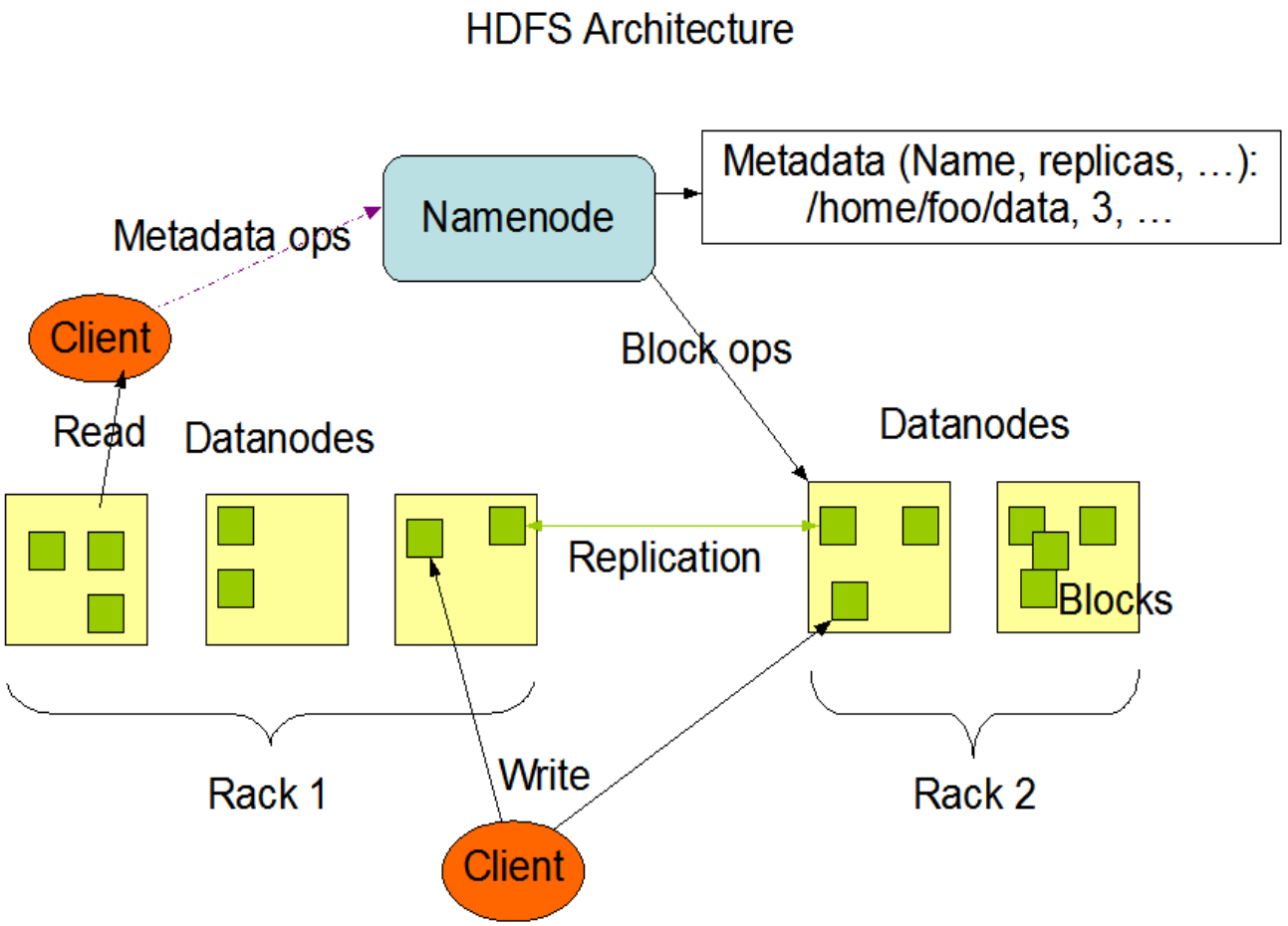
1.**HDFS**

- The **Hadoop Distributed File System** (HDFS) is a distributed file system designed to run on commodity hardware.
- HDFS is suited for very large files.
- It has many similarities with existing distributed file systems. However, the differences from other distributed file systems are significant.
- HDFS is **highly fault-tolerant** and is designed to be deployed on **low-cost hardware.**
- HDFS provides **high throughput access** to application data and is suitable for applications that have **large data sets**.



NameNode and DataNodes

- HDFS has a **master/slave architecture**.
- An HDFS cluster consists of a **single NameNode**, a master server that manages the file system namespace and regulates access to files by clients.
- In addition, there are a number of **DataNodes**, usually one per node in the cluster, which manage storage attached to the nodes that they run on.
- HDFS exposes a file system namespace and allows user data to be stored in files.
- Internally, a file is split into one or more blocks and these **blocks are stored in a set of DataNodes.**
- Default block size is **128MB**.
- Thus, each file is partitioned into several 128MB blocks and are placed in several datanodes.
- NameNode stores **metadata of the file** that is to be stored on Hadoop.
- DataNodes send **block report** periodically which contains block information.
- They also send **heart beat signal** to the NameNode. Thus, NameNode keeps track of active DataNodes
- NameNode is said to be **Single Point of Failure**.
- The NameNode executes file system namespace operations like opening, closing, and renaming files and directories. It also determines the mapping of blocks to DataNodes.
- The DataNodes are responsible for serving read and write requests from the file system's clients.
- The DataNodes also perform block creation, deletion, and replication upon instruction from the NameNode.
- The NameNode and DataNode are pieces of software designed to run on **commodity machines**. These machines typically run a **GNU/Linux operating system (OS).**
- HDFS is built using the Java language; any machine that supports Java can run the NameNode or the DataNode software.
- Usage of the highly portable Java language means that HDFS can be deployed on a wide range of machines.

REPLICATION

- Replication is done to improve fault tolerance.
- For the common case, when the **replication factor is three.**

2. HADOOP CLUSTER:

- A Hadoop cluster is a special type of computational cluster designed specifically for storing and analyzing huge amounts of unstructured data in a distributed computing environment.

- Such clusters run Hadoop's open source distributed processing software on low-cost commodity computers.

- Typically one machine in the cluster is designated as the **NameNode** and another machine the as **JobTracker**; these are the **masters**.

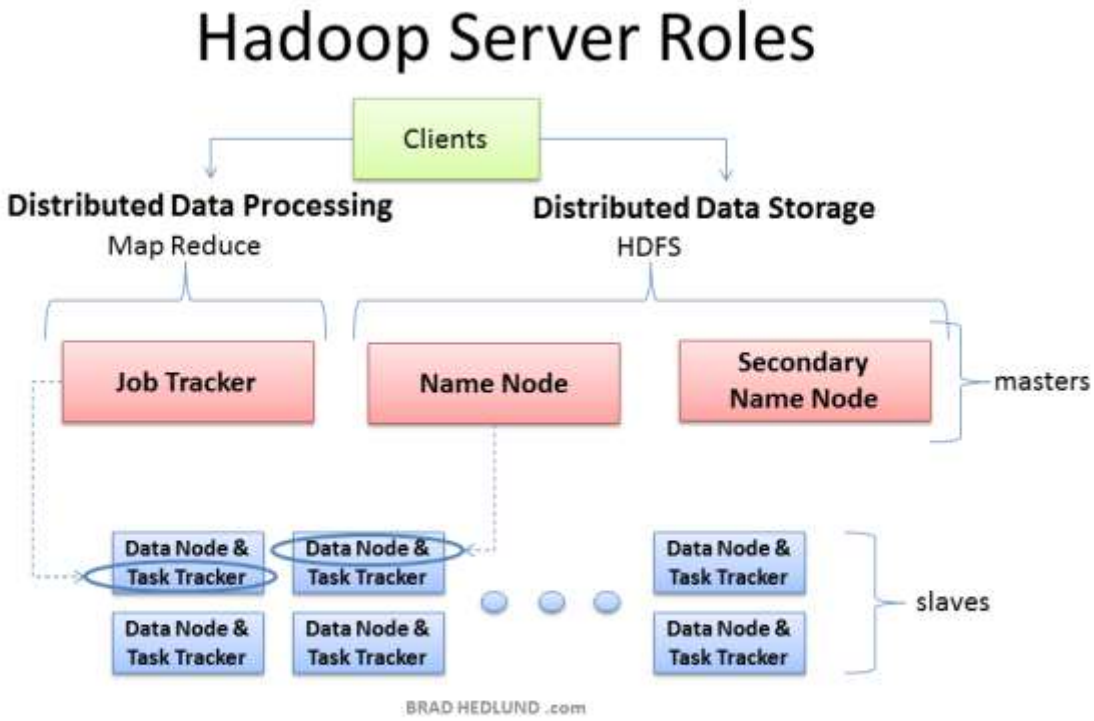
- The rest of the machines in the cluster act as both **DataNode** and **TaskTracker**; these are the **slaves**.

- Hadoop clusters are often referred to as **"shared nothing" systems** because the only thing that is shared between nodes is the network that connects them.

- Hadoop clusters are known for boosting the **speed of data analysis** applications.

- If a cluster's processing power is overwhelmed by growing volumes of data, additional cluster nodes can be added to increase throughput. Hence, **Scalable**

- Hadoop clusters also are **highly resistant to failure** because each piece of data is copied onto other cluster nodes, which ensures that the data is not lost if one node fails, termed as **replication** .



- The Master nodes oversee the two key functional pieces that make up Hadoop:

  1.storing lots of data (HDFS)

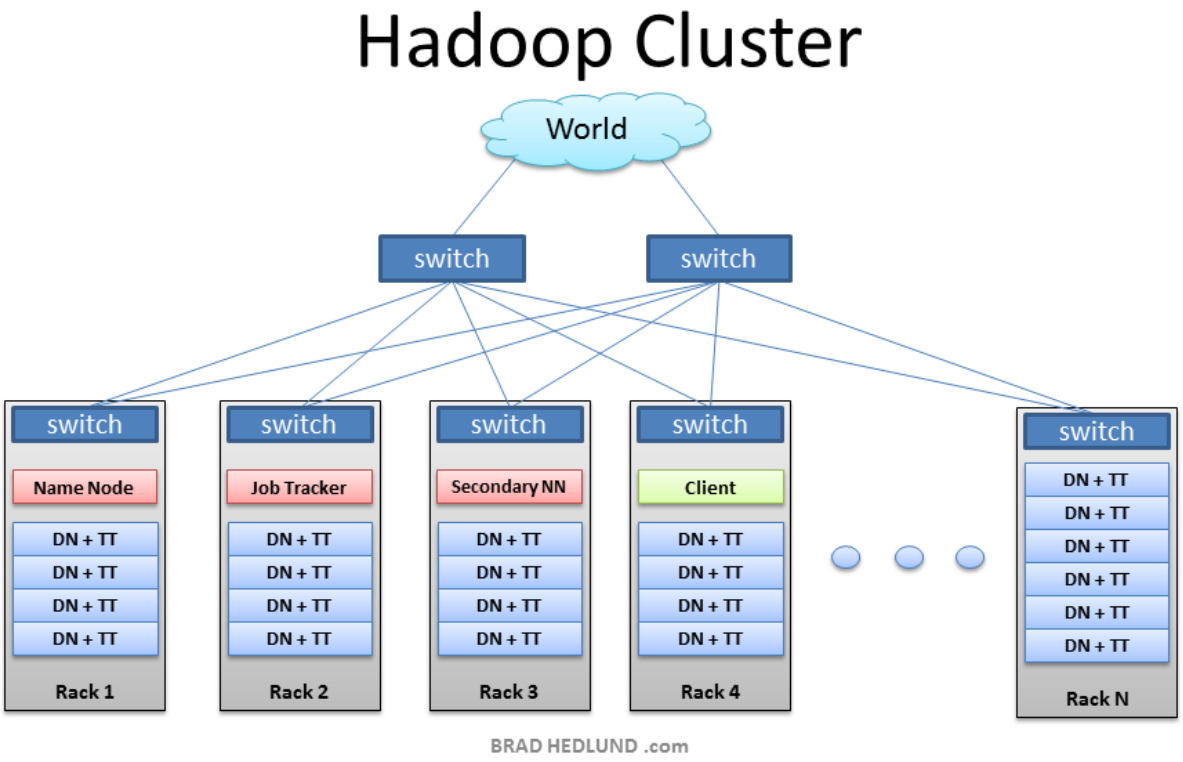
  2. running parallel computations on all that data (Map Reduce).

- The **Name Node** oversees and coordinates the **data storage function** (HDFS), while the **Job Tracker** oversees and coordinates the parallel **processing of data using Map Reduce**.

- Slave Nodes make up the vast majority of machines and do all the dirty work of storing the data and running the computations.

- Each slave runs both a Data Node and Task Tracker daemon that communicate with and receive instructions from their master nodes.

- **The Task Tracker daemon is a slave to the Job Tracker, the Data Node daemon a slave to the Name Node.**



3.HDFS BLOCKS

HDFS Block

Hadoop distributed file system also stores the data in terms of blocks. However the block size in HDFS is very large. The default size of HDFS block is 128MB. The files are split into 128MB blocks and then stored into the hadoop filesystem. The hadoop application is responsible for distributing the data blocks across multiple nodes.

Advantages of HDFS Block

The benefits with HDFS block are:

- The blocks are of fixed size, so it is very easy to calculate the number of blocks that can be stored on a disk.
- HDFS block concept simplifies the storage of the datanodes. The datanodes doesn't need to concern about the blocks metadata data like file permissions etc. The namenode maintains the metadata of all the blocks.
- If the size of the file is less than the HDFS block size, then the file does not occupy the complete block storage.
- As the file is chunked into blocks, it is easy to store a file that is larger than the disk size as the data blocks are distributed and stored on multiple nodes in a hadoop cluster.
- Blocks are easy to replicate between the datanodes and thus provide fault tolerance and high availability. Hadoop framework replicates each block across multiple nodes (default replication factor is 3). In case of any node failure or block corruption, the same block can be read from another node.

Why HDFS Blocks are Large in Size

The main reason for having the HDFS blocks in large size is to reduce the cost of seek time. In general, the seek time is 10ms and disk transfer rate is 100MB/s. To make the seek time 1% of the disk transfer rate, the block size should be 100MB. The default size HDFS block is 64MB.