A Paper on

Bigtable: A Distributed Storage System for Structured Data

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NAME: RAKESH NANDIGAMA

BIBLIOGRAPHY

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IDEA OF THE PAPER

- Google is search engine which contains millions of machines, large amount of data that may contains through copies of web, satellite data and it also contains hundreds of millions of users and as result it contains many incoming requests.

- To maintain all the above things Google has introduced the concept of Big table.

- Big table is a distributed storage system which is needed to store or handle the large amount of structured or semi structured data.

- Big table is designed to scale huge amounts of data like Petabytes which contains data across thousands of servers

- Big table is a concept used by Google in many projects to store data.

- Many applications of the Google like Google Earth, Google Finance, Personalized search, Google Analytics uses this concept to store data.

- Big table uses distributed Google file system to store data files.

DATA MODEL:

- A Big table is a multidimensional sorted map which is indexed in 3 dimensions keys like
  Row key
  Column key
  Time stamp key
- Row
  - Row keys are random strings
  - Accessing the data in a row is atomic
  - Rows are ordered lexicographically so that the related data is stored on small number of machines
  - Rows with consecutive keys are combined together called as 'tablets'.
- Column
  - Column keys are combined into group of sets called 'column families'
  - Generally similar type of data is stored in the column family.
  - A column key must be created before the data is stored.
  - A column key has two level name structure
    - Family : optional_qualifier
- Time stamp
  - In a Big table each cell contain multiple types of data which are indexed by time stamp
  - Time stamps are 64 bit integers
  - Using this most recent data is accessed easily because the data stored in decreasing time stamp order.

IMPLIMENTATION:

- Big table is mainly implemented using three major components
  - A Client library that is linked with user's code
  - One Master Server that assigns tablets to tablet servers and detects the addition and deletion of the tablet servers.
  - Many Tablet servers which manages tablets and splits the tablets whenever they get big.
- Client library interacts directly with tablet server for read and write operations.
- A Big table cluster stores many number of tables that contains a set of tablets and this tablets consist of data associated with a row range.

- The implementation is done by using the Google file system which contain SSTable file format i.e. Big table uses Google File system to store and log many data files this GFS contains SSTable file format internally this format is used le Big table.

- The main functionality of SSTable is to provide persistent, orders immutable map from keys to values. Each SSTable contains a number of sequences of blocks that contain block index which are used to locate blocks this block index is loaded into memory whenever the SSTable is opened. SSTables can be overlapped.

- In addition to the SSTables tablets are also required. Rows with consecutive keys are combined together called as 'tablets'. Tablets are built out of multiple SSTables. Tablets do not overlap.

- Multiple Tablets are combined to form a 'Table'.

- All these are organized to form a big cluster which contains group of tables. As the number of tablets is increasing the table automatically splits into multiple tablets.

- Each tablet is assigned to tablet server. Each tablet can store or handle the data up to 100-200 MB

ANALYSIS

- Big table is a concept introduced by Google to store or handle large amounts of structured data.

- Big table provides flexibility and high performance for all the Google applications where Big table concept is used.

- According to my analysis the usage of GFS helps the Big table a lot in its implementation.

- Using SSTable format helps the Big Table to store and log many files.

- In addition to SSTables using Tablets provides a good functionality for the Big table in its implementation.

- Instead of trying to access the data from large data sets use of seemingly single Big table seems to be very appropriate.

COMPARISION

- Relative to DBMS, Big table provides very simple and easy data retrieval mechanism. Big table does not use any relational operators.

- Big table provides atomic updates that are possible only at the row level.

- When compared to DBMS, Big table provides arbitrary number of columns per each row and it also provides arbitrary data type for each column.

- Relative to the DBMS, Big table provides extremely large scale data throughput at extremely small cost

- Fault tolerance is implemented in both the systems but it is better executed in the Big table.

- The usage of schema support in Big table is more flexible than DBMS.

- The programming model is quietly different when compared with DBMS. In DBMS we only state what we want but in Big table we program for the data access.

- DBMS provides the requirements more than the Google needs. So, Big table is enough for performing Google applications.

- When compared to DBMS, Big table is cheaper because most of the most of the DBMS requires a very expensive infrastructure.

ADVANTAGES

- There are many advantages of Big table over DBMS
    - Big table ha wide applicability
    - High performance
    - Fault-tolerant and persistent
    - High availability
    - Scalable
- It handles huge amounts data sets like petabytes very accurately without any inconsistency.
- There is no limit for the row length
- Disk access is reduced with the use of Big Table
- When compared to DBMS, Big table is cheaper because most of the most of the DBMS requires a very expensive infrastructure.

DISADVANTAGES

- Big table has less disadvantages when compared with DBMS
    - Big table does not support Atomicity
    - Big table does not support consistency
    - Big table does not support independency
    - Big table does not support durability
- Data loss can occur by the use of Big table
- Secondary index is not support using Big table
- Big table does not provide advanced features for data security