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Enhance ADOV Routing Protocol in TCP and CBR Traffic

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Abstract –This papers a survey of evaluating performance of Ad-hoc ondemand distance vector routing protocol in Mobile adhoc networks with different network parameters using network simulator. Our basic goal is to present vast information related to AODV protocol and modifications done to it to analyze its performance in TCP and CBR traffic using different performance metrics such as packet delivery ratio, average end-to-end delay, routing load, throughput, packet drop rate

Keywords: MANET; AODV; Network simulator

I. INTRODUCTION

Mobile ad-hoc network is a network which do not requires any fixed infrastructure; consist of mobile Nodes which communicate via wireless links. Each node in Manet acts as router as well as host. The nodes in Manet are free to move independently. Manet has several salient characteristics

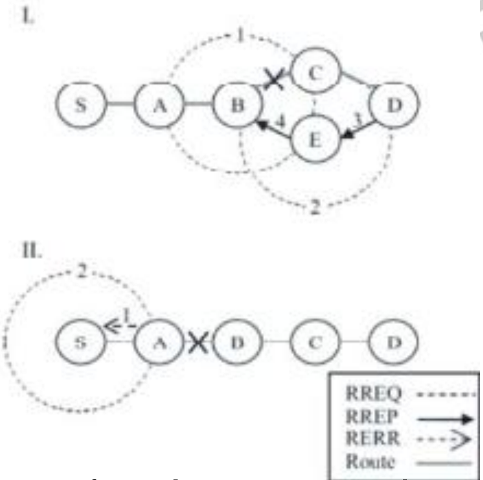
1. Dynamic topologies
2. Bandwidth constrained
3. Limited physical security
4. Energy-constrained operation. [1]

Each device in Manet is free to move in any direction and will therefore change its topology frequently. Adhoc routing protocols control how nodes decide which way to route packets. Ad-hoc routing protocols can be divided into two main categories ie proactive and reactive. AODV is one of the reactive routing protocols. This paper is a survey work that includes proposed modification and related work done to enhance the performance of AODV with different network parameters such as packet delivery fraction, average end to end delay, throughput, routing load. To evaluate performance of routing protocol, link break play a vital role for routing overhead.

In Section II, we discuss a brief overview of AODV protocol. Section III Traffic introduction IV presents related work done in AODV protocol. Section V gives overview of link break. Section VI finally concludes the paper

II. OVERVIEW OF AODV

AODV Routing Protocol: AODV is one of the routing protocols under study by MANET and the typical protocol of on-demand types. In AODV, each node has the routing table and the freshness of routes is ensured with the sequence number of each the routing information. When each node receives a control packet that occurred in on-demand, the routing table is updated based on the sequence number or the number of hops



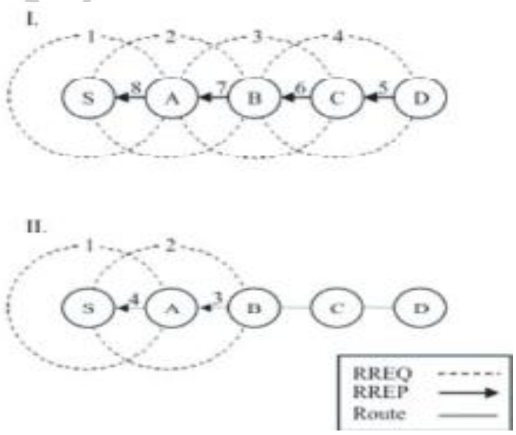


Fig. 1: The processes of route discovery   Fig. 2: The processes of route maintenance

If a route to a destination is needed, it is established at the route discovery phase and is maintained at the route maintenance phase.

Route Discovery: When a source node needs a route to a destination node and there is not the valid route in the routing table, the source node broadcasts a route request packet (RREQ) to the destination node. When each node receives the RREQ, it creates or updates a reverse route to the source node in the routing table. If it does not have a valid route to the destination node in the routing table, it rebroadcasts the RREQ. When the

RREQ flooding from the source node arrives at the destination node, the destination node creates or updates the reverse route. And it unicasts a route reply packet (RREP) which has an incremented the sequence number to the reverse route.
When each node receives the RREP, it creates or updates a forward route to the destination node and it forwards the RREP to the reverse route. When the RREP arrives at the source node along with the reverse route, it creates or updates the forward route and starts communications.
For example, Figure 1-I shows the process of the route discovery, which the source node S broadcasts the RREQ and the destination node D unicast the RREP. If each node has the valid route to the destination node in the routing table when it receives the RREQ, it unicast the RREP to the source node instead of the destination node. For example, Figure 1-II shows such a process, which the node B unicast the RREP instead of the node D. During the route discovery, when each node receives the RREQ that it has already processed, it discards the RREQ, so the loop is avoided and the overhead becomes low.

Route Maintenance: Each node broadcasts a Hello packet periodically for local connectivity. It broadcasts the RREP with TTL=1 as the Hello packet. When the node does not receive any packets from a neighbour during a few seconds, it assumes a link break to the neighbour. In addition, when the node has the link break to the neighbour based on an acknowledgment of MAC layer, it detects a route break to the destination node that the next hop of the route is the neighbour. When the node that detects the link break is close to the destination node (that is to say the number of hops to the destination node is smaller than the number of hops to the source node), it requires a new route to the destination node, which is known as Local.
Repair: The local repair is the route discovery which is similar to the description above. During the local repair, arrival data packets received are buffered. When the RREP is received and the local repair is successful, the node starts sending data packets in the buffer.
For example, Figure 2-I shows the process of the local repair after the link break between the node B and the node C. On the other hand, when the node that detects the link break is far from the destination node, or when the local repair is unsuccessful, the node propagates a route error packet (RERR), which contains the addresses of the unreachable destination, toward the source node. When each intermediate node receives the RERR, the routes which have the unreachable destination node and have the next hop which is the propagation node of the RERR are made invalid and it propagates the RERR again. When the source node receives the RERR, the route to the destination node is made invalid similarly and it rediscovers the route again. For example, Figure 2-II shows the process of the route maintenance after the link break between node A and the node B.

III. TRAFFIC INTRODUCTION

Introduction

Five ATM Forum-defined service categories exist. The basic differences among these service categories are described in the following sub-sections. These service categories provide a method to relate traffic characteristics and QoS requirements to network behaviour. The service categories are characterized as being real-time or non-real-time.

Constant Bit Rate (CBR)

"**C**onstant **B**it **R**ate "traffic is a terminology borrowed from the ATM world. It implies that data are sent at a fixed bit rate .a CBR stream is thus characterized by data being sent in packet of a fixed size with a fixed with fixed interval between each packet. The sources of CBR stream make no attempt to detect if the destination received the transmission data or even discovering if the destination exists. I.e. no connection established phase is required and traffic is flowing only from the source to the destination with no feedback from the destination of from intermediate nodes.

The CBR service category is used for connections that transport traffic at a constant bit rate, where there is an inherent reliance on time synchronisation between the traffic source and destination. CBR is tailored for any type of data for which the end-systems require predictable response time and a static amount of bandwidth continuously available for the life-time of the connection. The amount of bandwidth is characterized by a Peak Cell Rate (PCR). These applications include services such as video conferencing, telephony (voice services) or any type of on-demand service, such as interactive voice and audio. For telephony and native voice applications CBR provides low-latency traffic with predictable delivery characteristics, and is therefore typically used for circuit emulation.

TCP traffic [2]

Contrary to CBR traffic, TCP is a connection oriented, reliable and conforming transport protocol. I.e. period to transmitting data, a connection establishment phase must be completed, denoted a three way handshake. During transfer, TCP employs both flow control and congestion control. The purpose of flow control is to avoid overloading the recipient while congestion control is employee to shape the traffic such that it conforms to the available network capacity positive acknowledgement time out and retransmission are employ to ensure reliable data delivery.

Source for TCP data will maintain two "window" : a "receive window "for each destination , representing the available buffer capacity of the destination, and a "congestion window" representing the available capacity of the network .as the source transmits data ,the size of both window are reduced by an amount equal to the size of the data sent. When either window reaches zero, the source is not allowed to transmit.

The receive window is, initially, set to a value negotiated with the destination during the connection establishment phase for each byte of data sent; the window size is reduced by one byte. I.e. the transfer rate by the sender is controlled by the capacity of the destination. In the slow start phase if an acknowledgment is received before its time out expired, the congestion window is doubled. I.e. the congestion window grows exponentially.

When the congestion window has reached a specific threshold, the slow start phase end and is replaced by the congestion avoidance phase. During congestion avoidance, each timely acknowledges TCP segment causes the congestion avoidance; the growth of the congestion window is linear.

If an acknowledgment is not received before it is time out, TCP retransmits the data. Further the absence of an acknowledgment is taken as an indication of the network being congestion. To accommodate for this congestion. The congestion window is reset to the maximum size of one TCP segment, and the threshold for going between slow start and congestion avoidance is set to the current size of the congestion window, divided by two.

CBR, TCP and MANETs

CBT and TCP traffic impose different condition on MANETs. In this subsection, we will try to outline the impacts of some of these conditions.

First we observed that for TCP, both during connection establishment and data transfer, bidirectional traffic between the source and the destination is required in order for data to be successfully delivered. With CBR traffic, traffic from the source to the destination is sufficient. This implies that, for TCP traffic, it is required that the routes for each connection. Whereas for CBR only one route is required per stream of data.

Second, we observed that a long delay of an acknowledgment as an indication of network congestion. If the topology changes in MANETs, a reactive protocol may have to execute a renewed route discovery in order to acquiring a new route. The delay involved in this can be long enough to cause an acknowledgment to be delayed and, hence, time out in the source. I.e. a topological change in an otherwise not congested network will be treated as if the network was congested and the sender will have its transmission rate decreased.

IV. Related Work

In recent years, a number of studies have been done regarding AODV protocol using different parameters. Several researchers have done a lot of analysis of adhoc routing protocols taking different parameters such as packet delivery ratio, average end to end delay, routing load, throughput, packet drop rate.

1. PACKET DELIVERY RATIO (PDR)

It is the ratio of no of data packets successfully Delivered to the destination node and number of data packets generated by the source node.

i. AODV with reliable delivery AODV-RD based on link failure prediction mechanism is proposed and increases packet delivery ratio when compared with AODV-BR and original AODV.[3]
ii. Comparison is made between three routing protocols AODV , DSDV and DSR by varying packet size, time interval and simulation results show that when packet size increases PDR for AODV and DSR decreases and when time interval increases DSR performs better than AODV which in turn performs better than DSDV.[4]
iii. AODV-LFP (AODV based on link failure prediction) is proposed, it starts process of link restored before link break off and enhances Packet Delivery ratio. [5]
iv. Three protocols are compared AODV, DSDV, DSR by varying node speed and results conclude that at high speed PDR of AODV is high and when speed is slow, PDR of DSR is most optimal. [6]
v. AODVUU is proposed and compared with AODV and DSDV by varying maximum speed of nodes from 1m/s to 80m/s .Simulation results show that AODVUU protocol has higher PDR than AODV and DSDV.[7]
vi. In Multicast Ad hoc On-Demand Distance Vector (MAODV) protocol we increase a numbers of the senders, the PDF values are decreased. When we increase a numbers of receivers, the PDF values are changed randomly. When we increase the speed of mobile nodes, the PDF values are decreased. The PDF variance of TCP is greater than the variance of CUR. The PDF mean of TCP is lower than the mean of CBR.[13]

2. AVERAGE END TO END DELAY

It is the average time interval between generations of packet in a source node and successfully delivery of packet at the destination node.

i. Proposed AODV-RD is compared with AODV-BR and AODV by varying pause time and speed of nodes. Results show that AODV-RD has much shorter end to end delay.[3]
ii. Three routing protocols are compared AODV, DSDV, DSR and results show that delay decreases as packet size increases.[4]
iii. AODV-LFP is proposed which is based on link restore process before link break off and thereby decreases time of link restored effectively and reduces end-to-end delay.[5]
iv. Comparison is made between AODV, DSDV, DSR by varying node speed and analyses performance metric end-to-end delay that at high node speed ,AODV is more favourable as its delay is low but when speed is slow ,delay of DSR is optimal.[6]
v. AODVUU protocol is proposed and compared with AODV and DSDV by varying node speed and concludes that AODVUU performs better than the other two protocols in terms of time delay.[7]
vi. Four routing protocols are compared four AODV, DSR , DSDV, OLSR by varying network size and results concluded that DSDV and OLSR outperforms AODV and DSR in terms of time delay.[8]
vii. When we increase a number of senders, the AEED values are increased. When we increase a number of receivers, the AEED values are changed randomly. When we increase the speed of mobile nodes, the AEED values are increased. The AEED variance of TCP is greater than the variance of CBR. The AEED mean of CUR is significantly lower than the mean of TCP. [13]

3. ROUTING LOAD

It is the ratio of number of routing messages propagated by every node in the network and number of data packets successfully delivered to all destination nodes.

i. Three protocols are compared 3 protocols AODV, DSR and DSDV by varying packet size , results show that as packet size increases routing load increases. For DSDV routing load is very high.[4]
ii. AODV-BRL is proposed to improve the adaptation of routing protocols to topology changes by modifying AODV-BR. AODVBRL is based on extended hello message and least hop count first. Simulation results conclude that compared to AODV-BR , AODV-BRL improves routing load.[9]
iii. Performance of AODV and DSR is analyzed and compared by varying network size and transmission range of nodes. Results conclude that DSR generate less routing load than AODV.[10]

4. THROUGHPUT

It is the average number of packets successfully delivered per unit t ime.

i. Three protocols are compared by varying packet size and time interval and it is observed that as the packet size and time interval increases ,throughput decreases.[5]
ii. Performance metric throughput of AODV for chain topology is analyzed by varying network size from 5 to 55 nodes. Results show that AODV exhibits degrade performance in terms of throughput with increase in number of nodes. [11]
iii. Four protocols are compared AODV, DSR, DSDV and OLSR by varying network size .Simulation results conclude that throughput of DSR and AODV grow larger as network size increases and throughputs of DSDV and OLSR drop when network scales up.[8]

5. PACKET DROP RATE

It is the number of packets that are not successfully sent to the destination during transmission.

i. AOZDV which enhances AODV protocol through zone routing is proposed .AOZDV is compared with AODV and DSR by varying number of nodes and it is observed that with increasing number of nodes, AOZDV has low packet drop rate than other protocols.[12]
ii. AODV-LFP (AODV with link failure prediction) which is based on link restore process before link break off is proposed and compared with AODV protocol by varying node mobility rate. Results conclude that AODV-LFP has low packet drop rate than AODV. [5]

V. CONCLUSION

In this paper we have provided vast information regarding AODV protocol and its various modifications. The work done in this survey research aims to develop a good understanding of AODV protocol and improvements done to it to enhance its performance using different network parameters. We observe that large number of studies have been done in this field, we conclude that the proposed protocols enhance packet delivery ratio, throughput and reduces end-to-end delay, packet drop rate and routing load. When node speed, pause time and number of connections increases, PDR of AODV increases and when packet size increases, PDR of AODV decreases. When packet size and node speed increases, end-to-end delay of AODV reduces and when network size increases, end-to-end delay of AODV increases. Routing load of AODV increases with increase in network size, packet size and pause time. Throughput of AODV degrades as the packet size, time interval and number of nodes increases.

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