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To Analyse and Enhance AODV Protocol for Congestion Control in MANET using Knowledge Based Learning

Author
Amritpal Kaur
Punjabi University, Regional Centre for I.T. and Mgmt, Mohali, India
Email: *amrit1671@yahoo.in*

ABSTRACT
The wireless networks in recent years, have gained much interest due to auto configuration and connectionless services. MANET are type of wireless networks has self network configuring property make it necessary to research on the performance of routing protocol. The present study deals with the analysis of AODV protocol and its enhancement by improvement of congestion control. Knowledge based learning was used to enhance the AODV routing protocol. The tool that was used for simulation is NS 2. The parameters are used to analyzing the AODV and enhance AODV are throughput, delay, packet loss and routing overhead

Keywords---*MANET, AODV, Congestion, Congestion counter.*

INTRODUCTION

MANET stands for Mobile Ad Hoc Network is a self-configuring infrastructure less wireless network which consist mobile devices. Each mobile device is free to move anywhere independently in any direction. So in this network, topology changes frequently as devices move independently and changes their links to other devices very quickly. Due to very fast mobility of nodes, there will be drastic changes in the network it can find its applications in Military, Personal Area Networks connecting cell phones, laptops, smart watches, and other wearable computers[1].

The routing protocols in MANET are used for path establishment from source to destination. There are various routing protocol are used to route the packet from one node to another. The communication between the nodes in the MANET is done either directly or through intermediate nodes acting as routers. Thus, the nodes act both as hosts and routers. Due to the limited range of transmission, several nodes may be needed to route a packet to its destination. Finding multiple paths in a single route discovery, reduce the routing overhead incurred in maintaining the connection between source and destination nodes. Multipath routing can increase scalability, end-to-end throughput. Establishing and maintaining the ad hoc network through the use of routing protocols is an important research area[1]. Routing protocols helps mobile devices to find routes from the one node to other node if two nodes are in range otherwise path is establish through one or more intermediate nodes. Each node in the network has the knowledge of the all other nodes which it is directly attached. It is the routing protocol which first share this information with the immediate neighbors and then with all other nodes throughout the network. Routing protocols can be broadly classified into two types as [3] Table Driven Protocols or Proactive Protocols and On-Demand Protocols or Reactive Protocols. [3]: In proactive protocols each node maintains routing tables which contains the information of routes to all the nodes[3]Some of the proactive protocols are: DSDV (Destination-Sequenced Distance-Vector) and GSR (Global State Routing).

In *Reactive Protocols*, routes are discovered when required or needed. Some of the existing reactive protocols are: DSR (Dynamic Source Routing), AODV (ad hoc on demand distance vector) and TORA (Temporary ordered routing protocol).

Congestion is a key problem in mobile ad-hoc networks. Congestion has a severe impact on the throughput, routing and performance. Identifying the occurrence of congestion in a Mobile Ad-hoc Network (MANET) is a challenging task. To maintain and allocate network resources effectively and fairly among a collection of users is a major issue. Many devices in ad-hoc network, sharing a common resource compete for link bandwidth and the queues on the routers or switches, which leads to network overload. So when numbers of packets are present in a network is greater than capacity of network then this situation is called as congestion [2]. So by control of congestion reduces the delay, packet loss and routing overhead and improve the network reliability and throughput as shown in this paper [2].

BACKGROUND

AODV is an on-demand routing protocol used in ad hoc networks. Every node keeps a local routing table that contains the information to which of its neighbors it has to forward a data packet so that it reaches the desired destination. This protocol is like any other on-demand routing protocol which facilitates a smooth adaptation to changes in the link conditions. In case when a link fails, messages are sent only to the affected nodes. With this information, it enables the affected nodes invalidate all the routes through the failed link.

Source node issue a RREQ (Route Request Message) with the broadcast ID to its neighbours and update its table. The broadcast ID is incremented each time the source node initiates RREQ. when the RREQ message is received by neighbours it checks the destination address and source address if intermediate node is not the destination node then RREQ message is rebroadcasts the RREQ to its own neighbors by increasing the hop count. When an intermediate node receives a RREQ from various intermediate neighbor nodes with the same broadcast id and source address. It drops the duplicate RREQ and does not rebroadcast it. Then these nodes further forwards packets to its neighbor until the destination find outs and fresh route find out. To process the RREQ, the node sets up a reverse route entry with Route Reply message for the source node. When RREP is routed back along the reverse path and received by an intermediate node, it sets up a forward path entry to the destination in its routing table. When the RREP reaches the source node, it means a route from source to the destination has been established At last that route will be the final route that has the minimum hop count from source to destination and the source node can begin the data transmission

In case of link failure occurs, Route Errors (RERRs) message is generated. When RERR is received by the source node, it can either stop sending the data or reinitiate the route discovery mechanism by sending a new RREQ message if the route is still required.

AODV select the three paths to route the packet from source to destination. Second route is selected for path established between source and destination on the basis of hop counts and sequence numbers. Final path establishment according to minimum hop count and fresh sequence number. The source node can begin the data transmission to the destination.

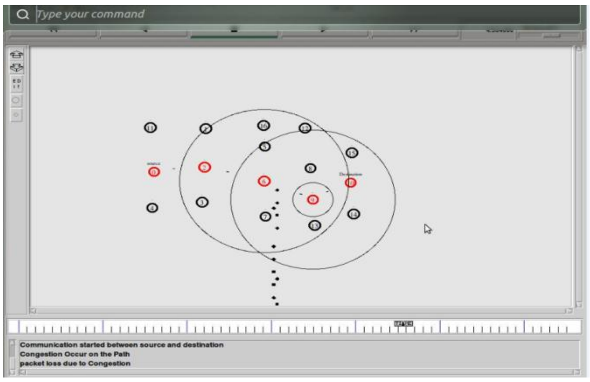

Figure 1: Packet loss due to congestion on the best path selected by the AODV

As all nodes try to route there packet on best path which is selected on the basis of hop count and sequence number in AODV. Best route are more vulnerable to congestion because there is no advance knowledge of congestion occur in the network so packet drop occurs which degrade the performance of AODV routing protocol as shown in figure 1.

PROPOSED SYSTEM

In present work to overcome congestion problem in AODV knowledge based learning will be used. In this technique final route from the source to destination is selected on the basis of path having minimum congestion. Using knowledge based learning chance of congestion at each node is calculated for all the paths from source to destination in advance. The path which has minimum congestion will be selected as final path.

There are four conditions which will be followed for the establishment of the path. These are:

- Minimum Congestion counter
- Path which is having least chances of congestion in future
- Minimum Hop Count
- Fresh Sequence Number

$$G_c = \frac{\sum_{c_o}\sum_{o} Cov(V_c, E)^2_{c_o,o}}{\sum_{o}\sum_{p} E^2_{o,p}}$$

This is the formula which is used to find congestion on the particular node in the previous times. In this technique four factors are considered for avoiding the congestion in the mobile ad hoc networks. The first factors is the path is selected which had minimum chances of congestion. The second priority is given to path which is having least chances of congestion in future and second last priority is given to hop count and last priority will be given to sequences number. On the basis of all these four factors the best and reliable path will be selected between source and destination

In AODV Source send route request message to all the nodes. Destination sends route reply message to its previous node with congestion counter and so on to the source node. Congestion counter contain the information of congestion at each node along all path selected by AODV. At the end source receive route reply message with congestion counter. The path which has minimum congestion counter will be selected as final path as shown in figure 2.

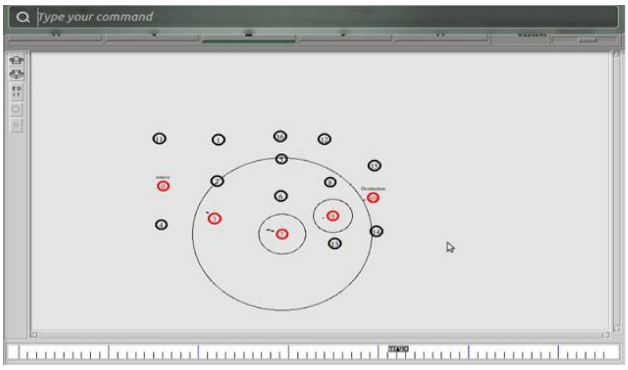

Figure 2: Final path having less congestion.

PERFORMANCE METRICS

There are different metrics are used to evaluate the performance of the protocols are throughput, end to end delay, jitter, routing overhead, packet delivery, packet loss etc. In this study following metrics are considered to analyze performance of the protocols:

Throughput: It is the average rate of successful message delivery over a communication channel or it can also be defined as the total amount of data a receiver actually receives from sender divided by the time taken by the receiver to obtain the last packet. The throughput is usually measured in bits per second (bit/s or bps), and sometimes in data packets per second or data packets per time slot [5].

Delay: This parameter is used to measure how much time takes to transfer the packets from source to destination [4]. Network congestion is indicated by higher end-to-end delays. This delay includes the total time of transmission i.e. propagation time, queuing time, route establishment time.

Packet loss: Packet loss occurs when one or more packets of data traveling across a computer network fail to reach their destination [6]. Packet loss is calculated as total lost packet to the total no of transmitted packets.

Routing overhead: The total number of routing packets transmitted during the simulation. For packets sent over multiple hops, each transmission of the packet (each hop) counts as one transmission [7].

SIMULATION RESULTS

Results obtained for all simulation scenarios for AODV and enhance AODV presented. The outputs for scenario is analyzed on the basis of performance metrics like throughput, delay packet loss and routing overhead.

The network simulator (NS), which is a discrete event simulator for networks, is a simulated program developed by VINT (Virtual Internetwork Test-bed) project group. It supports simulations of TCP and UDP, some of MAC layer protocols, various routing and multicast protocols over both wired and wireless network.

The simulation is carried out for 17 mobile nodes which in an 800 meter x 800 meter rectangular with 50 Maximum Number of Packets in interface queue.

End to End Delay comparison:

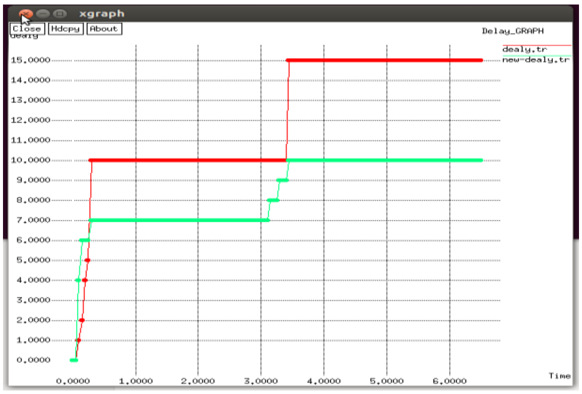

Figure 3: End to end Delay

It is interpret from the Figure 3 that delay is more in AODV as compare to Enhanced AODV.

Throughput comparison

From Figure 4 interpret that throughput in enhanced AODV is more as compared to AODV. It shows that AODV after applying knowledge base learning gives is better than existing AODV due to increase in performance of the network. The throughput of the proposed technique is more as compared to the existing techniqueso it is more efficient technique for congestion control in MANET.

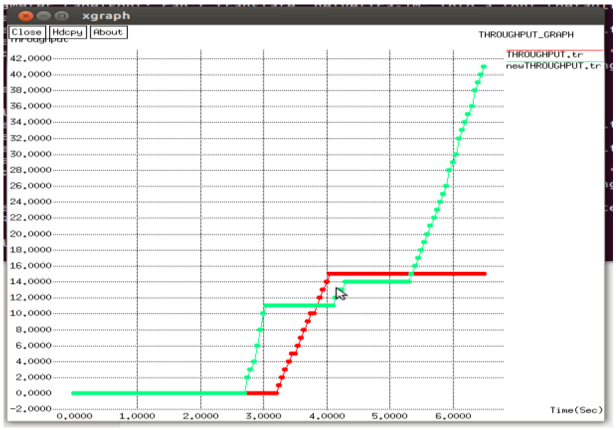

Figure 4: Throughput

Packet loss comparison

Figure 5 shows that packet loss in AODV is more as compared to Enhanced AODV.

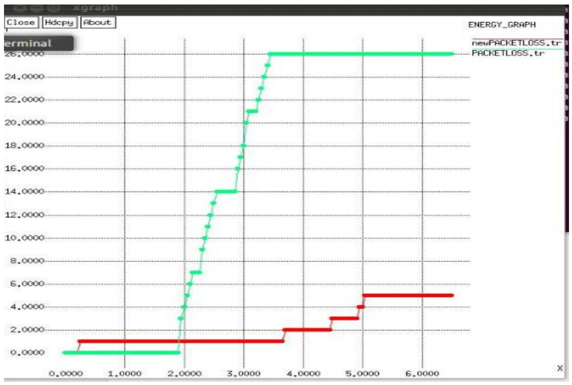

Figure 5: Packet loss

Routing overhead comparison:

Figure 6 show that Routing Overhead in Enhanced AODV is less as compared to existing AODV.

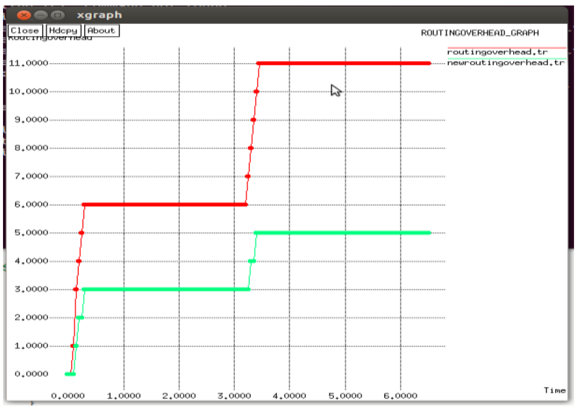

Figure 6: Routing overhead

CONCLUSION

In this research work on demand routing protocol AODV is considered for analysis and enhancement for congestion control. Knowledge based learning is used for the enhancement of AODV on the basis of the network performance parameters throughput, delay, packet loss and routing overhead. These parameter are used to addresses the efficiency and reliability of the protocol.

It is concludes that enhance AODV has high throughput than existing AODV. Packet loss, delay and routing overhead less in enhance AODV as compare to exiting AODV shows improve the network reliability and throughput.

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Author Profile

Amritpal Kaur received the B.Tech. degree in Computer Science and Engineering from Rayat and bahra college, Moahli Punjab Technical University, Punjab, India in 2012. She is currently pursuing M.Tech from Punjabi University Regional Center of I.T. and Mgmt., Mohali, India.