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Database Management
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Big Data Summary

Thusoo, A., Sarma, J. S., Jain, N., Shao, Z., Chakka, P., Zhang, N., … Murthy, R. (2010). Hive - a petabyte scale data warehouse using Hadoop. 2010 IEEE 26th International Conference on Data Engineering (ICDE 2010). http://doi.org/10.1109/icde.2010.5447738

Pavlo, A., Paulson, E., Rasin, A., Abadi, D. J., Dewitt, D. J., Madden, S., & Stonebraker, M. (2009). A comparison of approaches to large-scale data analysis. Proceedings of the 35th SIGMOD international conference on Management of data - SIGMOD 09. http://doi.org/10.1145/1559845.1559865

Main Idea of First Paper: “Hive - A Petabyte Scale Data Warehouse Using Hadoop”

- **Problem:** Pre-Hadoop
  - Data growing too fast.
  - Urgent need for infrastructure that could scale with growing amounts of data.

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- **Solution:** Hadoop
  - Jobs that had taken more than a day to complete now took a few hours.

- **Problem:** Hadoop
  - Not user-friendly.
  - Map-reduce programs for simple tasks.

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- **Solution:** Hive
  - Bring familiar concepts of SQL to Hadoop.
  - Utilize a new form of SQL called HiveQL.

- **Very popular with Facebook team.**

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- Simple summarization, business intelligence, machine learning applications, and support Facebook product features.

Implementation used in First Paper:

Data Model:

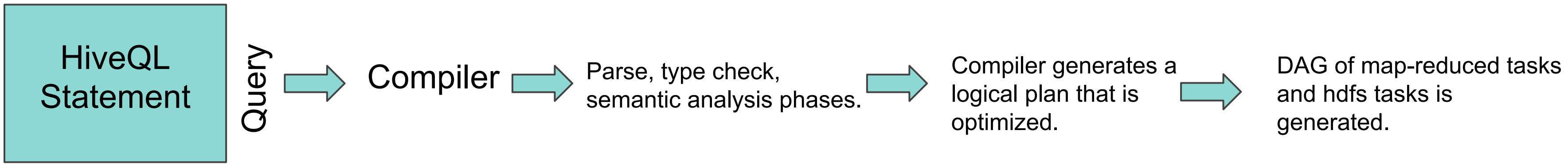
- ❑ Tables, rows, columns.
- ❑ Supports integers, floats, doubles, maps, structs.
- ❑ Any arbitrary data format and types can be plugged into Hive, by providing a **jar** that contains the implementations for the **SerDe** and **ObjectInspector** interfaces.

Query Language:

- ❑ **HiveQL:** subset of SQL with extensions useful in Hadoop environment.
- ❑ Enables people familiar with SQL to query right away.
- ❑ Lack of **INSERT INTO**, **UPDATE**, and **DELETE**, yet offers extensions to allow users to use the programming language of their choice.

Data Storage:

- ❑ **Tables:** stored in a directory in HDFS (Hadoop Distributed File System).
- ❑ **Partitions:** stored in a subdirectory within a table's directory.
- ❑ **Buckets:** stored in a file within the partition's or table's directory depending on whether the table is a partitioned table or not.



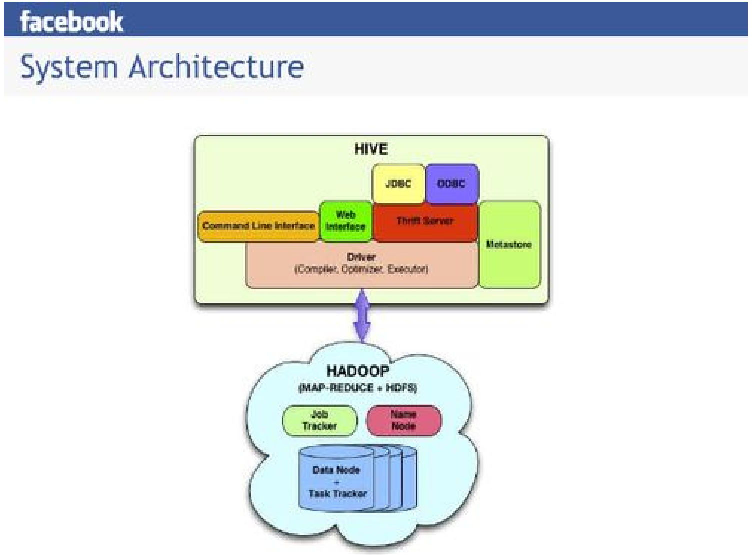
Analysis of First Paper:

Facebook:

- ❑ **Data-driven world:** As Facebook grows, amount of data grows.
- ❑ **Simplicity:** System can be used by novice and advanced users within hours.

Personal Experience:

- ❑ The Hartford Insurance Company.
- ❑ HiveQL is extremely similar to SQL, and is easy to pick up.
- ❑ Allows for tables to be organized, and for queries to be run separately.
- ❑ Faster, more storage, simple.



Main Idea of Second Paper: “A Comparison of Approaches to Large-Scale Data Analysis”

- **Why use MapReduce over Parallel Database System?**
- **Cluster Computing:** harnessing large numbers of processors working in parallel to solve a computing problem.
- **“Shared-nothing” collection:** system deployed on a collection of independent machines, each with a local disk and local main memory, connected together on a high-speed local area network.

MapReduce:

- Attractive and simple.
- Quicker load times.
- Provides simple model through which users can express relatively sophisticated distributed programs.

VS.

Parallel DBMS:

- Robust, high performance computing platform.
- High-level programming environment and parallelize readily.

GOAL: Understand the differences between the MapReduce approach and approach taken by the Parallel Database Systems.

Implementation used in Second Paper:

- ❏ Hadoop v. DBMS-X v. Vertica.
- ❏ Systems deployed on a 100-node cluster.
- ❏ **Benchmark tasks:** executed three times each, report the average of each trial.
- ❏ Each task executed on a single node, and then on different cluster sizes.
- ❏ Measured time it takes for each system to load the test data.

Grep Task: system scans through a data set of 100-byte records looking for three-character patterns.

- ❏ Two different data sets.
- ❏ First dataset fixes the size of the data per node to be the same as the original MR benchmark and only varies the number of nodes.
- ❏ Second dataset fixes the total dataset size to be the same as the original MR benchmark and evenly divides the data amongst a variable number of nodes.

Analytical Task: four tasks related to HTML document processing.

- ❏ Generate a collection of random HTML documents. Each node is assigned a set of 600,000 unique HTML documents.
- ❏ Generated two additional datasets meant to model log files of HTTP server traffic.

Analysis of Second Paper:

- ❏ Both parallel database systems displayed a significant performance advantage over Hadoop MR in executing a variety of data intensive analysis benchmark.
- ❏ DBMS-X was 3.2 times faster than MR.
- ❏ Vertica was 2.3 times faster than DBMS-X.
- ❏ MR much slower than Vertica… would not be my first choice for time management concerns.

Performance Advantage that the two database systems share is:

1. B-tree indices to speed the execution of selection operations.
2. Novel storage mechanisms (e.g. column-orientation).
3. Aggressive compression techniques with ability to operate directly on compressed data.
4. Sophisticated parallel algorithms for querying larger amounts of relational data.

Other conclusions:

- ❏ Impressed by how easy Hadoop was to set up and use compared to the databases.
- ❏ The Vertica installation process was also straightforward but temperamental.
- ❏ DBMS-X difficult to configure properly and required repeat assistance from vendor to obtain configuration that performed well.

Comparison of First and Second Paper:

First Paper:

- Describes an example of a MapReduce Implementation, Hadoop.
- The HiveQL is basically a combination of both the MapReduce and parallel SQL DBMS.

Second Paper:

- Compares MapReduce Implementation to Parallel SQL DBMS.
- An actual testing scenario, that determines the execution methods and success of each platform.

- Through personal experience with HIVE, I have found that HIVE is incredibly easy to use, pick up on, and implement with large amounts of data.

Stonebraker Talk:

- ❏ Past 25 years, concept that “one size fits all”. was the main idea of DBMS development.
- ❏ Argues that “one size fits none.”
- ❏ Most markets use column stores.
- ❏ **Column stores:** faster, and new installations are all column stores.
- ❏ **Complex Analytics:** Data Scientists will replace business analysts.
- ❏ Database Markets are not productive at all (Data Warehouse, NoSQL, and OTLP).
- ❏ Huge diversity of engines.
- ❏ Traditional row stores are good at none of the markets discussed.
- ❏ Great time to be a database researcher.
- ❏ Main memory databases getting bigger and bigger.

Advantages and Disadvantages Papers and Stonebraker Talk

Advantages:

- ❏ Able to take high level processing languages and translate to others within HIVE.
- ❏ Easy to use, adapt, learn.
- ❏ MapReduce extension from Hadoop.
- ❏ Hadoop was said to be very easy to setup and use compared to other databases.

Disadvantages:

- ❏ Complicated operations cannot be done via HIVE.
- ❏ HIVE is very useful with structured databases, but not with unstructured.
- ❏ Apparently slower, compared to some other database extensions.