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A study on increasing the performance of Heterogeneous clusters

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Abstract: Map Reduce implementation have mainly designed for homogeneous clouds, the data centres have been driven towards heterogeneous clouds due to the evolving application of hybrid clouds, geo distributed clouds and networking and storage devices. Since Map Reduce implementations are designed for heterogeneous cloud their performance is low in homogeneous clusters. In this paper we mainly present an extended study on three kinds of factors -System configuration, task scheduling for the process of resource utilization. Here we come under conclusion with 3 key findings. The performance of Map Reduce job will affect the performance map and reduce tasks when running on the different nodes. The job performance and resource utilization efficiency can be improved by scheduling the map and reduce tasks dynamically according to the capacity of nodes and prior knowledge about workload. When the shuffle data is large in size it can the random scheduling of reduce task will degrade the performance of homogeneous cluster even though it performs well in heterogeneous clusters.

Keywords: Hadoop, Map Reduce, Heterogeneous clusters, Cloud.

I. INTRODUCTION

We have entered an era of data management with technologies to store large and massive amount of data. The system which can manage this kind of data is called DISC-data intensive super computer system. Map Reduce is such a performance model developed by Google for the process of large scale data. For big data processing and cluster computing infrastructure cloud data centres typically employ big data processing and cloud services one of the most popular cluster development in cloud is hadoop Map Reduce [2] for immediate demand of computation resources to enlarge in-house resources. Geo distributed and hybrid cloud became popular solution approach. Most of the data centres are designed with heterogeneous set of servers, ranging from slow nodes of lower C.P.U. The price vary according to the size of the capacity of nodes which are provided by cloud data centres by Amazon to achieve equality in performance required at minimum cost, the mix of nodes with different storage, computer and networking capacity is required. Most of the Map Reduce implementation are designed for homogeneous clusters and they perform poor in heterogeneous cluster. LATE[4] represent most of the problems experience in heterogeneous clusters most of efforts till know are mainly follow on speculation schedule to find out a stragglers and schedule copy of stragglers tasks on different nodes only few efforts have been made to measure the efficiency and performance of setting suitable configuration for heterogeneous environment. we don't know exactly root cause why the Map Reduce job performance is less in heterogeneous clusters. By considering these open uses, in this paper we present a brief analysis on two categories of performance metrics - configuration of system and scheduling of tasks. We analyse how different scheduling parameter and system configuration parameter effect.

II. OVERVIEW AND THE BACKGROUND

A Execution model of Map Reduce cluster consists of many slave nodes and one unique master node. The job tracker executes on the master node for the process of execution of job scheduling of task. The task tracker executes on every slave node for the execution of tasks which will be assigned to task tracker.

Early Shuffle: Early shuffle allows starting the shuffle phase as soon as some map task complete and map output files are available. Early shuffle to diminish bisector network congestion utilizes parallel computing and its works as well when the no of map tasks and incoming data are large.

The early shuffle affects the following factors.

i. The execution performance of the synchronized map tasks.
ii. The performance dilapidation occurred at the map nodes to allow the early shuffle workloads.
iii. The best case where early shuffle provides the maximum overall performance gain.

Speculative execution in Hadoop: This refers to the artificial execution of tasks that is presently running at another straggler node due to its poor performance when compared to other peer nodes for same workload.

The accuracy of detecting straggler nodes and the accuracy of choosing speculative execution nodes will affect the efficiency of speculative tasks. Hadoop LATE is the recent speculative scheduler. It includes the LATE strategies [4]. LATE and Hadoop LATE does not take into consideration of early shuffle.

III. IMPACT OF PERFORMANCE ON SYSTEM CONFIGURATION

We study two types of system configuration on the performance of map reduce jobs. Firstly the effect of prior shuffle and speculation is described. Secondly the effect of

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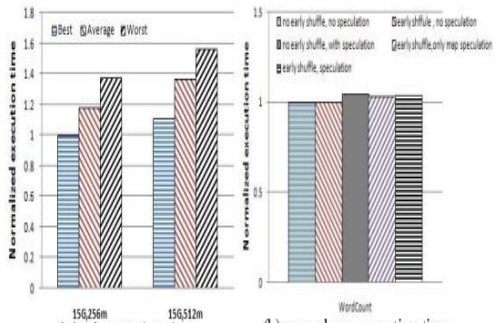
differing of task on different nodes on the performance of jobs is depicted.

Early shuffle and speculative effect:

From paper [5] Figure 3 it shows that when the size of block increases the execution time of map phase increase correspondingly. It is undetermined that the smaller block size will always leads to better performance. Secondly the execution time of map phase is increased compared to no early shuffle during turning on early shuffle. The execution time of Map phase is more efficient than with the both map and reduce speculation. This signifies that the reduce speculation can add additional overhead on map execution.



(a) job execution time (b) map phase execution time

Figure 3. Effectivenees of speculation

Memory Size and Block Size effect:

From paper [5] as the size of block increases the map phase execution time will go up accordingly. It is also observed that when the size of the block is small it can reduce the execution time of the speculative map tasks and different intermediate data size will be produced by different type of workload. Task scheduling algorithm impact on performance. The current task scheduler problem are analyzed from two aspects.

How the early shuffle effects on map task scheduler and reduce task scheduler? How the speculative task scheduler is effected by early shuffle?

Effect of early shuffle on the map task scheduler and reduce task scheduler. Each node which is running on map tasks have to run the following 3 types of the workloads whenever the early shuffle begins.

i. Map workload
ii. Shuffle allocating workload
iii. Shuffle appealing workload
iv. Map workload runs the remaining map tasks

Shuffle allocating workload and Shuffle appealing workload may cause possibility of extra burden on the slow running nodes and they may also slow down the performance rate of fast nodes for remaining map task. In the speculation scheduler the estimation of map progress rate may benot based on progress rate such as the straggler detection and speculation task selection.

Early shuffle effect of speculative scheduler: The number of reduce task should be equal to the fast worker nodes in the heterogeneous cluster. When the reduce phase begins the reduce scheduler schedules reduce task randomly in the sense that the master node will assign the very first reduce task to the first node with free reduce slot which will request for the reduce task then assign the next task to the second node with the next free reduce slot and so forth. The input data reduce task are twisted because of the partition. So the scheduler may assign reduce task with the largest input data to the slowest node with its worst case scenario.

IV. RELATED WORK

Many research efforts are made to improve the performance of Map Reduce [2] in heterogeneous environment. LATE [4] to present the problem of Map Reduce in heterogeneous environment a new version called YARN [3] has been developed. There are two trackers instead job tracker in hadoop 0.21 called resource manager and application manager which improve efficiency of task scheduling. By analysing all these we can say that no existing has provided detailed study of the effect of early shuffle on the performance of map reduce.

V. CONCLUSION

We studied two kind of factors system configuration and task scheduling which are very important for improving the map reduce performance. We conclude with following findings. First is early shuffle which will affect the performance of both the map and reduce tasks even though it is efficient for minimizing the latency of Map Reduce jobs. Second is that the sensitivity to the input block size may vary depending on the workload.

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