A Review on Congestion Control using AODV and Enhance AODV

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Abstract – *Ad-hoc network is defined as the temporary networks were nodes are moving without any fixed infrastructure or centralized administration. Here every node acts as both router as well as host. The topologies of these nodes dynamic, self-configurable and highly deployable. There are so many routing protocols which are defined for MANETs. As so many packets are transmitted by various nodes over the network, the chances of loosing the packets over the network increases over great extent. When the offered load on the network exceeds congestion occurs, which leads to packet losses. There are so many proposed protocols that are adaptive to congestion and deals with congestion. This paper discusses the congestion control protocols, AODV and Enhance AODV. Enhance AODV is modified version of basic AODV routing protocol which controls congestion very effectively than AODV routing protocol. The performance parameters such as packet delivery ratio, packet loss ratio, average end to end delay and throughput are discussed.*

***Key Words*: MANET; AODV; Enhance AODV (EAODV); Congestion control.**

1. INTRODUCTION

Ad-hoc Network is nothing but the collection of two or more wireless devices which are having the capability of communicating with each other by taking no help of any centralized administrator. Generally these networks are referred to as MANETs (Mobile Ad-hoc Networks) [1]. MANETs consists of numbers of nodes which moves freely within the network. Each node acts not only as a terminal but also as a router. If mobile nodes are within each other's radio range they can communicate with each other via wireless link and if not, they depend on other neighbouring nodes which act as routers to transmit packets [2]. Due to independent behaviour of MANET's, there are a number of issues and challenges in designing of MANET networks. The issues include security, topology control, quality of service, routing, power management, congestion control etc [8].The key issue in wireless networks is congestion in network.

Congestion is the condition when the offered load to the network exceeds the available resources. It can take place during the transferring of packets from source to destination which leads to packet loss. Their are also some other factors which are responsible for packet loss, such as mobility, link failures, interferences, etc., but among this congestion is at the top of the list. If their is no any appropriate congestion control strategy, then it will lead to a collapse of network due to congestion, and so data is not successfully delivered [4].Their are various congestion control algorithms such as EDAODV,AODV-I,CRP. This paper focuses on AODV and EAODV.

The rest of the paper is organized as follows. In Section 2, Congestion in MANET is described. Section 3 describes working of AODV. Enhance AODV(EAODV) protocol are illustrated in section 4. Section 5 demonstrates the overview of related work about topic. Section 6 concludes the paper.

2. Congestion in MANET's

Mobile ad-hoc network is network of mobile device which is free to move independently in any direction. Congestion is an obstruction where successful communication do not takes place. It is situation where, in a subnet too many packets are present [8]. Which leads to high overhead, packet losses, waste energy and long delays. The following difficulties can be created because of congestion.

- High overhead: The discovery of new routes for processing and communication is taken into account. It needs additional effort for maintaining the multipath regardless of the existence of alternate route if the use of multipath routing is done.

- Many packet losses : Packet losses are due to congestion. To minimize the excess load in the network the sending rate should be reduced at the sender side or by dropping the packets at the intermediate nodes or by applying both the processes which increases packet loss rate or minimum throughput.

- Long delay : The congestion is detected in this process. It is better to select the alternate new path when the congestion is more undesirable.

In this paper we have discussed AODV and EAODV to control network congestion.

3. AD-HOC ON-DEMAND DISTANCE VECTOR ROUTING PROTOCOL (AODV)

Ad-hoc On-Demand Distance Vector routing protocol is capable of both unicast and multicast routing. As it is on-demand algorithm, the routes are generated among nodes only when the source node desires and it is maintained as long as they are required by source. It uses destination sequence numbers and it is loop free. The active routes are maintained by AODV only when they are in use and the unused routes are deleted. It is self-starting, dynamic and loop-free. For large number of mobile nodes AODV is used.

The algorithm's primary objective are :

- To broadcast the packets which are discovered only when necessary.
- To distinguish between general topology maintenance and local connectivity management.
- To spread information throughout about changes in local connectivity to those neighboring mobile nodes which needs the information.

Using route request / route reply cycle AODV generates routes. When source node wishes to set a route to destination for which it does not posses route already a route request is broadcasted over the network. Every nodes which receives this packets updates the source node. The RREQ is having information of the IP address of the source node, broadcast ID, its current sequence number and the last sequence number of destination for which the source node is aware. A node which receives the RREQ sends back RREP (Route Reply). As the RREP propagate back to the source nodes sets forward pointers to destination. As the RREP is received by the source node, the data packets are forwarded to the destination. If there is a link break during transmission, at that node it generates a route error (RERR) message and sends it to source node in order to inform that the destination is now not reachable. Then on receiving RERR, if the source node still wants the route, it finds a new route [3].

Advantages of AODV

1) In AODV there is establishment of route only on demand.
2) Connection setup is faster.
3) Unnecessary overhead in the network is not caused.

Disadvantages of AODV

1) Periodic beaconing leads to unnecessary bandwidth consumption.

2) Delivery ratio drops from 10% to 28% as the connection increases from 10 to 50 nodes.

4. ENHANCE AD-HOC ON-DEMAND DISTANCE VECTOR ROUTING PROTOCOL (EAODV)

In AODV routing protocol there is no phenomenon to handle the congestion effectively. This system modifies or enhances the existing AODV algorithm by using congestion control phenomena. Here node transmits the packets and waits for acknowledgement for a threshold period of time. Threshold is the average threshold time of the network and it varies from network to network. If the acknowledgement is not received in threshold time period then the same node will retransmit or broadcast packets again to select alternate path. Because of this, this system detects and control congestion very fast then the AODV protocol. In AODV routing protocol there is no threshold period of time so nodes waits for an acknowledgement for a unnecessary time hence AODV system detects congestion late then the EAODV system. This shows more packet loss, packet delivery ratio will decrease, average end to end delay will increase. EAODV protocol work more effectively to control congestion at high traffic. The performance parameters are discussed below :

- **Packet Delivery Ratio (PDR) :** This is also called as packet delivery fraction (PDF). It is the ratio of received packets to the total number of data packets sent by source.
- **Packet Loss Ratio (PLR) :** It is the ratio of difference between the total number of generated packets and the total number of received packets to the total number of generated packets [5].
- **Average End to End Delay :** The interval time between packet send and packet received to the total number of packets received.
- **Throughput :** The total number of bits delivered to the higher layers per second.

5. RELATED WORK

- The challenges of MANET, routing protocols of MANET and the working of existing Ad hoc On demand Distance Vector (AODV) routing algorithm is discussed by bijendra bansal. As there are disadvantages in AODV protocol it is enhanced to Enhance Ad hoc On demand Distance Vector (EAODV) routing protocol. The congestion control using EAODV is discussed. The performance are evaluated by the use of various performance parameters like packet delivery ratio, end to end delay, packet loss ratio on different number of

nodes [5]. The congestion is detected and controlled very fast by using EAODV.

- Various congestion control techniques such as CBRRT (Congestion Based Route Recovery Technique), CA-AODV (Congestion Adaptive AODV), CFR (Congestion Free Routing) , LSRP (Link State Routing Protocol) , CARP (Congestion Adaptive Routing Protocol), AODV-I (Improved AODV) , ABCC (Agent Based Congestion Control Protocol) and CBCC (Cluster Based Congestion Control) have discussed and compared. The Survey on various Congestion Control Techniques in MANET's is done [6].

- Congestion is an important issue in mobile ad hoc networks leading to packet loss and degradation of the network. The existing routing protocol for MANETs do not support congestion control as they are not congestion adaptive. Since AODV has no congestion control mechanism, the congestion control protocol based on AODV, EDAODV,AODV-I and CRP are discussed [9].

- The history of MANET, challenges (issues) involve in MANET and its some applications are presented by mohit kumar and rashmi mishra [7]. The life cycle of mobile ad hoc network is classified into first, second and third generation. Presently, ad hoc networks are considered into the third generation. Regardless of the variety of applications and long history of mobile ad hoc network, there are still some issues and design challenges that have to overcome. The applications are tactical network, wireless sensor network, data networks, device network.

- MANET's are highly deployable, dynamic and self configurable because of which routing is an extremely challenging task in them. AODV routing protocol used for routing purposes in MANET's is an on-demand routing protocol which does not support congestion control because it is not congestion adaptive. Two congestion control protocols based on AODV in MANETs are discussed. Many authors have proposed protocols related to AODV which are congestion adaptive and deals with the congestion over the network. AODV-I and EDAODV are two congestion control protocols which deals with the congestion reactively [10]. These two protocols are simulated on NS2 by varying the size of data packets. The analysis of these protocols is done with AODV by calculating the values for performance metrics, namely, throughput, packet delivery ratio (PDR), routing overhead and end-to-end delay.

- In 2013 The study about various congestion control technique like routing base congestion control, window bases, and additive increase decrease of window base as well as transport layer bases congestion control technique is done, all the technique provide the more reliable and efficient congestion control but MANET are dynamic nature so through that point here proposed dynamic queue as well as acknowledgment delay bases congestion control technique that system more feasible to MANET environment [8]. And increase the performance of the network like packet delivery ratio, throughput and minimize the end-to-end delay of the network.

- T. S. Kumaran, and V. Sankaranarayanan in 2010 presented the early detection congestion and control routing protocol for wireless Ad-hoc networks called as EDAODV [11]. EDAODV detects congestion by calculating queue_status value at a node level and finding congestion status. Based on a congestion status, EDAODV utilizes the non-congested predecessor and successor nodes of a congested node and starts route finding process in both direction to find alternate non congested path between them for transmitting data. The process finds more non-congested alternate paths and chooses a best single path for transmitting data.

6. CONCLUSION

Congestion is a major problem in wireless networks. In MANET congestion occurs when packets transferred are greater than capacity of network. Due to congestion the performance of network degrades .Various existing congestion control methods are proposed by different studies which is seen here but still the congestion control is a challenging issue for MANET's.

In this paper we have seen AODV routing protocol but due to some disadvantages and congestion control mechanism is not present, the concept which is modified or enhanced version of AODV is discussed. In EAODV the congestion is controlled effectively than AODV routing protocol by wait for Acknowledgement method which will result in increase the packet delivery ratio and throughput, decrease the end to end delay, decrease in packet loss ratio. So, we can say that EAODV protocol is more effective to control congestion than AODV protocol.

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