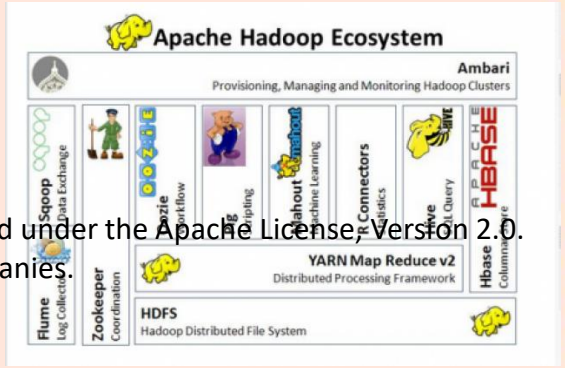
CBTU presents a course on **Big data and Hadoop**

Module 2: hadoop

Section 2.2: HDFS overview



BIG DATA

Hadoop Distributed File System (HDFS)

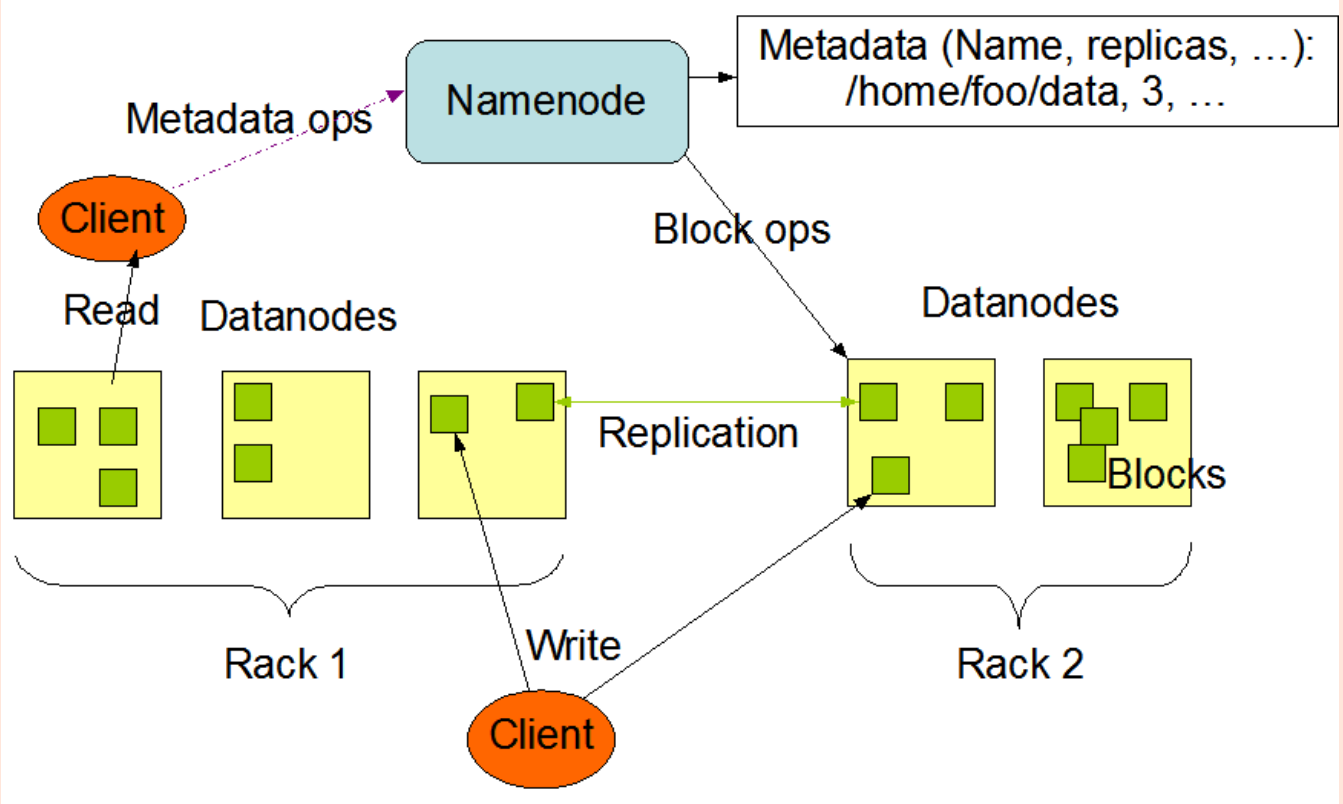
HDFS is based on the GFS or GoogleFS and provides a distributed file system that is designed to run on commodity hardware.

- It is highly fault-tolerant and is designed to be deployed on low-cost hardware.
- It provides high throughput access to application data and is suitable for applications having large datasets.

Hadoop features

- Open source: free and customizable
- Large datasets: distributed file system design
- Distributed storage and processing: to protect data loss in case of hardware failure
- Reliability: Built-in health check of cluster
- High Availability: of applications with parallel processing
- Security: Provides file permissions and authentication
- Scalability: machines can be added/removed easily
- Data locality

HDFS - master-slave architecture



http://hadoop.apache.org/docs/current/hadoop-project-dist/hadoop-hdfs/H

HDFS - Namenode

Namenode (Master Server) is installed on the the commodity hardware that contains the GNU/Linux operating system.

Namenode does the following tasks:

- Manages the file system namespace.
- Regulates client's access to files.
- Executes file system operations such as renaming, closing, and opening files and directories.

HDFS - Datanode

Datanode (Slave) is installed on a commodity hardware having the GNU/Linux OS.

Datanodes

- Manage the data storage of their system.
- Perform read-write operations on the file systems.
- Perform operations such as block creation, deletion, and replication according to the instructions of the namenode.

HDFS - Block (file segments)

The data file is divided into one or more segments (blocks) and stored in individual data nodes in HDFS files.

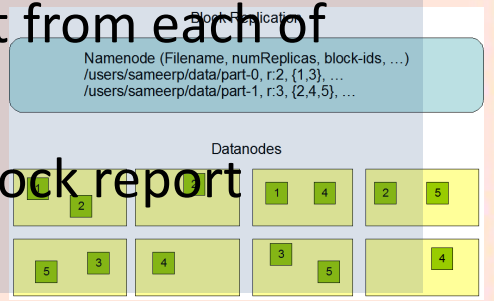
- A file is broken into small blocks of 128mb (default) stored in distributed cluster for high availability and fault tolerance.
- Blocks are replicated to 3 nodes by default and hdfs is rack ware to avoid single point of failure.

The File System Namespace

- HDFS file system is similar to traditional hierarchical file organization. A user or an application can create directories and store files inside these directories.
- Modify, Move and Delete files.
- HDFS supports user quotas and access permissions.
- NameNode maintains the file system namespace, replication data and meta data.

Data/Block Replication

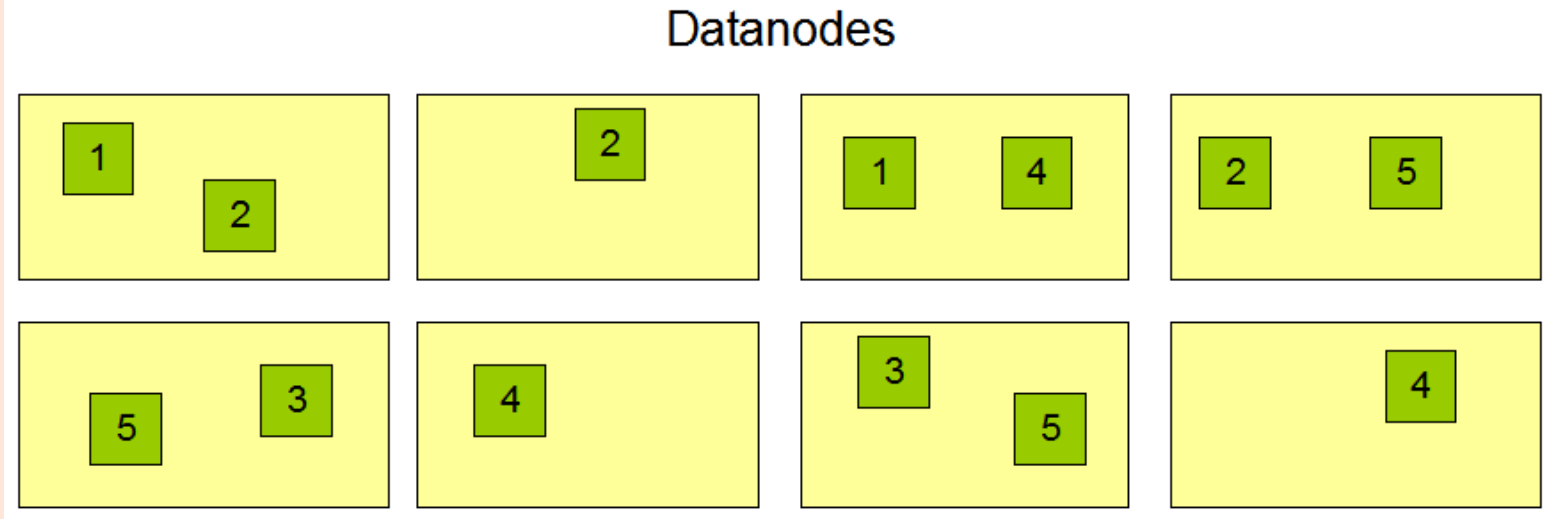
- HDFS stores large files across systems in a cluster.
- HDFS stores each file as a sequence of blocks.
- The blocks are replicated for fault tolerance.
- Block size and the number of replicas of a file are configurable.
- NameNode checks replication of blocks.
- NameNode receives a Heartbeat and a Block report from each of the DataNodes in the cluster.
- Heartbeat indicates liveliness of a DataNode and Block report contains a list of all blocks on a DataNode.



hadoop

Data/Block Replication

Namenode (Filename, numReplicas, block-ids, …)
/users/sameerp/data/part-0, r:2, {1,3}, …
/users/sameerp/data/part-1, r:3, {2,4,5}, …



The Communication Protocols

- All HDFS communication protocols are layered on top of the TCP/IP protocol.
- The DataNodes talk to the NameNode using the DataNode Protocol. A Remote Procedure Call (RPC) abstraction wraps both the Client Protocol and the DataNode Protocol. By design, the NameNode never initiates any RPCs. Instead, it only responds to RPC requests issued by DataNodes or clients.

DFSAdmin

- The DFSAdmin command set is used for administering a HDFS cluster.

Thanks for watching

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