

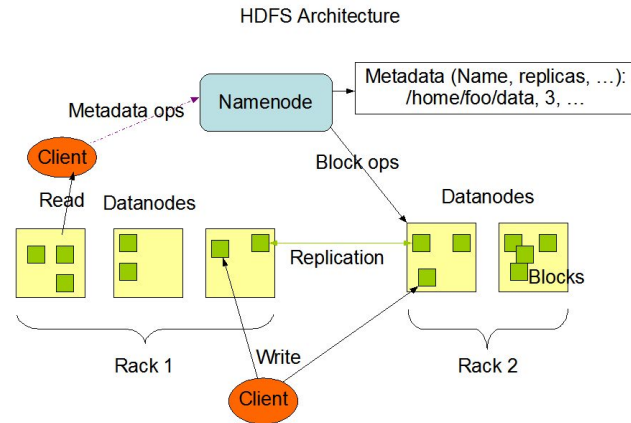


Doing Data Analytics III

31 Dec 2022

Hadoop Distributed File System

- Hadoop Distributed File System
- The Hadoop Distributed File System (HDFS) is a distributed file system designed to run on commodity hardware.



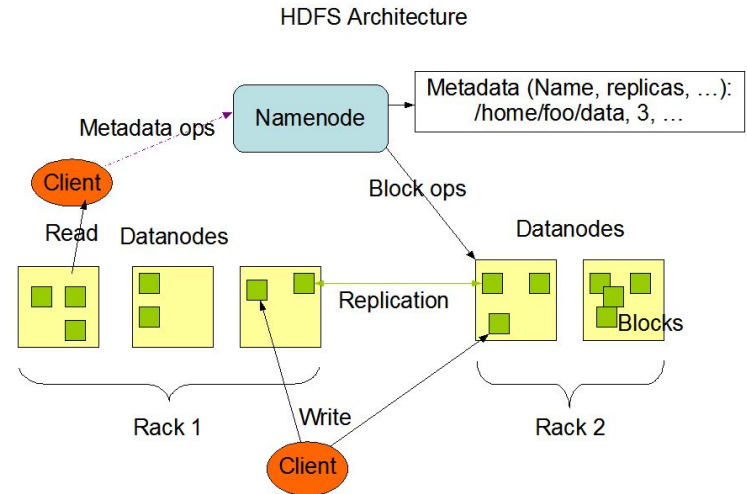
Source: [HDFS Architecture Guide](#)

HDFS Benefits

- **Fault tolerance:** HDFS creates a replica of data on other available machines in the cluster if suddenly one machine fails.
- **Failure recovery:** If a node fails in the cluster, HDFS has the ability to detect it and recover quickly and automatically.
- **Support large files:** A typical file in HDFS is gigabytes to terabytes in size. Thus, HDFS is tuned to support large files.
- **High throughput data access:** HDFS is a write-once-read-many access model for files. A file once created, written, and closed need not be changed.
- **Portability across heterogeneous hardware and software:** HDFS is written in JAVA. Usage of the highly portable Java language means that HDFS can be deployed on a wide range of machines.

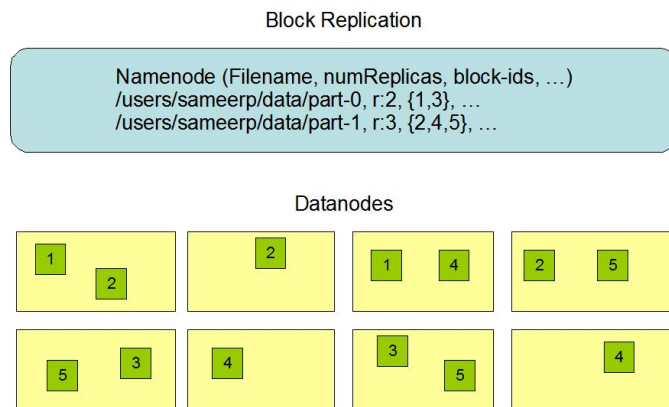
NameNode and DataNodes

- HDFS has a master/worker architecture
- NameNode (master) manages the file system namespace and regulates access to files.
- There are number of DataNodes (workers) which manage storage
- A file is split into fixed size blocks (64MB, 128MB) and replicated among the DataNodes.
- DataNodes also perform block creation, deletion, and replication upon instruction from the NameNode.



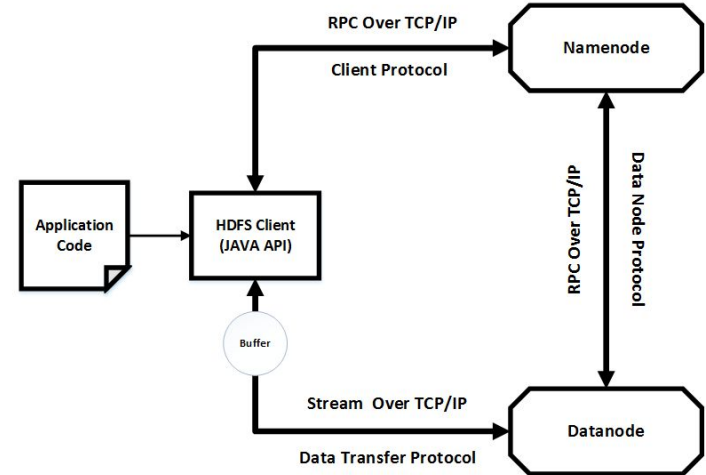
Data Replication

- The NameNode makes all decisions regarding replication of blocks.
- It periodically receives a Heartbeat and a Blockreport from each of the DataNodes in the cluster.
- It puts one replica on one node in the local rack, another on a node in a different (remote) rack, and the last on a different node in the same remote rack.
- The NameNode keeps an image of the entire file system namespace and file Blockmap in memory.



The Communication Protocol

- All HDFS communication protocols are layered on top of the TCP/IP protocol.
- Each DataNode sends a Heartbeat message to the NameNode periodically.
- The NameNode marks DataNodes without recent Heartbeats as dead and does not forward any new IO requests to them.
- The NameNode constantly tracks which blocks need to be replicated and initiates replication whenever necessary.
- Remote Procedure Call (RPC) protocol is used over TCP/IP for all the communications.



HDFS Shell Commands

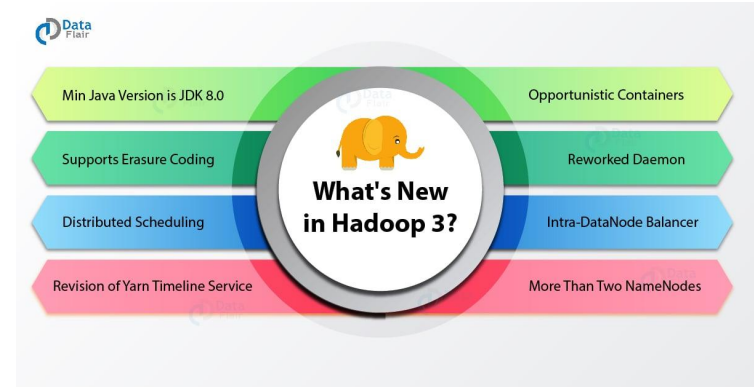
HDFS provides a command line interface called FS shell that lets a user interact with the data in HDFS. Some of the frequently used commands are as follows.

Command	Operation
<code>hadoop fs -ls /temp</code>	List HDFS files and directories inside temp
<code>hadoop fs -mkdir /temp</code>	Create temp directory in HDFS
<code>hadoop fs -rmdir /temp</code>	Remove directory temp in HDFS
<code>hadoop fs -copyFromLocal sample.txt /temp/sample.txt</code>	Copy local file sample.txt to HDFS location.
<code>hadoop fs -copyToLocal /temp/sample.txt sample.txt</code>	Copy a HDFS file to local file system

Source: [File System Shell Guide](#)

Hadoop 3.x

- **High Availability:** The loss of NameNode can crash the cluster. high-availability was introduced to help recover from NameNode failure. In Hadoop 3.x we can have two passive NameNodes along with the active node, as well as five JournalNodes.
- **Intra-DataNode Balancer:** Hadoop 3.x introduces intra-DataNode balancer to balance the physical disk inside each DataNode to reduce the skew of the data.
- **Erasure Coding (EC):** Typical HDFS installation has a replication factor of 3 which requires large storage capacity in the cluster. EC is a method of data protection in which data is broken into fragments, expanded, encoded with redundant data pieces and stored across a set of different locations or storage. This can bring down the replication factor from 3 to about 1.4.



Source: [Data Flair](#)

Questions & Answers

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post any questions or start
discussions.*

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