

# INTRODUCTION TO HADOOP

HIGH PERFORMANCE COMPUTING, CS-540

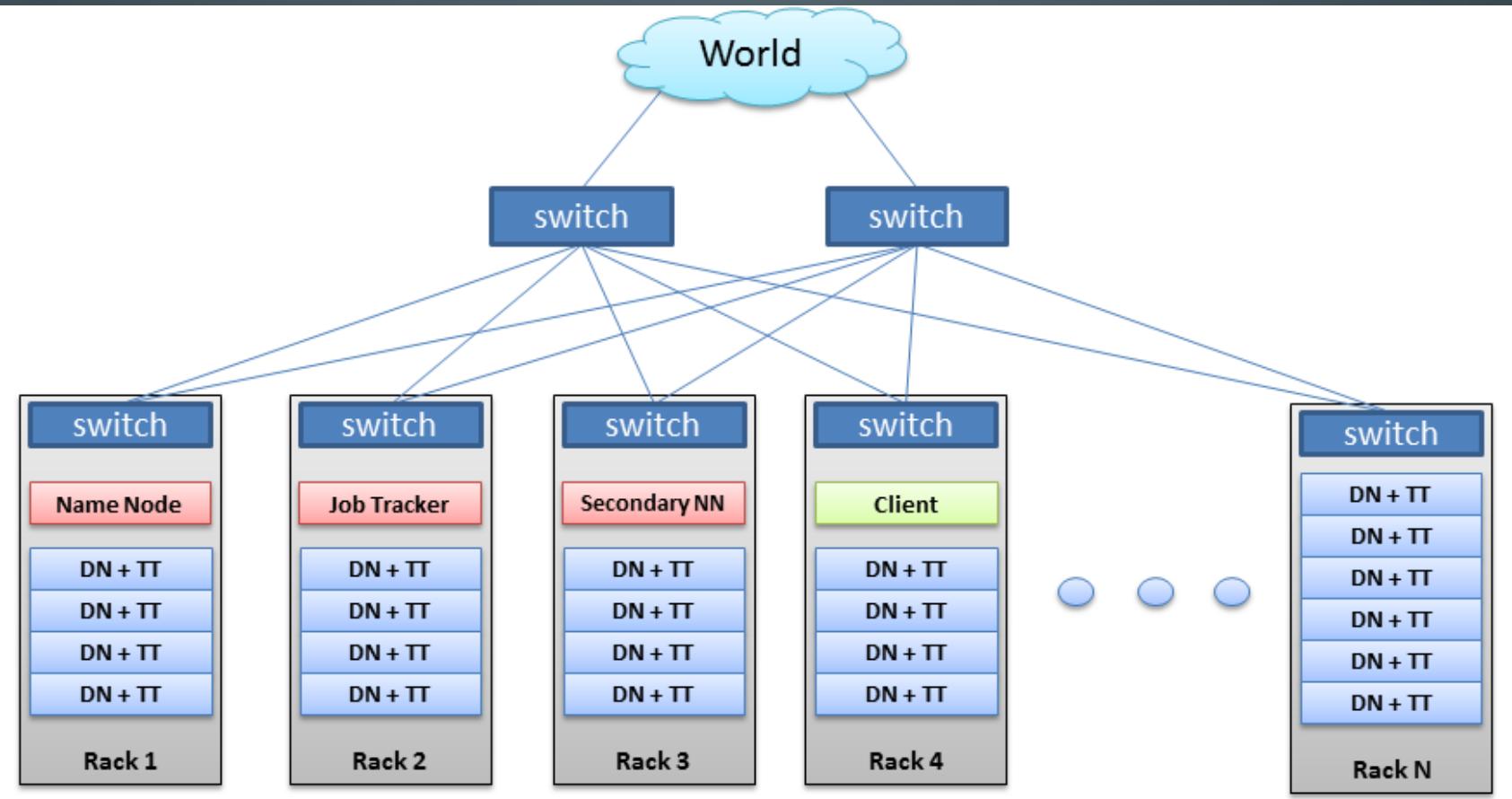
# HADOOP

- Apache open-source implementation of frameworks for distributed computing and data storage
- It's flexible and highly-available architecture for large scale computing and data processing within a collection of commodity hardware.
  - Heterogeneous hardware and storage types
  - Fault tolerant
  - Move computation rather than the data
- It was designed to process big data with reasonable cost and time.

# HADOOP ARCHITECTURE

- Distributed architecture
  - Some aspects are centralized
- Primary nodes of cluster is the majority of the computational power and storage of the system resides
- Primary nodes (Main nodes) execute TaskTracker to accept and reply to MapReduce tasks
- DataNodes are responsible for storing data (blocks)
- The NameNode maintains HDFS (Hadoop File System) directories & files
  - JobTracker to dispatches compute tasks to TaskTracker

# HADOOP ARCHITECTURE



# DISTRIBUTED FILE SYSTEM (DFS)

- Designed for a computing cluster
  - Extensive collection of connected compute nodes
- The goal of a DFS is never lose data
- Data/Files are split into contiguous block, or chunks
  - Typically 64MB
  - Hadoop 128MB
- Master node
  - Stores metadata, address/location of all blocks of data

# HADOOP FILE SYSTEM (HDFS)

- HDFS is a distributed file system that is designed for storing large data files.
- core component of Apache Hadoop
  - designed specifically to store large files
  - running on clusters of commodity hardware.
- HDFS is a Java-based file system that provides scalable and reliable data storage

# HDFS NODES

- An HDFS cluster is comprised of a NameNode and DataNodes
- NameNode manages the cluster metadata
  - Very similar to directory structure of a typical file system
  - There is only one NameNode in a cluster
  - Handles creation of more replica blocks when necessary after a DataNode failure

# HDFS NODES

- DataNodes store the data in HDFS
- Can run on any underlying filesystem
  - ext3/4, NTFS, etc.
- Signals the NameNode of what blocks it stores

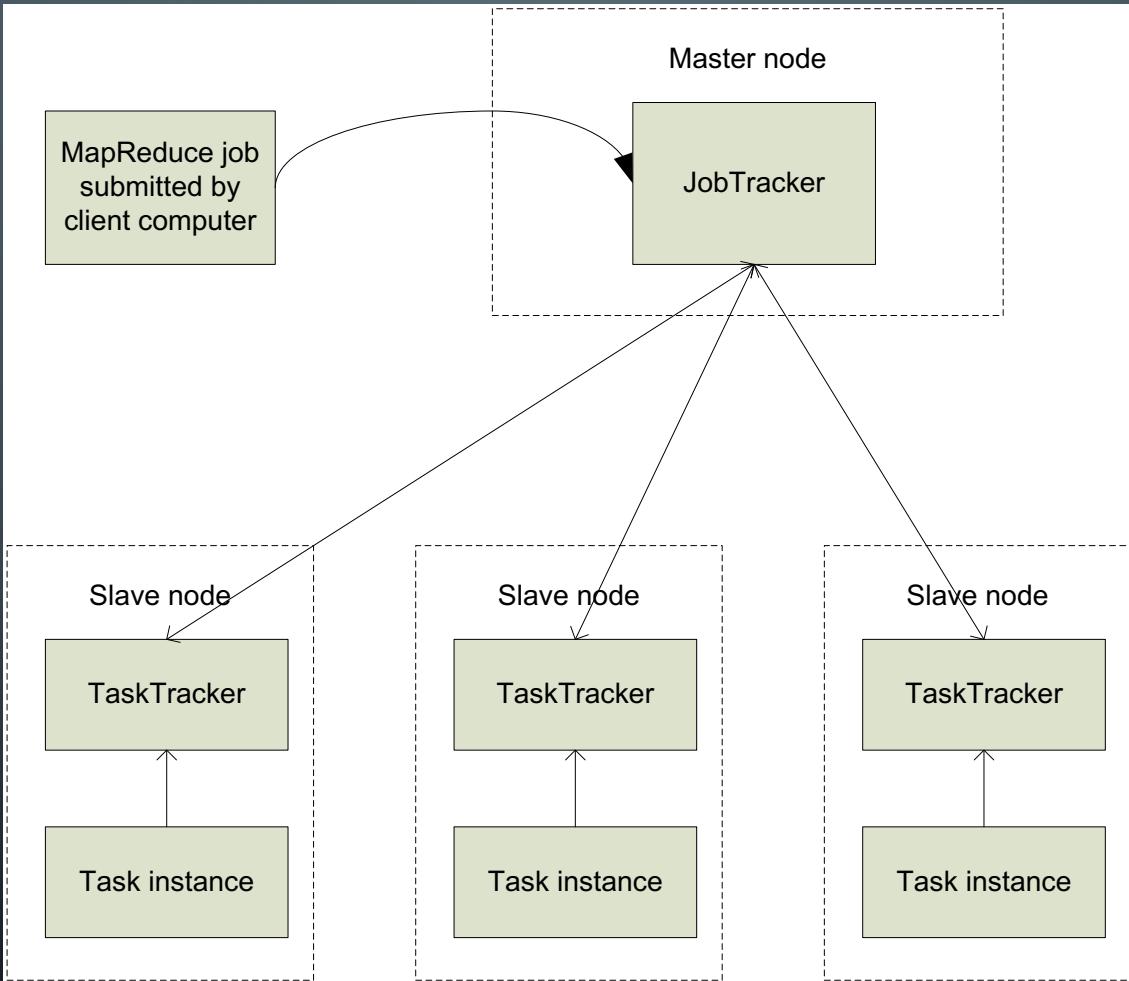
# MAP REDUCE

- Is the data processing engine used by Hadoop to distribute work throughout a cluster.
- MapReduce is a programming model that ties computation close to data
  - Reduces the overhead in moving data from node to node
- It is a simple programming model designed to process large volumes of data in parallel by dividing the job into a set of independent tasks.
- A MapReduce job splits a large data set into independent chunks and organizes them into key, value pairs for parallel processing.

# MAP REDUCE

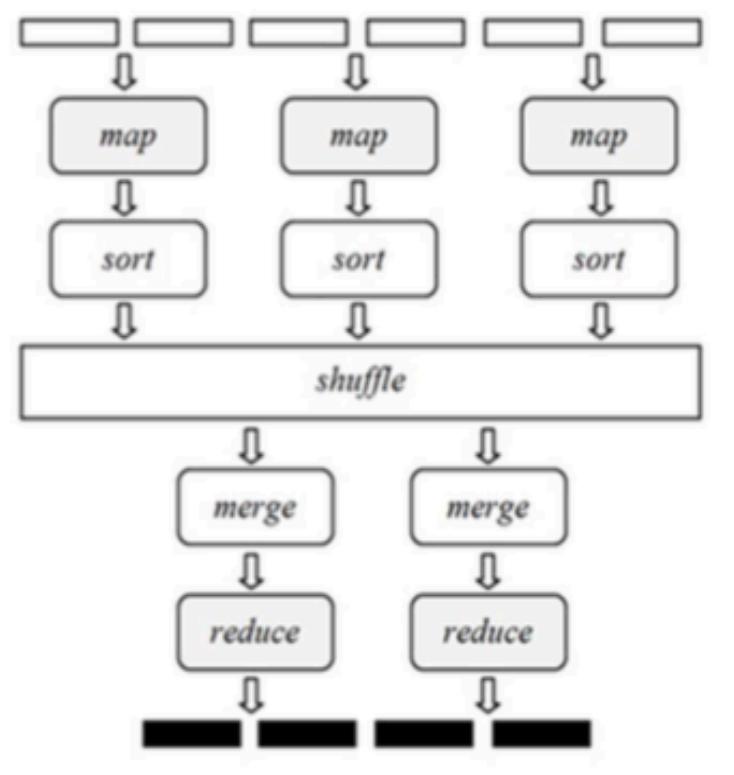
- **Map** method is responsible for breaking down the input into ranges
- The JobTracker (MasterNode) distributes those tasks to the worker nodes.
- The output of each map task is partitioned into a group of key-value pairs for each reduce task.
- **Reduce** component collects the results and combines, or consolidates them to provide a solution to the problem.
  - Each reduce queries the relevant partition from the nodes in the cluster where the maps executed, writes its output back into HDFS.
  - Each reduce task is able to collect the data from all of the maps for the keys and combine them to solve the problem.

# MAP REDUCE ARCHITECTURE



# MAP REDUCE

Input	Task Number	Mapper OUT	Reducer IN	Reducer OUT
to be or	1	to 1 be 1 or 1	be 1 be 1 not 1	be 2 not 1
not to be	2	not 1 to 1 be 1	or 1 to 1 to 1	or 1 to 2



# REFERENCES

- <https://www.ics.uci.edu/~cs237>
- <https://courses.cs.washington.edu/courses/cse490h>