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Review on Link Break Avoidance of AODV Routing Protocol in MANET

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Abstract

Mobile Ad-hoc Network (MANET) is a self-configuring, no fixed infrastructure, and fewer networks of mobile nodes connected by wireless network. In the study of Ad-hoc On-demand Distance Vector (AODV) reactive routing protocol is a very important area of research. The developer needs to develop the On-Demand Ad hoc Routing Protocol to design and implementation given best features in simulation test.
In this review paper is subjected to 'Ad hoc On demand Distance Vector' (AODV) routing protocol gives best performance with different define options in dynamic topology for various number of nodes and evaluated performance matrices. The different matrices are investigated namely- Packet Delivery Loss, average end-to-end delay and Throughput using NS-2 network simulator test results.

Keywords: AODV, MAC Layer, Link Break Avoidance, Performance matrices, NS-2.35 Simulation.

Introduction

This Ad hoc network is a type of computer-to-computer connection. In ad hoc communication mode is set up a wireless connection directly to another computer without having to connect to a wireless access point or any router. The ad hoc wireless networks makes them suitable for a variety of applications where central nodes can't be relied on, may improve the scalability of wireless ad hoc networks. The wireless ad hoc network is classified in three types of applications. They are Mobile Ad-hoc Networks (MANET), Wireless Mesh Networks (WMN), and Wireless Sensor Networks (WSN). MANET is a collection of mobile nodes communicating over a relatively bandwidth constrained wireless link with limited battery power consumption with high dynamic networks. The communication between mobile nodes or devices in MANET supports to do work in help of any routing protocol. The reactive routing protocol AODV [1] is working in important role in dynamic networks. Ad-hoc On demand Distance vector routing protocol handles two type of route descriptions. They are route discovery and route maintenance, Route discovery in AODV suffers from end to end delay and data loss as the routing table stores only one route to a destination. Route maintenance is introduced to check the validity of the route between the source and destination. If the node does not receive a data packet from a neighbor for a while, the link between source and destination is considered to be link is broken. The link break avoidance to rectify in three types of mobility taken as source node mobility, destination node mobility and intermediate node mobility.

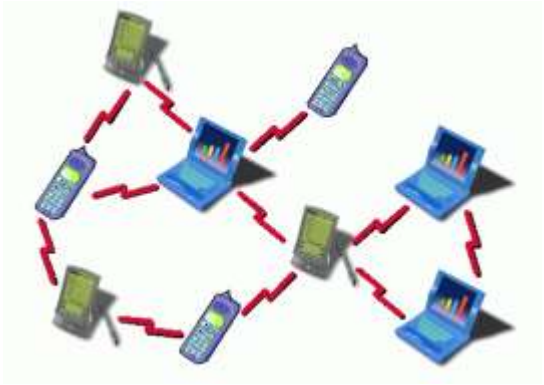

Fig.1.Wireless MANET

In this paper we present Ad-hoc On-Demand Distance Vector Routing (AODV) [1] a novel algorithm for the operation of such ad-hoc networks. The Reactive AODV routing protocol is improved by adding the Local Repair when a link break an active route occur mechanism. In this AODV protocol, intermediate nodes in an existing path try to find new paths to the destination in the event of a link breakage.

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The remainder of this paper is proposed work organized as follows: In Section II, Description of routing protocols in MANET and Section III presents the AODV Routing Protocol, Section IV discusses about link break Avoidance, Section V describes NS-2 simulation work and section VI explains about results and Xgraphs. And finally section VII discusses about conclusion.

Routing Protocols of Manet

In Mobile Ad-hoc Network, every mobile node is independent, loop free to dynamically moving in any direction, to change its links to other nodes frequently. The main advantage of MANET [2] is each mobile node can act as a 'router' as well as host, to forward the traffic to other specific node in wireless networks.

Some salient characteristics of MANETs are Dynamic topologies, Bandwidth constrained, variable capacity links, Energy constrained operation and Limited physical security MANET has been a popular topic of research in recent years with the advent and growth of wireless technology. Two popular types of MANET are VANET (Vehicular Ad-hoc network) and MANET (Internet based ad-hoc networks).The application of MANET are Military battlefield, Sensor networks, Difficult access networks, Automotive applications, Emergency services, Mesh networks and Commercial sector.
The Routing protocols for MANETs can be divided three main categories.

i. Proactive routing protocols:- Periodic broadcast of network topology updates is to compute the shortest path from the source to every destination and which consumes a lot of bandwidth.
For Example-DSDV-Destination Sequenced Distance Vector
WRP-Wireless Routing Protocol

ii. Reactive routing protocols:- routes are discovered based on-demand when a route must be required by a node to communicate with a destination.
For Example-AODV-Ad hoc On-demand Distance Vector
DSR-Dynamic Source Routing Protocol

iii. Hybrid routing protocols:- Based on local proactive and global reactive routing protocols are proposed to combination of their features.
For Example-ZRP-Zone Routing Protocol
FSR-Fisheye State Routing Protocol

AODV Protocol

AODV [3] routing protocol Uses an on-demand approach for finding routes, a route is established only when it is required by source node to destination node for transmitting data packets. In AODV, the source node and the intermediate nodes store the next hop information corresponding to each flow for data packet transmission. In this reactive routing protocol, the source node flow the Route Request (RREQ) message to send all nodes when the destination desire in the network. Route Request (RREQ) message to send different destination to obtain multiple routes. Every node updates its route information only if the destination sequence number of the current packet received is greater than the last destination sequence number stored at the neighbour node. Route Request (RREQ) message carries source and destination identifiers, sequence numbers, the broadcast identifier, and the time to live (TTL) field. Destination Sequence Number indicates newly generates the route that is accepted by the source node. When an intermediate node receives a Route Request and it prepares a Route Reply (RREP) message to forward a valid route to the destination. The intermediate node is determined by comparing the sequence number in the valid a route at the Route Request message. The Route Reply (RREP) message to send through all intermediate nodes to the source node having valid route allowed to the destination node. All intermediate nodes while forwarding a Route Request message enters the previous node destination sequence number and its BroadcastID. This helps in storing an active route at the intermediate node as AODV does not employ source routing of data messages. When a node receives a Route Reply message, information about the previous node from which the message was received is also stored in order to forward the data packet to the next node as the next hop toward the destination.

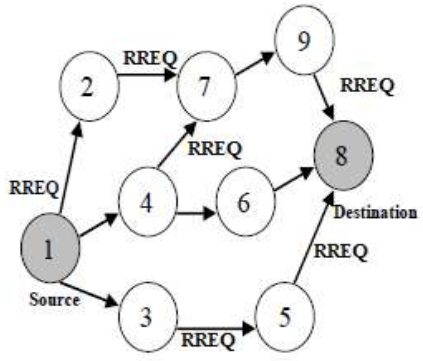

Fig.2. Route Establishment in AODV

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In figure.2 , source node 1 initiates a path finding process by originating a Route Request to be flooded in the network for destination node 8, assuming that the Route Request contains the destination sequence number as 4 and the source node as 1, when intermediate node 4,6 receive the Route Request message, they check their routes to the destination node. The route is not available to the destination, when the further forward it to their neighbours. Here nodes 5, 7 and 9 are the neighbours of nodes 2 and 3. If Route Request message reaches the destination node 8 through path 1-4-6-8 or any other route must be taken, the source node receives a Route Reply message from the destination node.

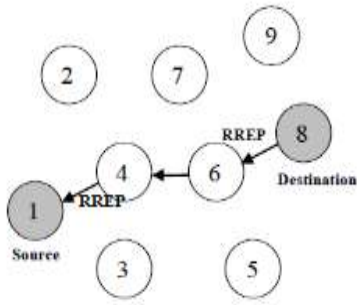

Fig.3.Route Maintenance in AODV

In figure.3, multiple Route Reply packets reach the source. All the intermediate nodes receiving a Route Reply update their route tables with the latest destination sequence number. They also update the routing information if it leads to a shortest path between source and destination node.

The AODV routing protocol is one of the best Route Discovery protocol in link break [5] repair path locally. Link break appear in source node due to mobility, then reinitiate the new route to finds the path by sending RREQ process towards the neighbour nodes in the topological change. If a link break is detected at an intermediate node, the node repair locally, by repairing node. The nodes by sending Route Reply with the loop count sent as infinite. If not repaired by node, it tries to rediscover another route. When a link breaks in between two nodes both the nodes initiate Route Error messages to inform their end nodes about the link break. The source node reinitiates the path finding process with new broadcastID and the previous destination sequence number.

Route Maintenance

Route maintenance of active routes in AODV [6] is done by continuous monitoring of link status of next hops. HELLO messages as sent periodically to the neighbor node to check whether the link exists. A RERR message is sent upstream to source node when a link failure is noticed. Source finds an alternate route to the unreachable nodes by reinitiating the route discovery. Every node in active path consumes a certain amount of energy for the active participation in communication. As the energy level goes down and reaches a minimum the associated link becomes unavailable. Limitation on transmission range and mobility can also be the reason for link failure. Alternate route discovery [4] in AODV suffers from end to end delay and data loss as the routing table stores only one route to a destination.

Link Break Avoidance

The wireless ad hoc networks during routing situation link break is one of the problem, and link failure is due to node mobility is a common problem of multi-hop in Mobile ad hoc networks. Link Failure [8] may occur due to mobility between mobile nodes, failure of nodes, and node power off. The mobility [7] of nodes and the wireless network may result in link breaks between intermediate nodes, source node and destination node. The ad hoc routing protocol use the route to be invalid, when it is automatically to discover a new route locally without resorting to an end-to-end path discovery. The solution of link breakages to make AODV routing protocol is more robust in wireless communication networks.

In this paper we calculate packet loss of data at all conditions. Repairing the link break locally to increase the number of data packets, which are able to be delivered to the RERR message travels to the source node. Local repair of link breaks sometimes results in increased route lengths at active routes to that destination.

V. NS-2 Simulation.

Network Simulator [9] (NS-2) version 2.35 is a open source software, provides simulation results of ad-hoc networks. It is installed on Red Hat Linux (version 5) Operating System (64bit). In our simulation, we consider a dynamic network of 50 nodes (one source node and one destination node) that are placed random within a 2000m X 1000m network area and simulation time 100seconds.Table I

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show the content of simulation parameters following below:

TABLE I
Parameter Metrics Of Simulation

```
====================================
======
# Define options
====================================
=======
 set val(chan)       Channel/Wireles Channel
 set val(prop)       Propagation/TwoRayGround
 set val(ant)        Antenna/OmniAntenna
 set val(ll)         LL              ; // Link layer type
 set val(ifq)        Queue/DropTail/PriQueue
 set val(ifqlen)     250
 set val(netif)      Phy/WirelessPhy
 set val(mac)        Mac/802.11
 set val(nn)         50          ; // number of mobile
nodes
 set val(rp)         AODV      ; // routing protocol
 set val(x)          2000      ; // X dimension of the
topography
 set val(y)          1000      ; //Y dimension of the
topography
```

The network simulation during communication of nodes in mobile ad hoc networks to investigated the performance metrics three parameters they are Data packet loss, End-to-End delay and Throughput. Performance metrics using AWK Script language code and condition.

Data Packet Loss: Packet loss is the failure of one or more transmitted packet of data source node to destination node delivered shows the transmit efficiency from this parameter. The procedure to calculate using 'grep' command in MAC layer.

Average End-to-end delay: the period from source node sending data till the destination receiving them, which includes the route building time and data transmit time.

Throughput: It is the sum of data rates how fast data sent from source to destination in network without data loss. Throughput is measured in bits per second under digital bandwidth of communication channel.

Results and Xgraphs

The results and animated screenshots represent following figures (fig.5, fig.6, fig.7, fig.8) shows using NS-2 simulator. The figure.5 represent initial topology with source to destination stated, figure.6 represent starting source node to destination node RREQ message process, figure.7 shows the intermediate node due to mobility to link break condition and figure.8 shows reinitiates source node to destination node RREQ, RREP message process. The parameter metrics are packet loss (Fig.10), Throughput (Fig.11) and Average end to end delay (Fig.12), has been taken X-graph results to analyse the performance of the AODV routing protocol.

TABLE II
Tcl Code Display Simulation Set Up

Simulator	NS-2.35
Protocol	AODV
Simulation time	100 sec
MAC layer	802.11
Network Area	2000x1000m
Transmission Range	250m
Number of Nodes	50
Bandwidth	2Mbps
Traffic Type	Constant Bit Rate
Packet size	512 Bytes

The route is established, it is maintained for the entire transmission period. But as the nodes are mobile, after a period of time, some nodes no longer be within the scope of neighbours and therefore the paths which are part of them become disabled, in this case lead to reinitiate the process of discovering paths, and additional control packets are generated.

Fig.5. Path Discovery in Source and Destination

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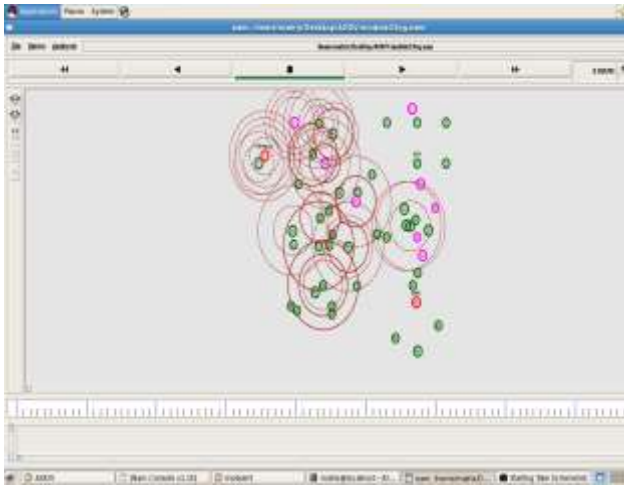

Fig.6. Source Node started Route Request message

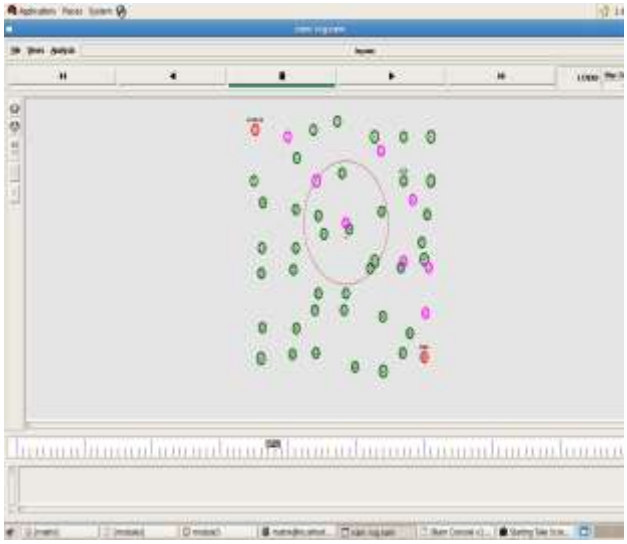

Fig.7. Link breaks in Intermediate Node Mobility

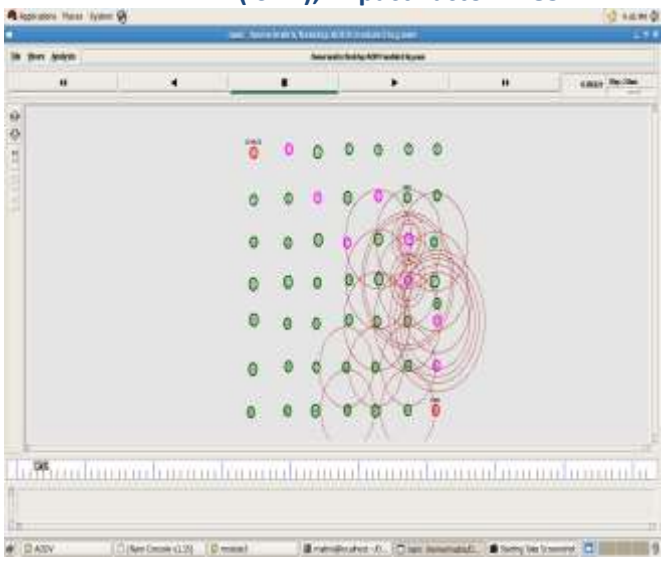

Fig.8. Route Reply Process in destination to source node

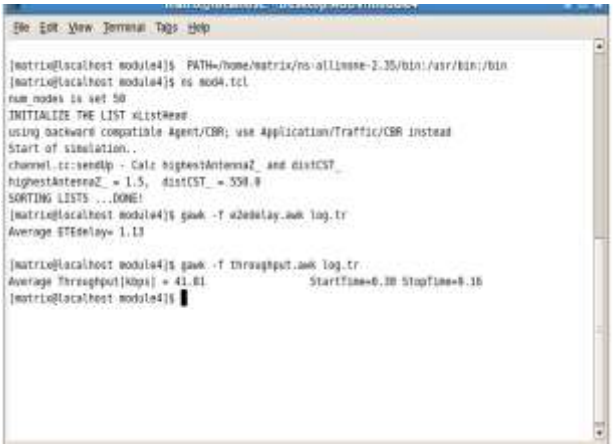

Fig.9.End-to-End Delay and Throughput values in AODV routing Protocol

The simulation analysed that the packet loss rate is increased when there is high mobility in the network. The dropping of packets may occur frequently, which leads variations on the throughput of the network. The results generating that the protocol of AODV routing protocol of the parameters that packet loss, average end to end delay and throughput has been taken in different simulations in the following given table.

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Nodes Vs Packet loss		Time Vs E2EDelay		Time Vs Throughput	
10	54	10	1.11	10	41.8
20	43	15	1.96	15	43.3
30	46	20	1.86	20	44.8
40	33	25	2.11	25	45.2
50	39	30	2.22	30	46.7

X-Graphs:

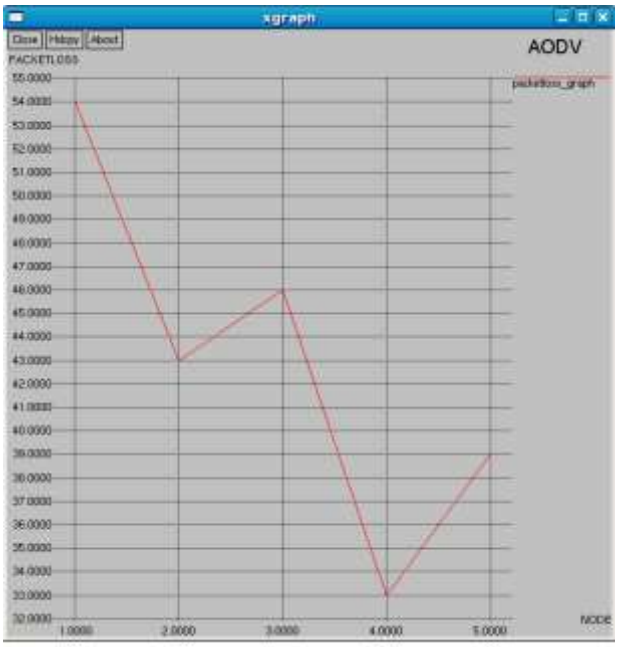

Fig.10. Dropping Packet loss

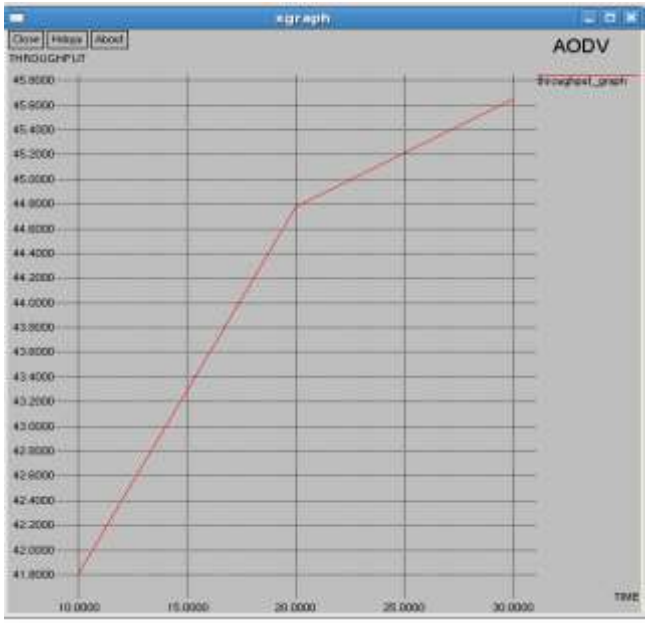

Fig.11. Throughput values increasing in different simulations

Fig.12. Varying Average End to End Delay

Conclusion

In this paper, we study a review paper on the reactive routing protocol AODV in mobile ad hoc networks under mobility. The performance of the network shows how link break avoidance scheme has been performed using AODV protocol in MANET. Performance of AODV is analyzed using NS 2.35 simulator for various parameters. Link breaks due to

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mobility is analyzed for varying network size and number of nodes. The review represent that as the number of nodes and mobility of network size increases the occurrence of link breaks are also high. For such cases AODV delivers better throughput, average end to end delay and packet data loss. The future work doing create new reactive routing protocol and compare to another protocols, better results given in distributed network.

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