Bigtable: A Distributed Storage System for Structured Data

Chang, Fay, Jeffrey Dean, Sanjay Ghemawat, Wilson C. Hsieh, Deborah A. Wallach, Mike Burrows, Tushar Chandra, Andrew Fikes, and Robert E. Gruber. "Bigtable: A Distributed Storage System for Structured Data." OSDI ’06: 7th USENIX Symposium on Operating Systems Design and Implementation (2006): 205-18. Google, Inc. USENIX Association, 08 Nov. 2006. Web. 24 Nov. 2013.

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Main Idea

- The authors wanted to create a high performance data storage system that could scale well
  - Thousands of servers and petabytes of data
- Needs to be flexible in terms of data size and data type
- Flexibility in how the client organizes their data
- Dynamically control whether to serve data out of memory or disk

Implementation

- Data is stored in a map which is indexed by row key, column key, and timestamp
- Uses the Google file system to store log and data files
- Master server is responsible for all tablet servers
- Supports compression and caching for read performance
- Make use of metadata so data can be found very quickly
  - Can perform lookups and scans without actually reading from the disk

Analysis

- Bigtable accomplishes its goal very well
- Scalability is very impressive
- It allows for flexibility in many different areas
  - Can choose to optimize for latency or storage space
- Handles all kinds of data, and many different structures
- Relies completely on Google products

Pros and Cons

- Pros
  - Flexibility
  - Use metadata to use memory instead of reading from the disk
  - Built for large projects so it scales well

- Cons
  - Relies completely on Google technology (GFS, SSTable, Chubby)
  - Load balancer isn't perfect
  - Can be bottle-necked by the network

Use Cases

- Technologies that require large amounts of data and analysis of that data
  - Google analytics
    - Collects a large amount of data on websites and analyzes the traffic patterns
  - Google Earth
    - Has to store satellite images (70 terabytes) but they are compressed already so bigtable compression is off
  - Personalized search
    - Stores info on each person's web searches and tailors results to what they will want to see