

# Brian Main

## Big Data Paper Summary

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GHEMAWAT, SANJAY, HOWARD GOBIOFF, AND SHUN-TAK  
LEUNG. *THE GOOGLE FILE SYSTEM*. WEB.

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PAVLO, ANDREW, ERIK PAULSON, ALEXANDER RASIN,  
DANIEL J. ABADI, DAVID J. DEWITT, SAMUEL MADDEN, AND  
MICHAEL STONEBRAKER. *A COMPARISON OF  
APPROACHES TO LARGE-SCALE DATA ANALYSIS*. WEB.

# Main Idea of the Google File System



- The Google File System (GFS) is "a scalable distributed file system for large distributed data-intensive applications."
- GFS is deployed within Google as the storage platform for processing data and research and development projects.
- GFS supports around a few million, multi-gigabyte files and appends new data rather than overwriting existing data.
- GFS provides performance, scalability, reliability, and availability.
- GFS possesses qualities essential for supporting large-scale data processing workloads on commodity hardware.
- GFS has high aggregate throughput to many concurrent readers and writers performing a variety of tasks.

# Google File System Implementation



- GFS utilizes operations to create, delete, open, close, read, and write files.
- GFS uses a cluster architecture, which consists of a single master and numerous chunkservers and is available to multiple clients.
- GFS divides files into chunks, where a globally unique 64-bit chunk handle is assigned by the master.
- The master stores 3 major types of metadata:
  - the file and chunk namespaces
  - the mapping from files to chunks
  - the locations of each chunk's replica
- GFS uses a operation log to control updates and remain reliable and avoid inconsistencies.
- GFS enforces atomic file namespaces which are handled by the master to ensure correctness and store a log.
- To fully utilize each machine's network bandwidth, the data is pushed linearly along a chain of chunkservers rather than distributed in some other topology.
- Each master operation acquires a set of locks, typically read locks on directory names and either a read or write lock on the full pathname, before it runs.
- Files are renamed to a hidden name that includes deletion timestamp on the operation log before being deleted later.
- Chunks are checked by the master through a chunk version number to distinguish between up-to-date and old chunks.

# Google File System Analysis



- GFS consists of hundreds or thousands of storage machines build from inexpensive commodity parts.
- This can lead to application and operating system bugs, human errors, and disk, memory, connector, network, and power failures.
- The concept of a master being able to control chunks and locks helps the overall system remain reliable.
- The operation log allows developers to check bugs and allow disaster recovery.
- The design can handle large-scale data, which is a common problem with today's technology.

# Paper Comparisons



- Cluster computing refers to "harnessing large numbers of processors working in parallel to solve a computing problem."
- Similar to the master of GFS making workloads easy to manage, MapReduce (MR) has a simple model using only 2 functions: Map and Reduce.
- The input data set is stored in a collection of partitions, similar to chunks of GFS, which is deployed on each node in the cluster.
- The Hadoop system is the most popular open-source implementation of the MR framework, which is under development by Yahoo! and the Apache Software Foundation.
- The Hadoop framework is implemented into the GFS.
- Hadoop loads data either through the Hadoop command-line file utility or custom data loader program.
- MR relies on the system it is running on, task start-up times, compression rates, loading and data layout, execution strategies, and a failure model to support backups.
- Just like GFS, MR is easy to use and follows basic programming methods of guess and check coding.

# Advantages and Disadvantages



- **Advantages**

- GFS consists of hundreds or thousands of storage machines build from inexpensive commodity parts.
- GFS provides performance, scalability, reliability, and availability.
- Just like GFS, MR is easy to use and follows basic programming methods of guess and check coding.

- **Disadvantages**

- GFS can lead to application and operating system bugs, human errors, and disk, memory, connector, network, and power failures.
- Since GFS runs on Hadoop, it relies on the system it is running on, task start-up times, compression rates, loading and data layout, execution strategies, and a failure model to support backups.
  - ✦ This can change performance based on physical hardware.