A Survey on Workload Classification and Job Scheduling by using Johnson's Algorithm under Hadoop Environment

R.Manopriya
PG Scholar
Department of Computer Science and Engineering
Coimbatore Institute of Engineering and Technology
Coimbatore, India

C.P.Saranya M.E
Assistant Professor
Department of Computer Science and Engineering
Coimbatore Institute of Engineering and Technology
Coimbatore, India

S.Gunasekaran, Ph.D
Professor and Head
Department of Computer Science and Engineering
Coimbatore Institute of Engineering and Technology
Coimbatore, India

ABSTRACT

Bigdata deals with the larger datasets which focus on storing, sharing and processing the data. The organisation face difficulties to create, manipulate and manage the large datasets. For example, if we take the social media Facebook,there will be some posts on the page.The number of likes, shares and comments are given at a second for a particular post,it leads to creation of large datasets which gives trouble to store the data and process the data. It involves massive volume of both structured and unstructured data.The major problem exists in Bigdata community is workload classification and scheduling of jobs with respect to the disks. Identifying the computation time of individual jobs in the machine uses mapreduce concepts rather than minimizing the overall computation time of entire set of jobs.

Mapreduce algorithm is initially applied for splitting the larger datsets into minimized output dataset. Mapreduce consists of two phases for processing the data: map and reduce phases. Under map phase,the given radar input dataset is splitted into individual key-value pairs and an intermediate output is obtained and in reduce phase that key value pair undergoes shuffle and sort operation. Intermediate files are created from map tasks are written to local disk and output files are written to distributed file system of Hadoop. The different types of jobs are given to different disks for the process of scheduling. Johnson's algorithm is used for obtaining the minimum optimal solution among different jobs given in the Hadoop environment. Job type and data locality of the jobs are two important factors for job scheduling process. The Performance analysis of individual disks are calculated on the basis of size of the dataset taken and formation of number of nodes.

Keywords

Dataset classification(Radar dataset), Mapreduce algorithm, Job scheduling using Johnson algorithm, Hadoop distributed file system(HDFS).

1. INTRODUCTION

The explosion of big data is testing the capabilities of the most advanced analytics tools. The emerging technologies such as the Hadoop framework represents completely new approaches to capturing, managing, and analyzing big data. Big data is typically described by the three characteristics Volume,variety and velocity, and it is referred to be as 3vs.

The quantity of data which is generated is considered as volume which determines the size only.The data size may be in petabytes (1000 terabytes).The category to which the data belong is defined by variety.This helps the people who are closely analyzing the data. Heterogeneous, complex, and variable data, which are generated in formats as different as e-mail, social media, video, images, blogs and sensor data.It specifies the speed of generation of data or how fast the data is generated. Big data technologies describe a new generation of technologies and architectures, designed to extract the value from very large volumes of a wide variety of data, by enabling high-velocity capture, discovery, and/or analysis.

2. HADOOP ARCHITECTURE

A small Hadoop cluster includes a single master and multiple worker nodes. The master node consists of a Job tracker, Task tracker, Name node and Data node.

A.Job tracker

The primary function of the job tracker is managing the task trackers, tracking resource availability . The Job tracker is a node which controls the job execution process. Job tracker performs mapreduce tasks to specific nodes in the cluster. Client submit jobs to the Job tracker. When the work is completed, the Job tracker updates its status.Client applications can ask the Job tracker for information.

B.Task tracker

It follows the orders of the job tracker and updating the job tracker with its status periodically. Task tracker run tasks and send the reports to to Job tracker, which keeps a complete record of each job.Every Task tracker is configured with a set of slots,it indicates the number of tasks that it can accept.

C.Name node

The namenode maps to, what block locations and which blocks are stored on which datanode. Whenever a datanode undergoes a disk corruption of a particular block, the first table gets updated and whenever a datanode is detected to be dead due to network failure or a node, both the tables get updated.The updation of the table is based on only failure of the nodes.It does not depends on any neighbour blocks or any block locations to identify its destination.Each blocks are separated with its job nodes and respective allocated process.

D.Data node

The node which stores the data in hadoop system are known to be as datanode. All datanodes send a heartbeat message to the namenode for every three seconds to say that they are alive. If the namenode does not receive a heartbeat from a particular data node for ten minutes, then it considers that data node to be dead or out of service .It initiates some other data node for the process.The data nodes update the namenode with the block information periodically.

3. LITERATURE SUPPORT

The section II literature support consists of papers on different features which exhibits on different resource allocations to the disks, job scheduling and improving the data locality.Resources can be allocated based on the measure of each disks performance and its minimum computation time.Initially clusters are formed for scheduling and mapping the datasets.Resource allocation in Hadoop map reduce is done at the level of fixed-size resource splits of the nodes are called slots.It is the basic unit of resource allocation which represents a fixed proportion of multiple shared resources on a machine. The primary advantage of slots is the ease of implementation of mapreduce paradigm.

4. PROPOSED WORK

This section provides the background for the MapReduce framework and Johnson's algorithm for job scheduling based on the job type evolution and number of nodes.

4.1.Mapreduce algorithm

Mapreduce is a linearly scalable programming model which has emerged as an important programming model for big-scale data processing applications with various computational characteristics in large scale clusters.The programmer writes two functions namely map and reduce function.Each defines a mapping from one set of key-value pairs to another.It uses a distributed file system to share files with the task trackers that run the temporary files.

Map step: The master node takes the input, chops it up into smaller sub-problems, and distributes those to worker nodes. A worker node may do this again in turn, leading to a multi-level tree structure.The worker node processes that smaller problem, and passes the answer back to its master node.The dataset is given as a client input into hadoop distributed file system.Under the map process,the given dataset is splitted into individual lines or words using mapper instances and an intermediate output is obtained by output.

Reduce step: Shuffle,sort and reduce are the three process to be done in reduce phase.The intermediate output obtained in map phase undergoes shuffle,and it gets sorted order. At the final phase reduce ,the dataset get reduced. Each step starts only after the previous step is completed. The master node then takes the answers to all the sub-problems and combines them in a way to get the output the answer to the problem it was originally trying to solve.

TABLE I COMPARISON OF DIFFERENT RESOURCE ALLOCATION TECHNIQUES

PAPERS	FEATURES	ALGORITHM APPLIED
Orchestrating an Ensemble of MapReduce Jobs for Minimizing Their Makespan	i)Resource allocation among different jobs. ii)To minimize the overall makespan (completion time of jobs which is allocated).	Mapreduce algorithm, Johnson algorithm, Balanced pool algorithm
A FineGrained Resource Orchestration Framework for Hadoop MapReduce	i)To identify the resource bottlenecks and resolve them through on-demand resource allocations.	Regression scheme and Uniform scheme
Automatic Resource Inference and Allocation for Map Reduce Environment	i)To control resource allocations for different applications. ii)To determines job ordering and the amount of resources to allocate for meeting the job deadlines.	HFS(Hadoop fair scheduler) and SLOMODEL (Service level objectives)
Coupling Task Progress for MapReduce Resource-Aware scheduling	i)To avoid job starvation and provide data locality. ii)To optimize the tasks and improves the overall response time.	FIFO scheduler and Capacity scheduler
Dynamic Slot Allocation Technique for MapReduce Clusters	i)Allocation of slots without any delay. ii)To improve the utilization and performance for MapReduce clusters	Dynamic Hadoop Fair Scheduler and Mapreduce algorithm

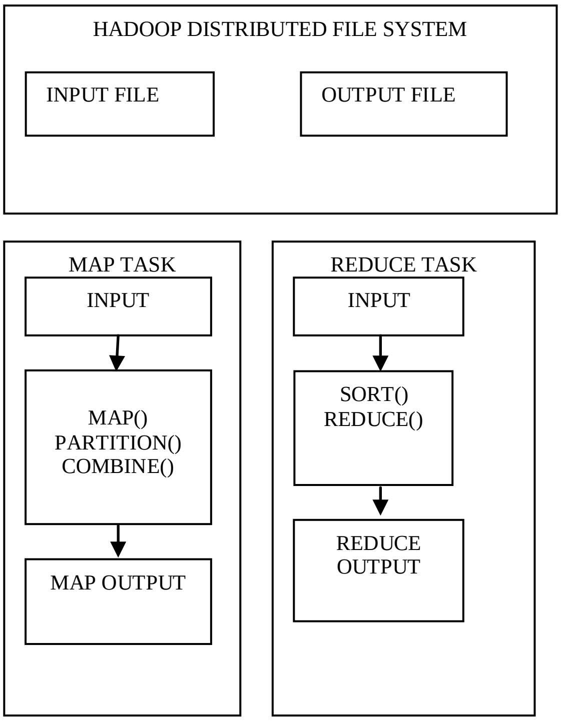

Figure 1 Mapreduce process architecture

4.2 Johnson’s algorithm

Johnson's algorithm is used to find an optimal solution of order for different sets of jobs to be processed. It obtains minimal makespan(computation time); Johnson's algorithm will identify only one solution. Consider the two columns find out the smallest in two columns suppose A is small ,schedule it to the next or else B is small then it is changed to last.The sequence of jobs are changed based on the job size until all the jobs in disks get scheduled.Consider an example for job scheduling using Johnson's algorithm,

STEP 1:

JOB	A	B
1	7	2
2	1	6
3	5	3

Here Job 2 is smallest, so it goes first.
The order of job sequence is 2….

STEP 2:

JOB	A	B
1	7	2
2	1	6
3	5	3

Here Job 1 is smallest, so it goes first.
The order of job sequence is 2, …,1

STEP 3:

JOB	A	B
1	7	2
2	1	6
3	5	3

Here Job 3 is smallest, so it goes first.
The order of job sequence is 2,3,1

STEP 4:

JOB	A	B
1	7	2
2	1	6
~~3~~	~~5~~	~~3~~

Here Job 5 is smallest, so it goes first.
The order of job sequence is 2,3,1

STEP 5:

JOB	A	B
1	7	2
~~2~~	~~1~~	~~9~~
~~3~~	~~5~~	~~3~~

Here Job 6 is smallest, so it goes first.
The order of job sequence is 2,3,1

5. THE APACHE HADOOP

Apache Hadoop is an open-source software framework for writing and running distributed applications that process large amounts of data on clusters of commodity hardware. Hadoop is an Apache top level project being built and it is licensed under the Apache License 2.0. Hadoop was created by Doug Cutting and Mike Cafarella in 2005. Cutting, who was working at Yahoo at the time, named it after his son's toy elephant.

The Apache Hadoop framework modules are

1. Hadoop common package contains libraries and utilities needed by other Hadoop modules. It contains the necessary Java Archive (JAR) files and scripts needed to start Hadoop. The package also provides source code and documentation.
2. Hdfs stores data and perform the process.
3. Hadoop yarn is responsible for managing clusters.
4. Hadoop Map reduce is a programming model for large scale data processing.

6. CONCLUSION

In this project work, the study of map reduce algorithm is performed under Apache Hadoop framework. It deals with workload classification and minimizing the computation time of entire jobs.Initially,the radar daatset is taken as a user input to the hadoop system. It process the datasets as splitting it into individual datasets as line by line or para of datas.According to the keys and values it performs it tasks under map and reduce stages. Then Hadoop cluster is formed and jobs are allocated to the specific pools. Data node,Name node,Job tracker and Task tracker are the Hadoop cluster components which does their tasks in complete manner. If client sends dataset to the Hadoop distributed file system, it separates the tasks to master node and slave node and performs the job using mapreduce concepts taken under map stage and reduce stage. After completion of the given tasks,datasets finally get reduced.By using Johnson's algorithm, the optimal solution for individual jobs for different disks are been calculated. Different jobs such as job1….job2….jobn are taken and processed using job scheduling technique.Depending upon different disks space and performance jobs given to the system gives the output quickly.Here,the efficiency of the jobs of different disks are been calculated by the datasets taken and number of nodes that is generated in Hadoop distributed file system.In future, further the performance and throughput of individual hadoop clusters should be calculated by using clasification algorithms.

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