Application of Parallel K-Means Clustering Algorithm for Prediction of Optimal Path in Self Aware Mobile Ad-Hoc Networks with *Link Stability*

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Abstract. Providing Quality of Service (*QoS)* in terms of bandwidth, delay, jitter, throughput etc., for Mobile Ad-hoc Network (MANET) which is the autonomous collection of nodes, is challenging issue because of node mobility and the shared medium. This work is to predict the Optimal link based on the link stability which is the number of contacts between 2 pair of nodes that can be effectively applied for prediction of optimal effective path while taking *QoS* parameters into account to reach the destination using the application of *K*-Means clustering algorithm for automatically discovering clusters from large data repositories which is parallelized using Map-Reduce technique in order to improve the computational efficiency and thereby predicting the optimal effective path from source to sink. The work optimizes the previous result by pre-assigning task for finding the best stable link in MANET and then work is explored only on that stable link hence, by doing so we are able to predict the optimal path in more time efficient way.

Keywords: K-Means, Map-Reduce, MANET, QoS, Time of Contact.

1 Introduction

Due to popularity and advance application of Mobile Ad-hoc networks which neither has fixed infrastructure nor administrative support, where as a conventional wireless network requires both fixed infrastructure and centralized administration for their operation [1]. For such a complex network, providing Quality of Service (QoS) is critical and challenging issue. Traditional MANET routing protocols focused on finding a feasible route from a source to destination, without any consideration for optimizing the utilization of network resources or for supporting application specific QoS requirements [8-10] where the most concerned thing was to find the path from source to destination which is the shortest among all existing path. Hence to support QoS, the essential problem is to find a route with efficient available resources, such as finding the lowest cost or most stable route that meets the QoS constraints. When we say stable route we actually mean the paths whose *time of contact* is high in given

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duration of time. Here the simulation was run to check the number of contacts the nodes make with each other in given simulation time, if the contacts made by the nodes to each other are stable then we say such link as stable link hence those links are highly durable and can be trusted in predicting the path which is optimal from source to destination.

1.1 Previous Work

In our previous work *"Application of Parallel K-Means Clustering Algorithm for Prediction of* optimal *path in Self Aware Mobile Ad-Hoc Networks",* in that work we have found the optimal path from source to sink using the K-Means clustering algorithm which is one of the popular clustering techniques used for minimizing the total distance between the group's members and its corresponding centroid; which is the representative of the group, by finding the best division of *n* entities in *k* groups. The K-Means clustering mines the large datasets in order to find the centroid for the obtained information from running the simulation for the nodes in the network hence once the centroid of the cluster was found we tried to group the pattern based on to which cluster they belonged, hence we finally were able to find the best, good and bad cluster and find to which cluster the available paths belong to.

The rest of the paper is organized as follows: Section 2 provides an overview of Map-Reduce technique; Section 3 describes previous result and analysis. 4 Proposed solutions.

2 Map-Reduce for Determining Clusters and K-Means Clustering Algorithm

Figure 1 explains the working principle of *Map-Reduce* model along with its utilization in determining clusters. *Map tasks* are referred to as group of independent tasks assigned to each worker for further processing by utilizing the information collected from software agents [3]. Then, the *master* will distribute the tasks among *workers* based on the information from software agents either in the round robin or in the serial fashion. Each *worker* will perform the *K-Means* algorithm on the information given and thereby determining the clusters as *Best, Good and Bad.*

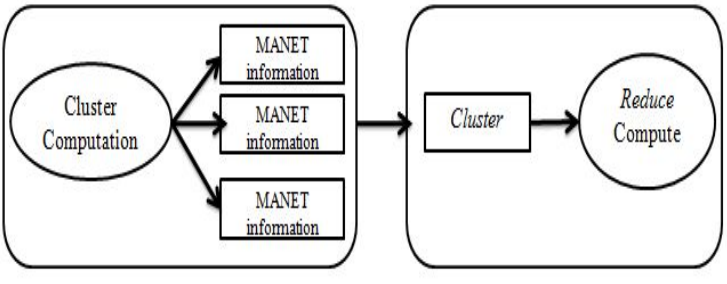

Fig. 1. Map-Reduce model