QoS parameters analysis in Reactive and Clustering based routing protocols

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Abstract - This paper discusses the K-means clustering technique and its impact on reducing the routing overhead for Mobile AdHoc Network (MANETs). MANETs are very important in establishing connections in remote areas, military areas, emergency situations, conferences etc. Since the applications of MANETs in various areas is increasing day by day; it is imperative to look for new techniques to reduce the overhead and improve Quality of Service parameters. This paper discusses the various routing protocols in MANETS and the impact of clustering technique in providing better QOS parameters.

Keywords: *AODV, Routing, QOS parameters*

I. INTRODUCTION

Mobile Ad Hoc networks (MANETs) are independent network of nodes. MANETs are like a wireless infrastructure wherein all the nodes act as routers [1]. In MANETs every node can act as a router to send and receive information of various types from one place to another. MANETs especially form a very important network during emergency situations as well as in areas where setting up infrastructure is very difficult. When the distance between source to destination is more; then the intermediate nodes carry the packets towards the destination. Hence it is imperative that selection of intermediate nodes should be done keeping in mind that these nodes should be energy efficient otherwise it will lead to loss of packets [2]. Since MANETs are used in various applications, it becomes important that the system has low error, good bandwidth and less packet drop rate. So, routing protocols and related techniques play a crucial part in this. This paper discusses the impact of various routing protocols on Quality of Service (QoS) parameters of MANETs and how K- means clustering technique can result in improved QoS parameters.

II. MANET ROUTING PROTOCOLS

MANETs have a dynamic topology so selection of routing protocols is very important so that the loss of packets is minimal and QOS parameters are maintained. Mainly there are three types of routing protocols that are used in MANETs: proactive and reactive.

Proactive routing protocols are table driven and thus require a lot of overhead. To find a path from source to destination, a path finding algorithm is run [3]. Also, for a network having dynamic topology, it becomes difficult to update the table again and again. [4].

Reactive routing protocols are the most commonly used routing protocols in MANETs. Reactive routing protocols do not maintain any network topology information and were designed to reduce the overheads in proactive protocols by maintaining information for active routes only. Reactive protocols save a lot of control overhead as there is no need to exchange routing information periodically. The necessary route from source to destination is acquired as and when required through a connection establishment process. Routes are usually discovered by flooding route request (RREQ) packets in the network. On receiving a RREQ packet, a route reply (RREP) is sent back to the source. The main reactive routing protocols used in MANETs are Ad Hoc on Demand Distance Vector (AODV) and Dynamic Source Routing (DSR) protocols.

III. ROUTING PROTOCOLS AND THEIR IMPACT ON MANETS

In this section various routing protocols and their impact are discussed.

A. Ad Hoc On Demand Distance Vector (AODV):

It uses on demand routing approach for finding routes. Moreover, the latest routing information is maintained by route discovery procedure and updated routing table. In AODV, RREQ is used when node cannot broadcast the request. A RERR message is sent when there is topology change and route to destination node cannot be found out. However, AODV does not provide any backup routes in case of route failure. Any route breakage will lead to loss of packets and error which is not desirable especially in critical situations.

B. Ad Hoc On Demand Distance Vector Backup Routing (AODVBR):

AODV BR protocol introduced by Lee et al. provided backup route when there was a route failure [5]. However, it could not provide any alternate routes in case the backup route also failed. Since MANETs are being used in various and important applications these days, it becomes necessary to provide multiple and energy efficient backup routes for packets to reach the destination without route failure. [Indian Journal of Science and Technology paper].

C. Ad hoc On Demand Multipath Distance Vector (AOMDV): Ad hoc On Demand Multipath Distance Vector (AOMDV) is de failures. AOMDV extends AODV to provide multiple paths during route discovery. This protocol uses hop by hop approach and establishes multiple reverse paths from the destination node as well as various intermediate nodes. However, the solutions provided on failure of the main route are not energy efficient. The backup routes are not selected on the basis of which nodes are most energy efficient and this leads to backup route failure and loss of packets again.

D. Ad Hoc On Demand Distance Vector nth Backup Routing (AODVnthBR): In AODV nthBR protocol, in case of the main route failure alternate backup route is found one after the other. On failure of the main route, the nearest node is found by using distance vector calculation. The node is then checked for its energy value. If the energy of the node is above a threshold level, then it is selected for transmission, else some other node is selected. In case the backup route also fails, then the next node is selected by the same procedure. So, by energy efficient technique it is ensured that route selection is efficient leading to low packet loss. However, when the number of nodes are less and when multimedia packets are transmitted, then the results are not very effective.

F. QoS Aware K-means clustering technique:

K-means clustering technique is used to cluster the network into nodes [6]. Here, firefly optimization techniques are used to find cluster heads for the cluster nodes. The transmission of data begins in the network nodes and it is found that the network performs well for various QoS parameters

IV. COMPARISON OF RESULTS OF VARIOUS PROTOCOLS

A. Throughput:

It is the final count of the number of data packets received at the destination over the complete simulation time.

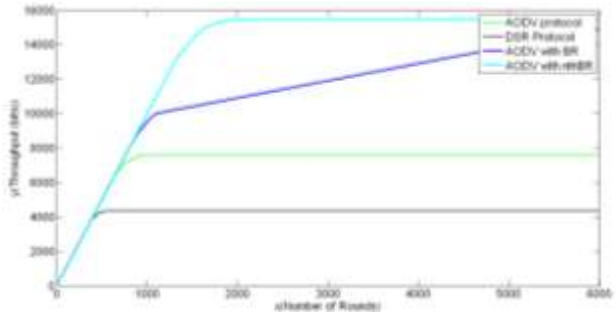

Fig. 1. Throughput

We can see from the Fig.1 that the results obtained are best when AODV nthBR protocol is implemented, followed by AODV protocol, then by AODV BR protocol and finally by DSR protocol.

B. Packet Delivery Fraction (PDF):

$$PDF = \frac{Data\ received\ by\ destination}{Data\ sent\ by\ transmitter}$$

In Fig.2, the results obtained are best with AODV nthBR protocol and least with DSR protocol .

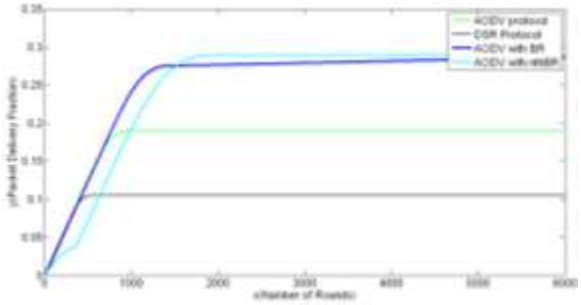

Fig. 2. Packet Delivery Fraction

C. **End to end delay**

As observed from Fig.3 end to end delay is found to be minimum with AODV nthBR protocol.

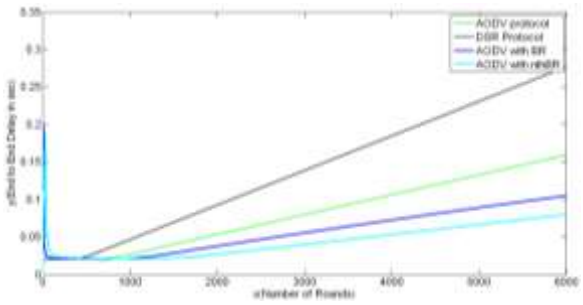

Fig. 3. End to end delay

D. QoS Aware K-means Clustering Technique

It can be observed from Fig. 4 that throughput obtained with KF-mac clustering technique is found to be better than other related routing protocols using clustering techniques like FEAR and MDSR protocols [6]. In this clustering technique, k-points are selected as centroid nodes. Then a cluster head is selected from the nodes. In steady state phase routing formation takes place.

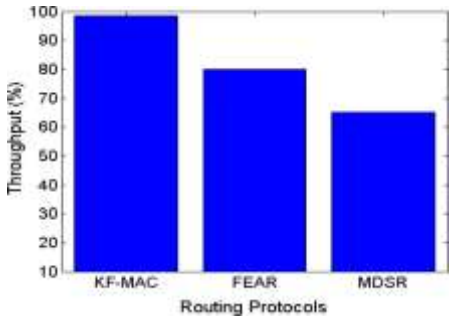

Fig. 4. Throughput using clustering techniques.

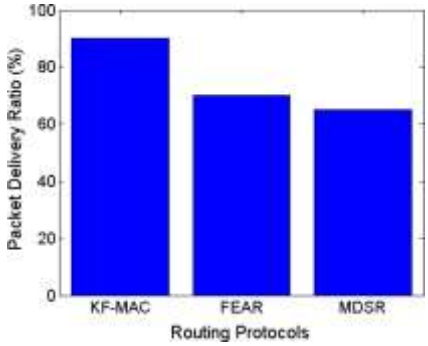

Fig. 5. Packet Delivery Fraction using clustering techniques

V. CONCLUSION

The comparative analysis of the results obtained using various protocols show that AODV nthBR protocol provides best results when compared to other traditional routing protocols. Also, while comparing routing protocol using clustering techniques it is observed that results obtained with KF-MAC protocol is found to be the best. In future, AODV nthBR protocol can be combined with clustering techniques for better results.

VI. REFERENCES

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