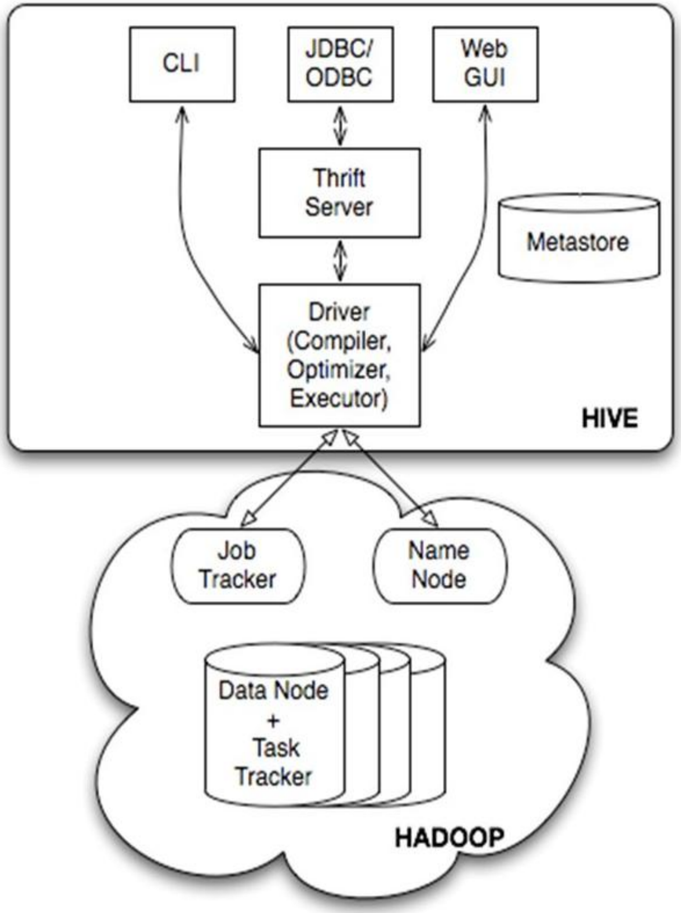
Hive

- 数据仓库工具。可以把Hadoop下的原始结构化数据变成Hive中的表
- 支持一种与SQL几乎完全相同的语言HiveQL。除了不支持更新、索引和事务，几乎SQL的其它特征都能支持
- 可以看成是从SQL到Map-Reduce的映射器
- 提供shell、JDBC/ODBC、Thrift、Web等接口



Hive简介

- 起源自facebook由Jeff Hammerbacher领导的团队
- 构建在Hadoop上的数据仓库框架
- 设计目的是让SQL技能良好，但Java技能较弱的分析师可以查询海量数据
- 2008年facebook把hive项目贡献给Apache

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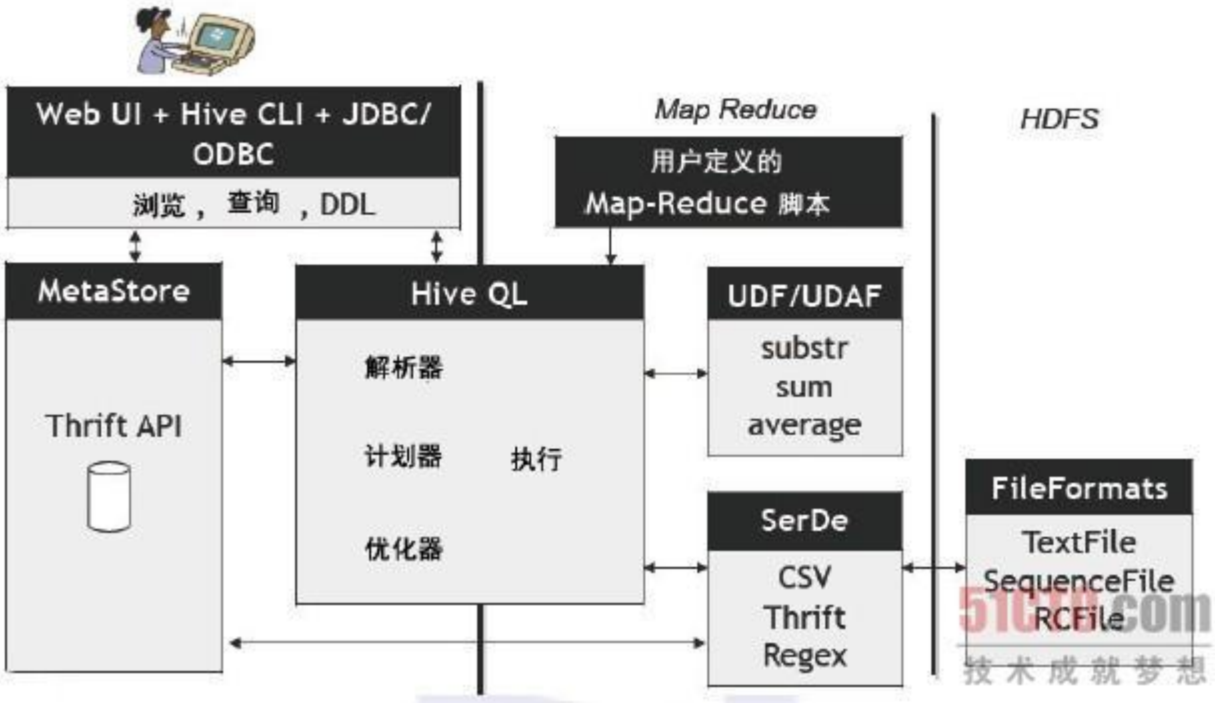
Hive的组件与体系架构

- 用户接口：shell, thrift, web等
- Thrift服务器
- 元数据库“Derby, Mysql等
- 解析器
- Hadoop



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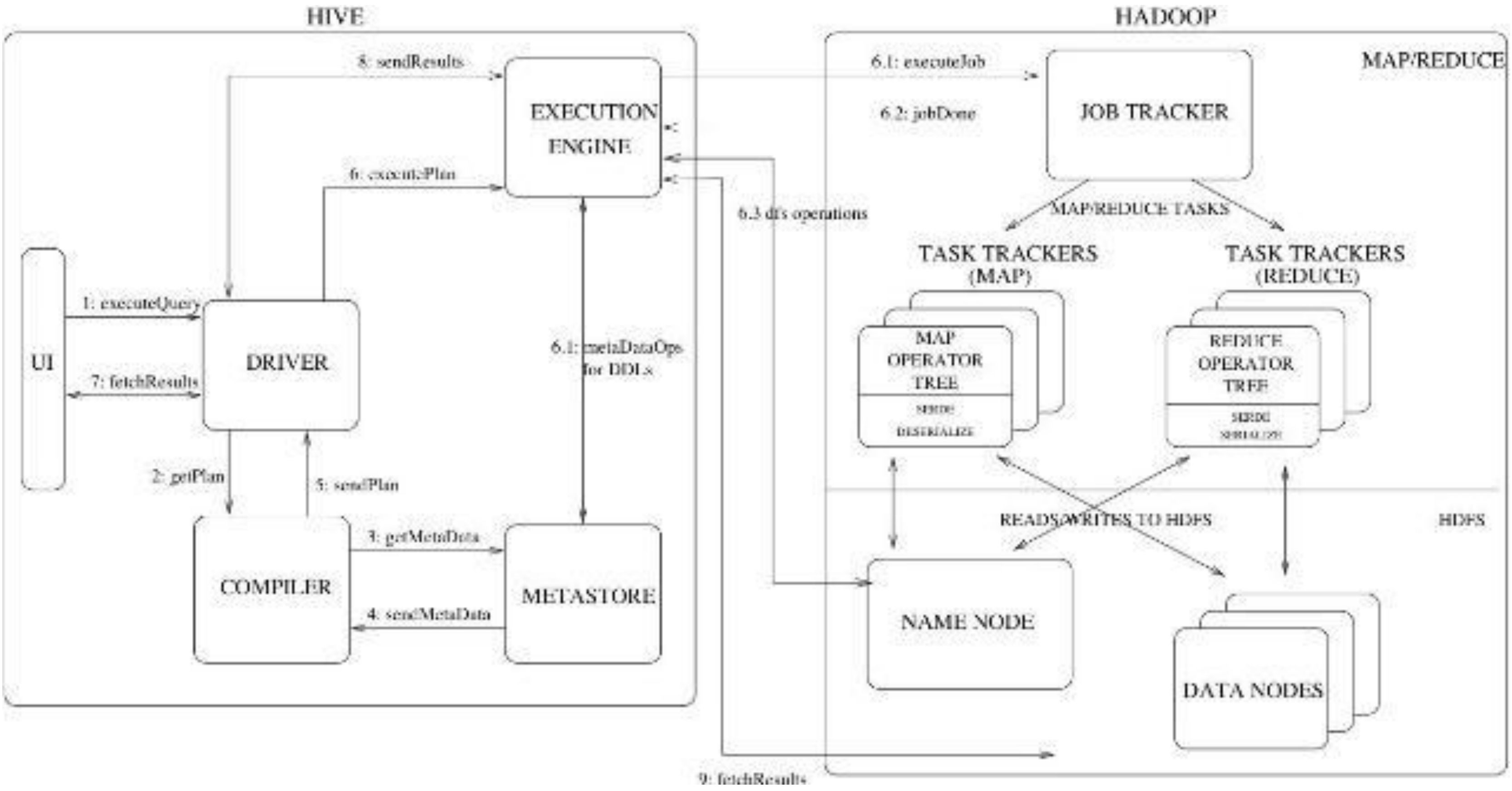
架构图


HIVE
HADOOP
8: sendResults
EXECUTION ENGINE
6.1: executeJob
6.2: jobDone
JOB TRACKER
MAP/REDUCE
6: executePlan
6.3 dfs operations
MAP/REDUCE TASKS
TASK TRACKERS (MAP)
TASK TRACKERS (REDUCE)
UI
1: executeQuery
DRIVER
7: fetchResults
6.1: metaDataOps for DDLs
MAP OPERATOR TREE
SERDE DESERIALIZE
REDUCE OPERATOR TREE
SERDE SERIALIZE
2: getPlan
5: sendPlan
READS/WRITES TO HDFS
HDFS
3: getMetaData
COMPILER
METASTORE
4: sendMetaData
NAME NODE
DATA NODES
9: fetchResults

Hive安装

- 内嵌模式：元数据保持在内嵌的Derby模式，只允许一个会话连接
- 本地独立模式：在本地安装Mysql，把元数据放到Mysql内
- 远程模式：元数据放置在远程的Mysql数据库

Hive安装：内嵌模式

1.下载

http://apache.dataguru.cn/hive/hive-0.8.1/hive-0.8.1.tar.gz

2.安装

(1)上传hive安装包到机器上,使用root用户登陆:

```
 tar -xvf hive-0.8.1.tar.gz
```

(2)将解压的hive分别移动并改名为/usr/local/hive

```
rm -rf /usr/local/hive mv hive-0.8.1  /usr/local/hive
```

内嵌模式

3.配置hive

(1)修改/usr/local/hive/bin/hive-config.sh

在文件末尾加入

export JAVA_HOME=/usr/local/jdk export HIVE_HOME=/usr/local/hive export HADOOP_HOME=/usr/local/hadoop

(2) 根据hive-default.xml复制hive-site.xml

cp /usr/local/hive/conf/hive-default.xml /usr/local/hive/conf/hive-site.xml

(3)配置hive-site.xml,主要配置项如下:

hive.metastore.warehouse.dir：（HDFS上的）数据目录

hive.exec.scratchdir：（HDFS上的）临时文件目录

hive.metastore.warehouse.dir默认值是/user/hive/warehouse

hive.exec.scratchdir默认值是/tmp/hive-${user.name}

内嵌模式

以上是默认值，暂时不改。

(4)改变 /usr/local/hive的目录所有者为hadoop

```
chown -R hadoop:hadoop /usr/local/hive
```

(5)配置hive的log4j:

```
cp /usr/loca/hive/conf/hive-log4j.properties.template
/usr/loca/hive/conf/hive-log4j.properties
```

修改/usr/loca/hive/conf/hive-log4j.properties将

org.apache.hadoop.metrics.jvm.EventCounter改为

org.apache.hadoop.log.metrics.EventCounter

(6)启动hive

使用hadoop用户登陆,执行/usr/local/hive/bin/hive

Hive安装：独立模式

- 安装Mysql并启动服务
- 在Mysql中为hive建立账号，并授予足够的权限，例如hive账号，授予all privileges
- 用上述账号登陆mysql，然后创建数据库，比如名叫hive，用于存放hive的元数据
- 在本地安装mysql客户端
- 配置hive-site.xml文件，指出使用本地Mysql数据库，已经连接协议，账号、口令等
- 把mysql-connector-java-x.x.x.jar复制到hive的lib目录下
- 启动hive能进入shell表示安装成功

Hive安装：远程模式

- 在本地模式的基础上修改hive-site.xml文件，设置hive.metastore.local为false，并指向远程mysql数据库即可

hive-site.xml文件内容

```
<property>
  <name>hive.metastore.local</name>
  <value>false</value>
  <description>controls whether to connect to remove metastore server or open a new metastore server in Hive Client JVM</description>
</property>

<property>
  <name>javax.jdo.option.ConnectionURL</name>

        <value>jdbc:mysql://mysql_server_host:3306/hivedb?createDatabaseIfNotExist=true&useUnicode=true&characterEncoding=latin1</value>
  <description>JDBC connect string for a JDBC metastore</description>
</property>
```

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hive-site.xml文件内容

```
<property>
  <name>javax.jdo.option.ConnectionDriverName</name>
  <value>com.mysql.jdbc.Driver</value>
  <description>Driver class name for a JDBC metastore</description>
</property>

<property>
  <name>javax.jdo.option.ConnectionUserName</name>
  <value>mysql_username</value>
  <description>username to use against metastore database</description>
</property>

<property>
  <name>javax.jdo.option.ConnectionPassword</name>
  <value>mysql_password</value>
  <description>password to use against metastore database</description>
</property>
```

hive-site.xml文件内容

```
<property>
  <name>hive.stats.dbconnectionstring</name>

        <value>jdbc:mysql://mysql_server_host:3306/hive_stats?useUnicode=true&characterEncoding=latin1&user=mysql
        _username&password=mysql_password&createDatabaseIfNotExist=true</value>
  <description>The default connection string for the database that stores temporary hive statistics.</description>
</property>

<property>
  <name>hive.stats.dbconnectionstring</name>

        <value>jdbc:mysql://mysql_server_host:3306/hive_stats?useUnicode=true&characterEncoding=utf8&user=mysql_
        username&password=mysql_password&createDatabaseIfNotExist=true</value>
  <description>The default connection string for the database that stores temporary hive statistics.</description>
</property>
```

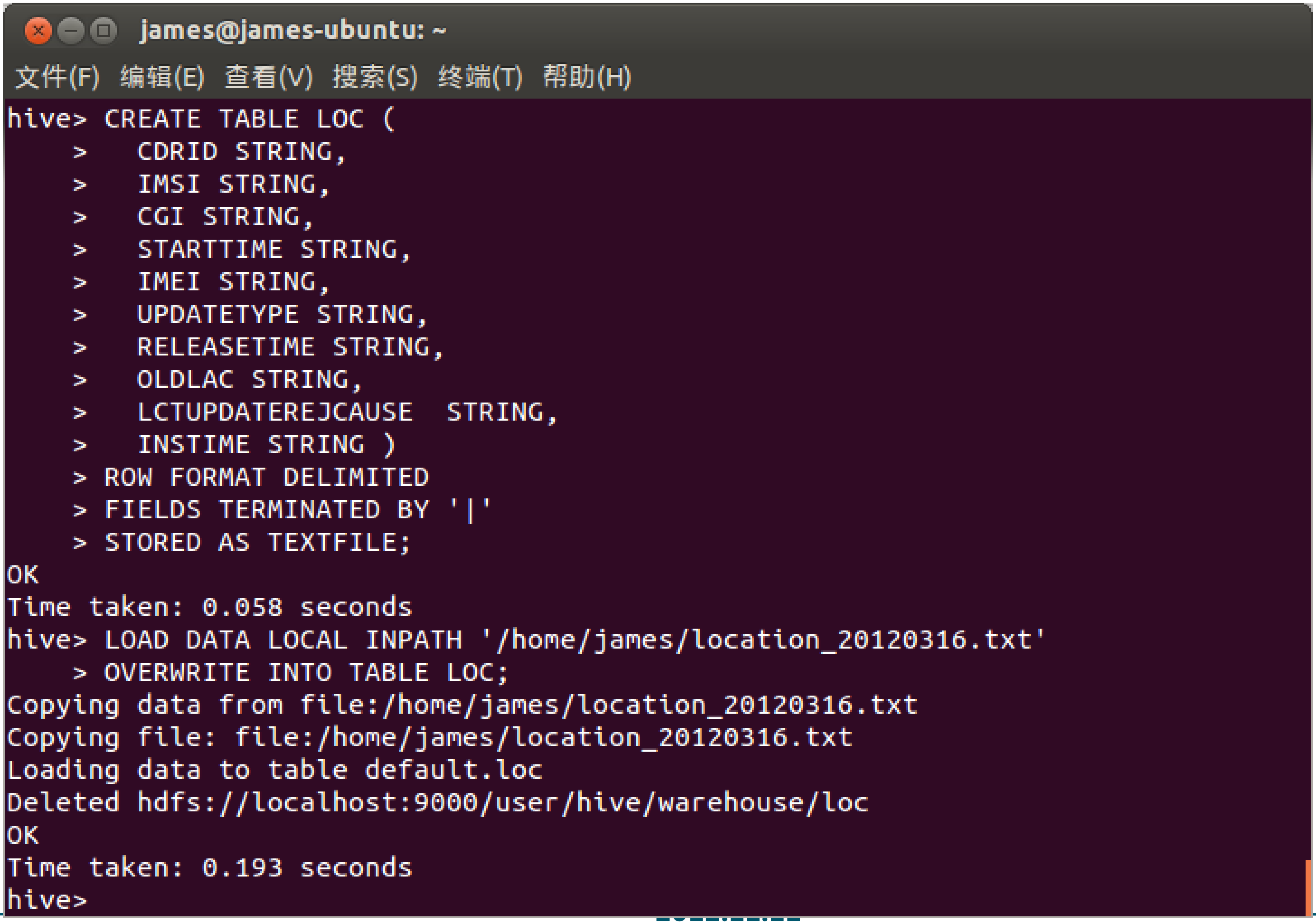
hive-site.xml文件内容

```
<property>
  <name>hive.stats.dbclass</name>
  <value>jdbc:mysql</value>
  <description>The default database that stores temporary hive statistics.</description>
</property>

<property>
  <name>hive.stats.jdbcdriver</name>
  <value>com.mysql.jdbc.Driver</value>
  <description>The JDBC driver for the database that stores temporary hive statistics.</description>
</property>

<property>
  <name>hive.metastore.uris</name>
  <value>thrift://127.0.0.1:9083</value>
</property>
```

Hive shell

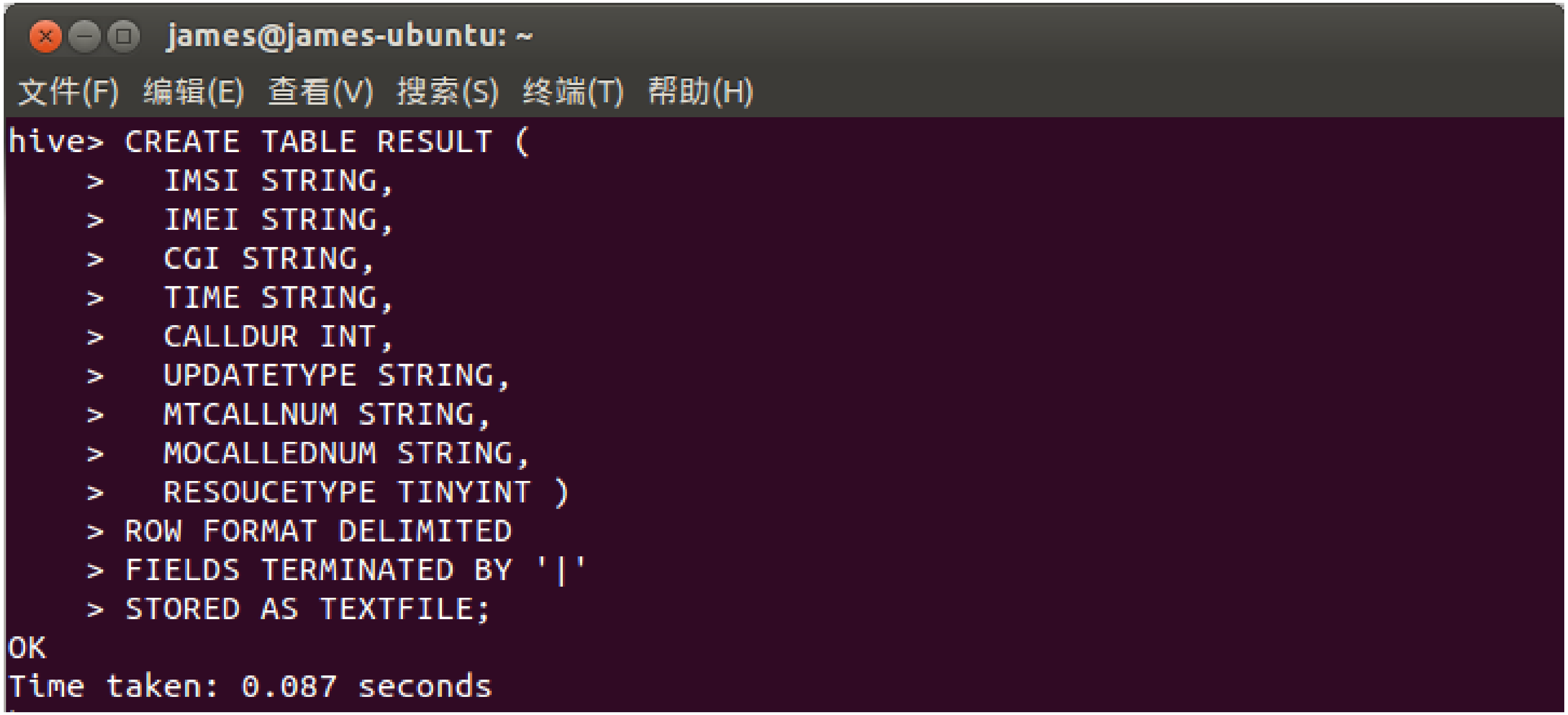
- 执行HiveQL（大约相当于SQL 92标准）
- 查看或临时设置Hive参数，只对当前会话有效
- 创建函数
- 导入jar包

创建表



```
hive> CREATE TABLE LOC (
    >   CDRID STRING,
    >   IMSI STRING,
    >   CGI STRING,
    >   STARTTIME STRING,
    >   IMEI STRING,
    >   UPDATETYPE STRING,
    >   RELEASETIME STRING,
    >   OLDLAC STRING,
    >   LCTUPDATEREJCAUSE  STRING,
    >   INSTIME STRING )
    > ROW FORMAT DELIMITED
    > FIELDS TERMINATED BY '|'
    > STORED AS TEXTFILE;
OK
Time taken: 0.058 seconds
hive> LOAD DATA LOCAL INPATH '/home/james/location_20120316.txt'
    > OVERWRITE INTO TABLE LOC;
Copying data from file:/home/james/location_20120316.txt
Copying file: file:/home/james/location_20120316.txt
Loading data to table default.loc
Deleted hdfs://localhost:9000/user/hive/warehouse/loc
OK
Time taken: 0.193 seconds
hive>
```

创建表



```
hive> CREATE TABLE RESULT (
    >   IMSI STRING,
    >   IMEI STRING,
    >   CGI STRING,
    >   TIME STRING,
    >   CALLDUR INT,
    >   UPDATETYPE STRING,
    >   MTCALLNUM STRING,
    >   MOCALLEDNUM STRING,
    >   RESOUCETYPE TINYINT )
    > ROW FORMAT DELIMITED
    > FIELDS TERMINATED BY '|'
    > STORED AS TEXTFILE;
OK
Time taken: 0.087 seconds
```

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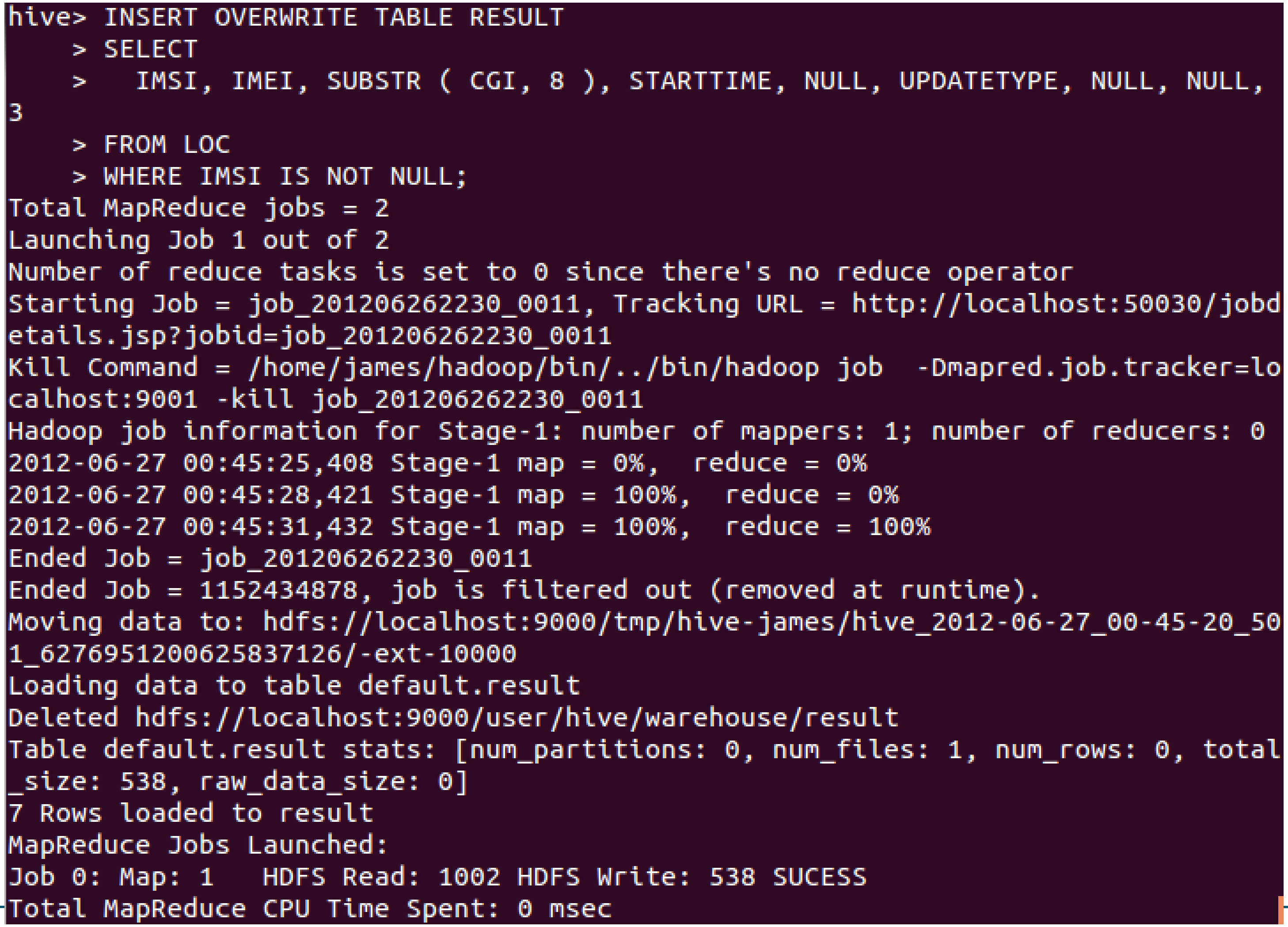
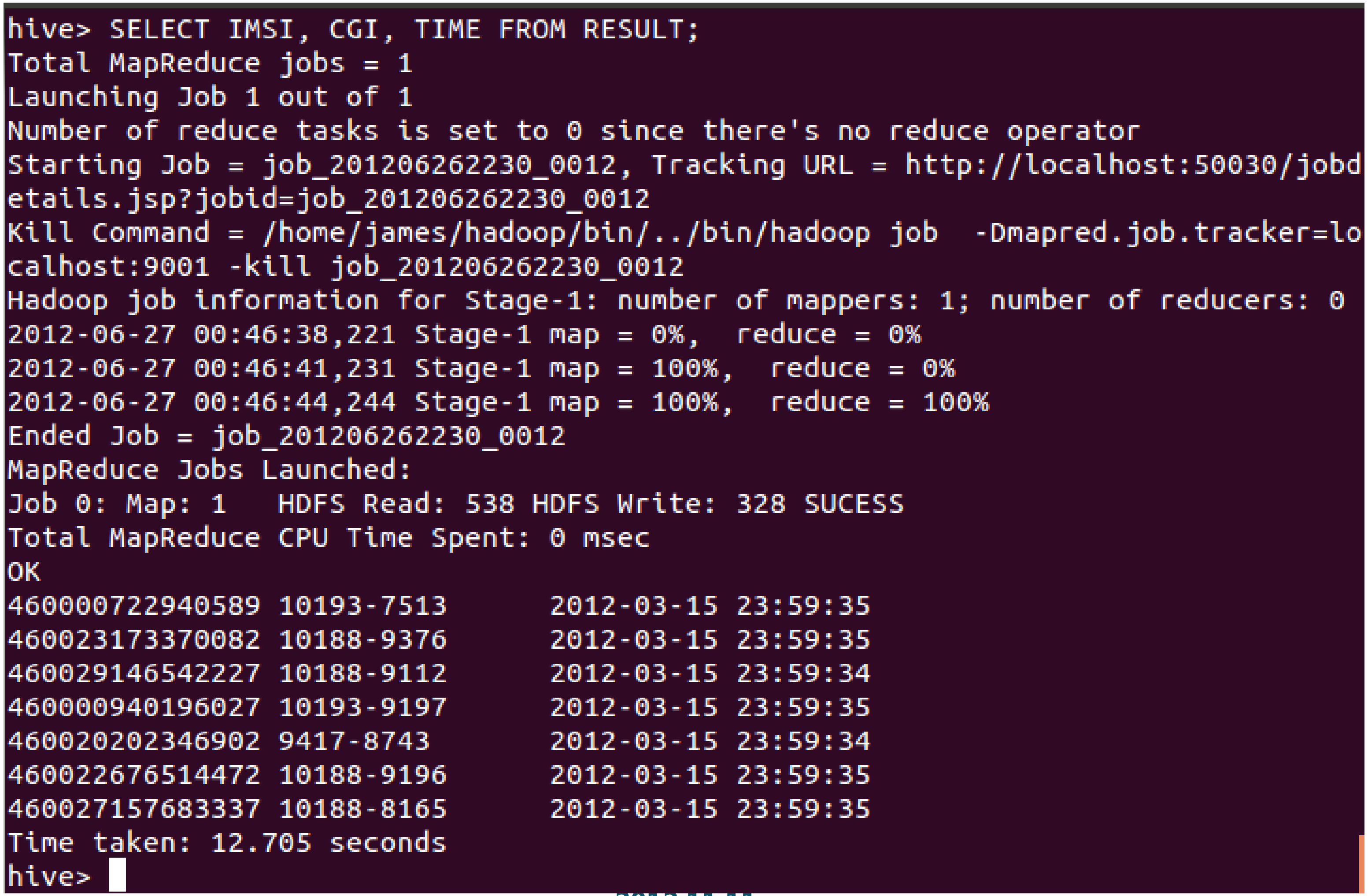
插入数据



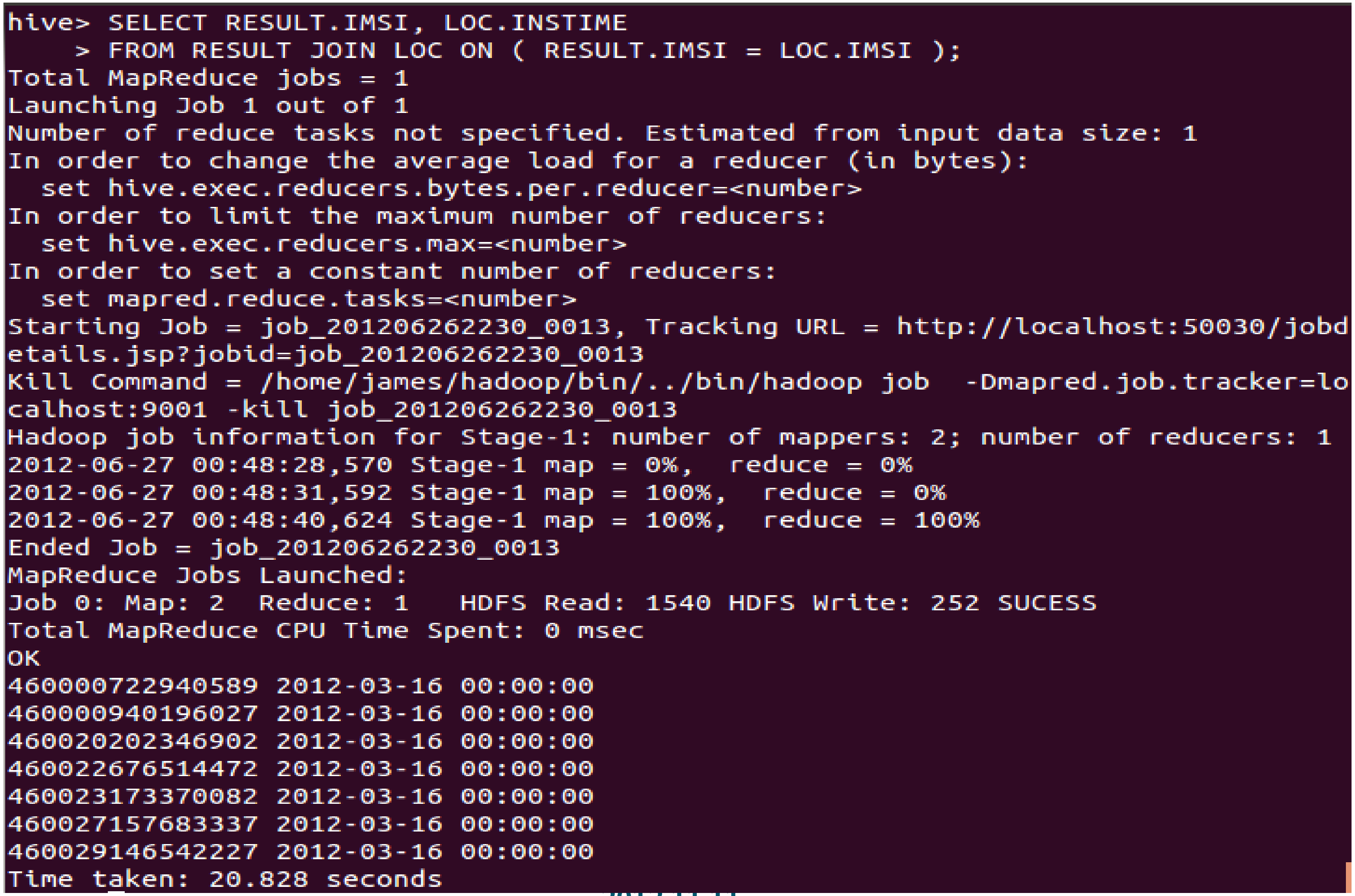
```
hive> INSERT OVERWRITE TABLE RESULT
    > SELECT
    >   IMSI, IMEI, SUBSTR ( CGI, 8 ), STARTTIME, NULL, UPDATETYPE, NULL, NULL,
3
    > FROM LOC
    > WHERE IMSI IS NOT NULL;
Total MapReduce jobs = 2
Launching Job 1 out of 2
Number of reduce tasks is set to 0 since there's no reduce operator
Starting Job = job_201206262230_0011, Tracking URL = http://localhost:50030/jobd
etails.jsp?jobid=job_201206262230_0011
Kill Command = /home/james/hadoop/bin/../bin/hadoop job  -Dmapred.job.tracker=lo
calhost:9001 -kill job_201206262230_0011
Hadoop job information for Stage-1: number of mappers: 1; number of reducers: 0
2012-06-27 00:45:25,408 Stage-1 map = 0%,  reduce = 0%
2012-06-27 00:45:28,421 Stage-1 map = 100%,  reduce = 0%
2012-06-27 00:45:31,432 Stage-1 map = 100%,  reduce = 100%
Ended Job = job_201206262230_0011
Ended Job = 1152434878, job is filtered out (removed at runtime).
Moving data to: hdfs://localhost:9000/tmp/hive-james/hive_2012-06-27_00-45-20_50
1_6276951200625837126/-ext-10000
Loading data to table default.result
Deleted hdfs://localhost:9000/user/hive/warehouse/result
Table default.result stats: [num_partitions: 0, num_files: 1, num_rows: 0, total
_size: 538, raw_data_size: 0]
7 Rows loaded to result
MapReduce Jobs Launched:
Job 0: Map: 1   HDFS Read: 1002 HDFS Write: 538 SUCESS
Total MapReduce CPU Time Spent: 0 msec
```

查询



```
hive> SELECT IMSI, CGI, TIME FROM RESULT;
Total MapReduce jobs = 1
Launching Job 1 out of 1
Number of reduce tasks is set to 0 since there's no reduce operator
Starting Job = job_201206262230_0012, Tracking URL = http://localhost:50030/jobd
etails.jsp?jobid=job_201206262230_0012
Kill Command = /home/james/hadoop/bin/../bin/hadoop job  -Dmapred.job.tracker=lo
calhost:9001 -kill job_201206262230_0012
Hadoop job information for Stage-1: number of mappers: 1; number of reducers: 0
2012-06-27 00:46:38,221 Stage-1 map = 0%,  reduce = 0%
2012-06-27 00:46:41,231 Stage-1 map = 100%,  reduce = 0%
2012-06-27 00:46:44,244 Stage-1 map = 100%,  reduce = 100%
Ended Job = job_201206262230_0012
MapReduce Jobs Launched:
Job 0: Map: 1   HDFS Read: 538 HDFS Write: 328 SUCESS
Total MapReduce CPU Time Spent: 0 msec
OK
460000722940589 10193-7513      2012-03-15 23:59:35
460023173370082 10188-9376      2012-03-15 23:59:35
460029146542227 10188-9112      2012-03-15 23:59:34
460000940196027 10193-9197      2012-03-15 23:59:35
460020202346902 9417-8743       2012-03-15 23:59:34
460022676514472 10188-9196      2012-03-15 23:59:35
460027157683337 10188-8165      2012-03-15 23:59:35
Time taken: 12.705 seconds
hive> █
```

表连接



```
hive> SELECT RESULT.IMSI, LOC.INSTIME
    > FROM RESULT JOIN LOC ON ( RESULT.IMSI = LOC.IMSI );
Total MapReduce jobs = 1
Launching Job 1 out of 1
Number of reduce tasks not specified. Estimated from input data size: 1
In order to change the average load for a reducer (in bytes):
  set hive.exec.reducers.bytes.per.reducer=<number>
In order to limit the maximum number of reducers:
  set hive.exec.reducers.max=<number>
In order to set a constant number of reducers:
  set mapred.reduce.tasks=<number>
Starting Job = job_201206262230_0013, Tracking URL = http://localhost:50030/jobd
etails.jsp?jobid=job_201206262230_0013
Kill Command = /home/james/hadoop/bin/../bin/hadoop job  -Dmapred.job.tracker=lo
calhost:9001 -kill job_201206262230_0013
Hadoop job information for Stage-1: number of mappers: 2; number of reducers: 1
2012-06-27 00:48:28,570 Stage-1 map = 0%,  reduce = 0%
2012-06-27 00:48:31,592 Stage-1 map = 100%,  reduce = 0%
2012-06-27 00:48:40,624 Stage-1 map = 100%,  reduce = 100%
Ended Job = job_201206262230_0013
MapReduce Jobs Launched:
Job 0: Map: 2  Reduce: 1   HDFS Read: 1540 HDFS Write: 252 SUCESS
Total MapReduce CPU Time Spent: 0 msec
OK
460000722940589 2012-03-16 00:00:00
460000940196027 2012-03-16 00:00:00
460020202346902 2012-03-16 00:00:00
460022676514472 2012-03-16 00:00:00
460023173370082 2012-03-16 00:00:00
460027157683337 2012-03-16 00:00:00
460029146542227 2012-03-16 00:00:00
Time taken: 20.828 seconds
```

JDBC/ODBC接口

- 用户可以像连接传统关系数据库一样使用JDBC或ODBC连接Hive
- 目前还不成熟

JDBC的具体连接过程

1.使用jdbc的方式连接Hive，首先做的事情就是需要启动hive的Thrift Server,否则连接hive的时候会报connection refused的错误。

启动命令如下：

```
hive --service hiveserver
```

2.新建java项目，然后将hive/lib下的所有jar包和hadoop的核心jar包hadoop-0.20.2-core.jar添加到项目的类路径上。

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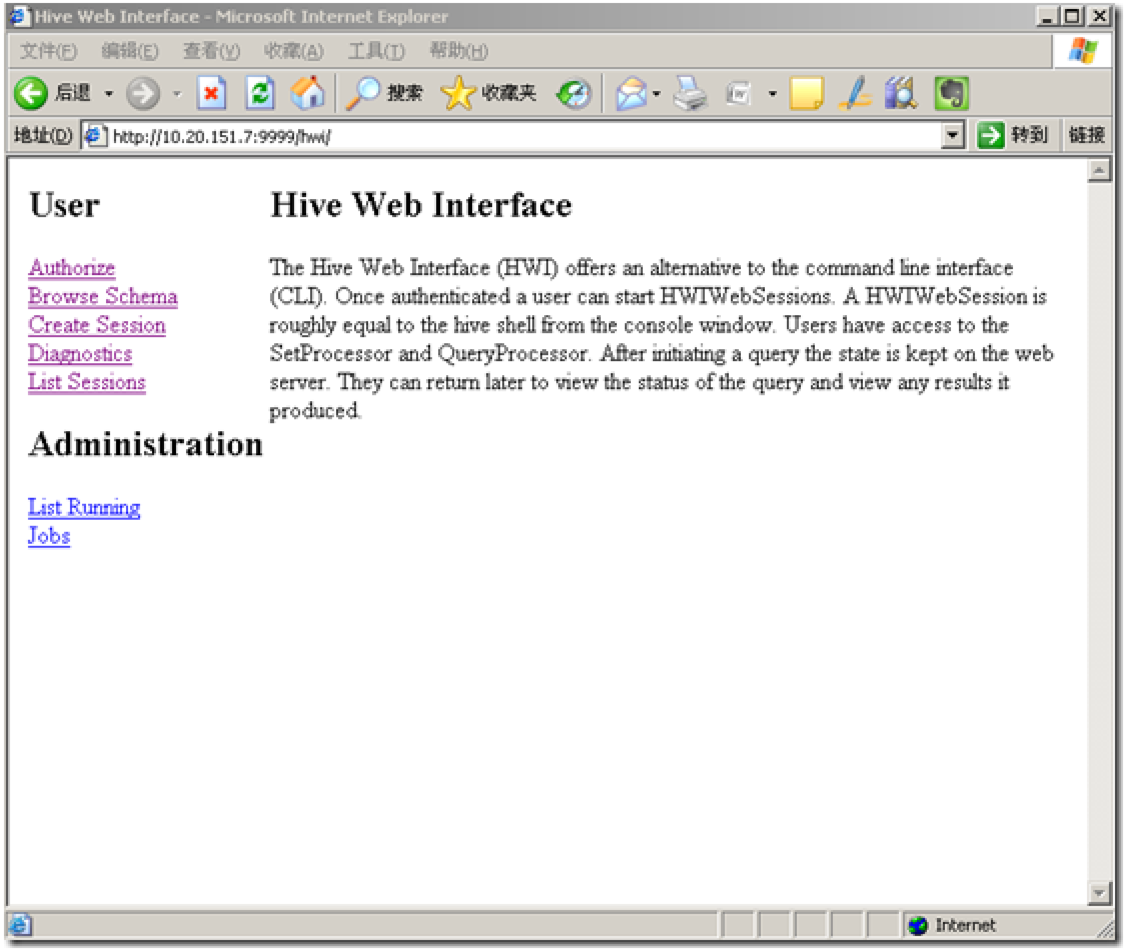
样板代码

```
public static void main(String[] args) throws Exception {
        // TODO Auto-generated method stub
        Class.forName("org.apache.hadoop.hive.jdbc.HiveDriver");
        String dropSql="drop table pokes";
        String createSql="create table pokes (foo int,bar string)";
        String insertSql="load data local inpath '/home/zhangxin/hive/kv1.txt' overwrite into  table pokes";
        String querySql="select bar from pokes limit 5";
        Connection connection=DriverManager.getConnection("jdbc:hive://localhost:10000/default", "", "");
        Statement statement=connection.createStatement();
        statement.execute(dropSql);
        statement.execute(createSql);
        statement.execute(insertSql);
        ResultSet rs=statement.executeQuery(querySql);
         while(rs.next())
        {
            System.out.println(rs.getString("bar"));
        } }
```

Web接口

- 假设hive部署在10.20.151.7机器上，conf/hive-default.xml文件都是默认值，那么我们直接在浏览器中输入：http://10.20.151.7:9999/hwi/ 就可以访问了



Hive Web Interface - Microsoft Internet Explorer
文件(F) 编辑(E) 查看(V) 收藏(A) 工具(T) 帮助(H)
后退 搜索 收藏夹
地址(D) http://10.20.151.7:9999/hwi/
转到 链接
Internet

User

- Authorize
- Browse Schema
- Create Session
- Diagnostics
- List Sessions

Hive Web Interface

The Hive Web Interface (HWI) offers an alternative to the command line interface (CLI). Once authenticated a user can start HWIWebSessions. A HWIWebSession is roughly equal to the hive shell from the console window. Users have access to the SetProcessor and QueryProcessor. After initiating a query the state is kept on the web server. They can return later to view the status of the query and view any results it produced.

Administration

- List Running Jobs

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元数据

NUCLEUS_TABLES

A

DBS

SEQUENCE_TABLE

SERDES

TBLS

SDS

PARTITION_KEYS

COLUMNS

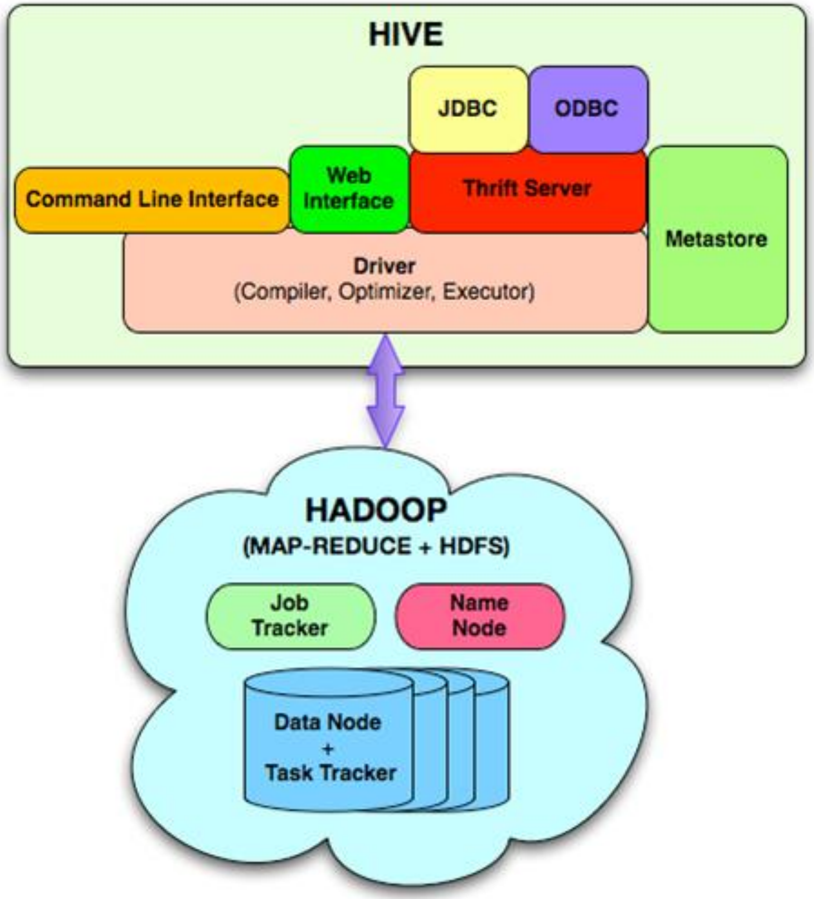
BUCKETING_COLS

SD_PARAMS

SORT_COLS

SERDE_PARAMS

TABLE_PARAMS



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Hive的数据放在哪儿？

- 数据在HDFS的warehouse目录下，一个表对应一个子目录
- 桶与reduce
- 本地的/tmp目录存放日志和执行计划

Hive的UDF

- 见刘鹏书P196

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Thanks

FAQ时间