



06/12/2012

## Column Statistics in Hive (WIP)

Shreepadma Venugopalan

Software Engineer, Platform Team

Cloudera

cloudera

# Agenda

- Motivation
  - Why Column Statistics?
- New Statistics
- Computing and Persisting Statistics
  - How to Compute Column Statistics?
  - How to Persist Column Statistics?
- Open Issues
- Summary
- Further Readings

# Why Column Statistics?

- Current State of Statistics in Hive
  - Number of rows, size of data etc. on table and partition level
  - Useful in determining the size of inputs to a Join operator
  - Insufficient for implementing a full fledged cost based optimizer

# Why Column Statistics?

- Solution: Statistics on column level
  - Needed for implementing a cost based optimizer, query progress indicator
  - Useful for implementing Theta Joins (Natural Join) as well!

# What are the New Statistics?

- Min Value
- Max Value
- Average Length
- Max Length
- Number of Distinct Values
- Number of Null Values
- Equi-depth Histograms

# How to Compute Column Statistics?

- Stats Computation
  - Algorithms follow two phases – collect (Map) and aggregate (Reduce)
  - Requirements: Memory required should scale sub-linearly (preferably logarithmically) with the size of data
  - Problem: Not all statistics are trivial to compute!
    - Number of distinct values
    - Equi-depth Histograms

# Hard to Compute Statistics - Example

- Number of Distinct Values
  - Naïve approach: Keep track of all distinct values in column; Impractical to keep in memory given the size of data
  - Flajolet-Martin approach: Use hash functions to estimate the number of distinct values; Memory required is only logarithmic in size of data

# How to Compute Column Statistics?

- Stats Computation (contd..)
  - Implemented using Generic UDAF framework
  - Integrate into Hive using new StatsCollector and StatsAggregation Operators
- Explicit Computation
  - Triggered through an explicit “analyze” command
- Implicit Computation (Optional)
  - Incrementally compute and maintain statistics automatically while loading data



# How to Persist Column Statistics?

- Use Metastore
  - Extend schema to persist new statistics
  - Provide new Thrift API to retrieve new statistics

# Open Issues

- How to aggregate equi-depth histograms constructed by the map tasks?
- Can we improve the estimates of the number of distinct values without increasing the memory footprint?

# Summary

- Tracked by JIRA - HIVE-1362
- So far.. 😊
  - UDAFs for computing all statistics except histograms
- ToDos 😞
  - Equi-depth histograms
  - Metastore and Thrift API changes to persist and retrieve statistics
  - Integrate with analyze command in Hive

---

Questions?

# Further Reading

- Learn
  - Academic
    - A. Gruenheid, et. al., Query Optimization using Column Statistics in Hive.
    - S. Chaudhuri, An Overview of Query Optimization in Relational Systems.
    - P. Flajolet and N.G. Martin, Probabilistic Counting Algorithms for Database Applications.
  - Blog: <http://www.cloudera.com/blog>
- Download 'n' play
  - [www.cloudera.com/download](http://www.cloudera.com/download)
- Contribute to the community
  - [hadoop.apache.org](http://hadoop.apache.org)
- Expertise input
  - Join [cdh-user@cloudera.org](mailto:cdh-user@cloudera.org)

Contact me:  
[shreepadma@cloudera.com](mailto:shreepadma@cloudera.com)