EXPERIMENT 12

TITLE: Design a distributed application using MapReduce

OBJECTIVE:

1. To explore different Big data processing techniques with use cases.
2. To study detailed concept of Map-Reduced.

SOFTWARE REQUIREMENTS:

1. Ubuntu 14.04 / 14.10
2. GNU C Compiler
3. Hadoop
4. Java

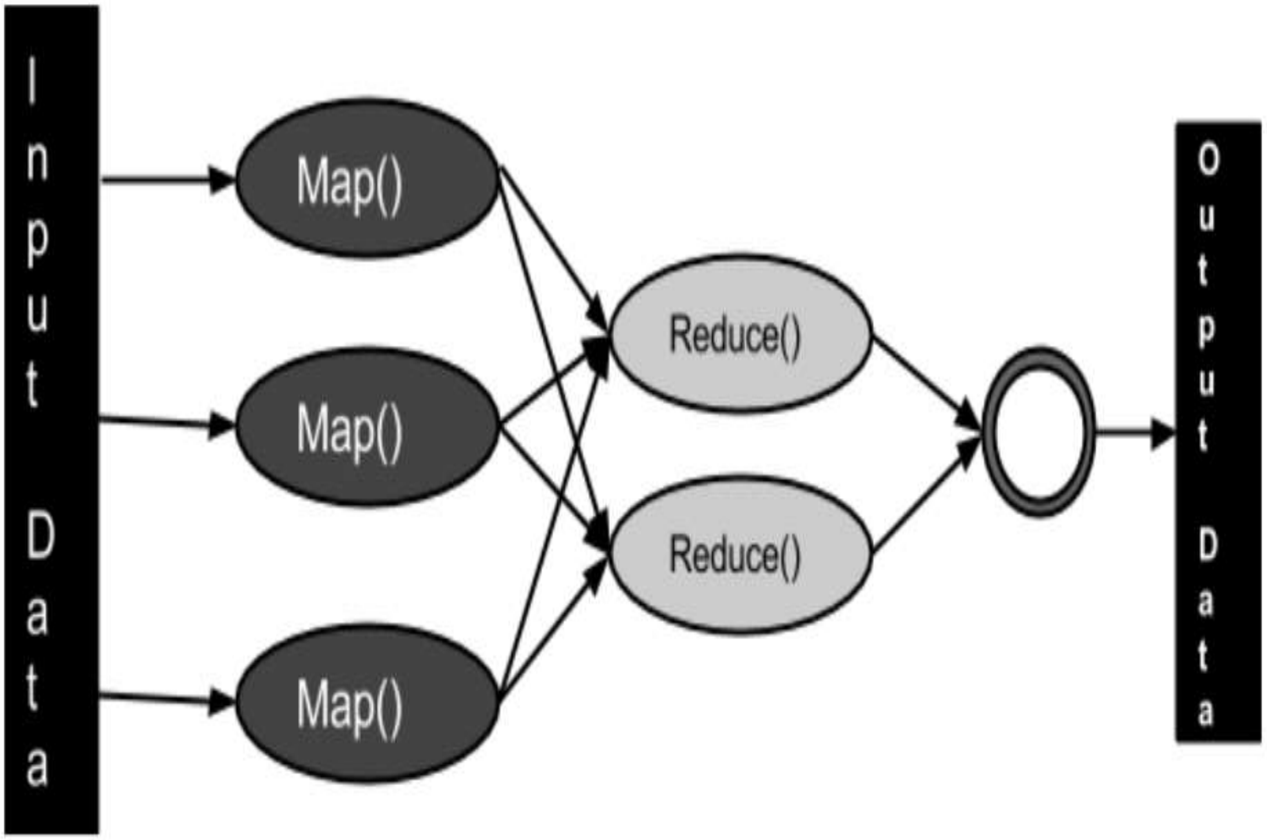
PROBLEM STATEMENT: - Design and develop a distributed application to find the coolest/hottest year from the available weather data. Use weather data from the Internet and process it using MapReduce.

THEORY:

MapReduce is a framework using which we can write applications to process huge amounts of data, in parallel, on large clusters of commodity hardware in a reliable manner. MapReduce is a processing technique and a program model for distributed computing based on java.The MapReduce algorithm contains two important tasks, namely Map and Reduce.

Map takes a set of data and converts it into another set of data, where individual elements are broken down into tuples (key/value pairs). Secondly, reduce task, which takes the output from a map as an input and combines those data tuples into a smaller set of tuples. As the sequence of the name MapReduce implies, the reduce task is always performed after the map
job. The major advantage of MapReduce is that it is easy to scale data processing over multiple computing nodes. Under the MapReduce model, the data processing primitives are called mappers and reducers. Decomposing a data processing application into mappers and reducers is sometimes nontrivial. But, once we write an application in the MapReduce form, scaling the application to run over hundreds, thousands, or even tens of thousands of machines in a cluster is merely a configuration change. This simple scalability is what has attracted many programmers to use the MapReduce model.

MapReduce program executes in three stages, namely map stage, shuffle stage, and reduce stage. Map stage: The map or mapper’s job is to process the input data. Generally the input data is in the form of file or directory and is stored in the Hadoop file system (HDFS). The input file is passed to the mapper function line by line. The mapper processes the data and creates several small chunks of data.Reduce stage: This stage is the combination of the Shuffle stage and the Reduce stage. The Reducer’s job is to process the data that comes from the mapper. After processing, it produces a new set of output, which will be stored in the HDFS.



Map Function – It takes a set of data and converts it into another set of data, where individual elements are broken down into tuples (Key-Value pair).

Example – (Map function in Word Count)

Input	Set of data	Bus, Car, bus, car, train, car, bus, car, train, bus, TRAIN,BUS, buS, caR, CAR, car, BUS, TRAIN
Output	Convert into another set of data	(Bus,1), (Car,1), (bus,1), (car,1), (train,1), (car,1), (bus,1), (car,1), (train,1), (bus,1),

	(Key,Value)	(TRAIN,1),(BUS,1), (buS,1), (caR,1), (CAR,1), (car,1), (BUS,1), (TRAIN,1)

- **Reduce Function** – Takes the output from Map as an input and combines those data tuples into a smaller set of tuples.

Example – (Reduce function in Word Count)

Input **(output of Map function)**	Set of Tuples	(Bus,1), (Car,1), (bus,1), (car,1), (train,1), (car,1), (bus,1), (car,1), (train,1), (bus,1), (TRAIN,1),(BUS,1), (buS,1), (caR,1), (CAR,1), (car,1), (BUS,1), (TRAIN,1)
Output	Converts into smaller set of tuples	(BUS,7), (CAR,7), (TRAIN,4)

Work Flow of Program

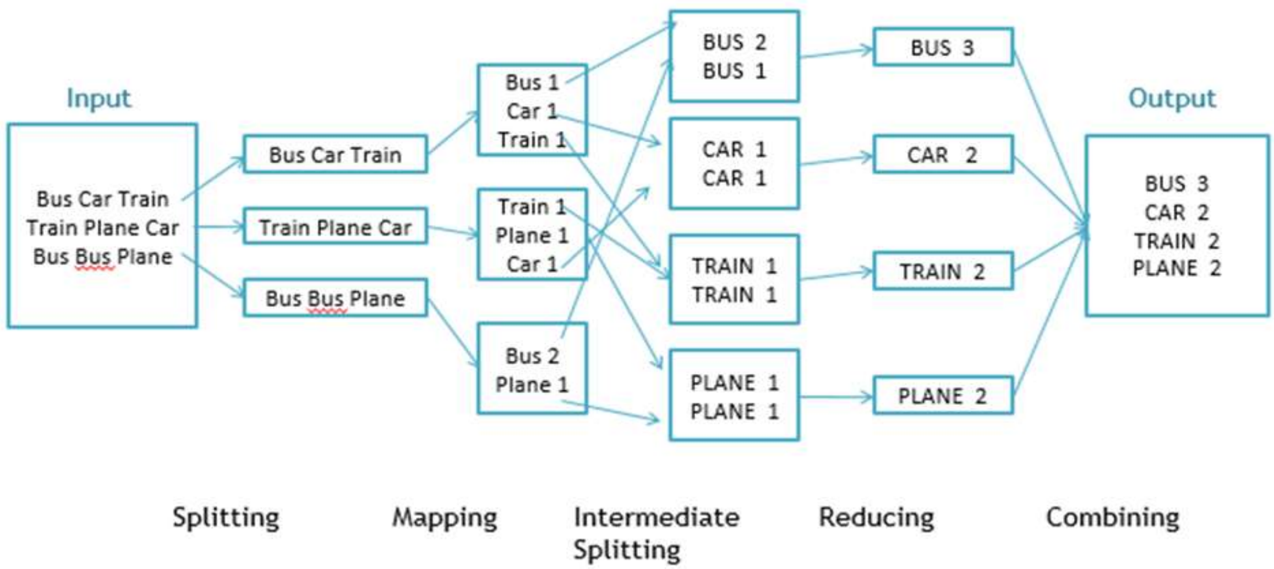


Fig. WorkFlow of MapReducing

Workflow of MapReduce consists of 5 steps

1. **Splitting** – The splitting parameter can be anything, e.g. splitting by space, comma, semicolon, or even by a new line ('\n').
2. **Mapping** – as explained above
3. **Intermediate splitting** – the entire process in parallel on different clusters. In order to group them in "Reduce Phase" the similar KEY data should be on same cluster.
4. **Reduce** – it is nothing but mostly group by phase

Combining – The last phase where all the data (individual result set from each cluster) is combine together to form a Result**.**

CONCLUSION: Thus we have learnt how to design a distributed application using MapReduce and process a Dataset.