Comparison of On Demand Routing Protocols AODV with AOMDV

Neetha Paulose, Neethu Paulose

Abstract— **Mobile ad hoc networks (MANET) is a type of ad hoc network that can change locations and configure itself. MANETS are mobile, they use an infrastructure-less, dynamic network consisting of a collection of wireless mobile nodes that communicate with each other without the use of any centralized authority. Due to its fundamental characteristics, such as wireless medium, dynamic topology, distributed cooperation, MANETs is vulnerable to various kinds of security attacks like worm hole, black hole, rushing attack etc . In recent years, routing has been the most focused area in ad hoc networks research. On-demand routing in particular, is widely developed in bandwidth constrained mobile wireless ad hoc networks because of its effectiveness and efficiency. The Ad Hoc On-demand Distance Vector (AODV) routing scheme is a widely used routing technique in ad hoc networks due to its low routing traffic overhead. However, the performance of the minimum hop routing used by AODV degrades significantly when the underlying system has routes that have high throughput and hop count. This paper provides a comprehensive study of AODV and modified AODV in terms of the routing metric and the route discovery mechanism of the AODV scheme. The modified schemes termed as AOMDV.**

Index Terms— **AODV, AOMDV, MANETs, Throughput, Packet Loss.**

I. Introduction

Network Components in a wireless network communicate with each other using wireless channels. The use of wireless networks has become more and more popular. Based on the type of network infrastructure used for communication, wireless communication network are categorized into two types:

- Infrastructured Networks
- Infrastructure-less Networks

Infrastructured Networks

An infrastructure network consists of wireless mobile nodes and one or more bridges, which connect the wireless network to the wired network as shown in figure 1.1. These bridges are known as base stations. A mobile node within the network searches for the nearest base station connects to it and communicates with it.

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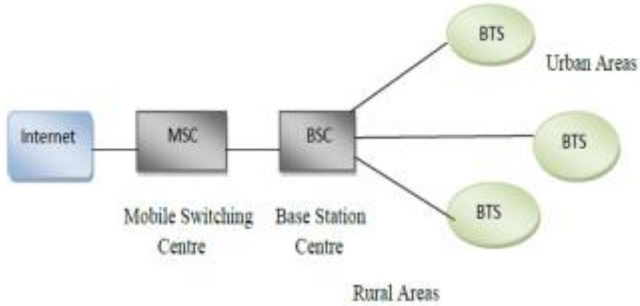

Fig 1.1 infrastructure based network

Infrastructure-less Networks

In Contrast to infrastructure networks, each node in this network acts both as a router and a host. The network topology is dynamic, because the connectivity among the nodes may vary with time due to node improvements. There is no base station or access point. Nodes can communicate with each other by forming a multi hope route as shown in figure 1.2. Hence there is a need for efficient routing protocol to allow the nodes to communicate over multi-hop paths without access point. Since these networks pose many complex issues, there are many problems for research and contributions. Mobile Ad-Hoc Networks is a type of infrastructure less networks in which nodes are portable devices such as mobile phones and laptops.

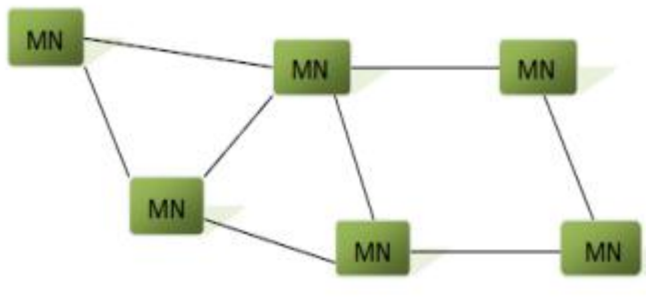

Fig 1.2 Infrastructure less Network

A Mobile Adhoc Network is a collection of independent mobile nodes that can communicate to each other via radio waves. The mobile nodes that are in radio range of each other can directly communicate, whereas others needs the aid of intermediate nodes to route their packets. Each of the node has a wireless interface to communicate with each other. These networks are fully distributed, and can work at any place without the help of any fixed infrastructure as access points or base stations. Figure 1 shows a simple ad-hoc network with 3 nodes. Node 1 and node 3 are not within range of each other, however the node 2 can be used to forward packets between node 1and node 2. The node 2 will

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act as a router and these three nodes together form an ad-hoc network.

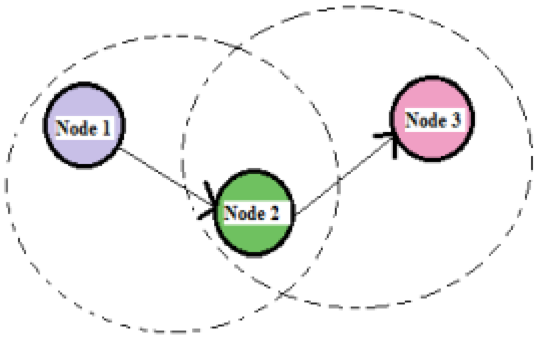

Fig 1.3 Example of Mobile Ad Hoc Network

MANETs characteristics

1) Distributed operation: There is no background network for the central control of the network operations, the control of the network is distributed among the nodes. The nodes involved in a MANET should cooperate with each other and communicate among themselves and each node acts as a relay as needed, to implement specific functions such as routing and security.

2) Multi hop routing: When a node tries to send information to other nodes which is out of its communication range, the packet should be forwarded via one or more intermediate nodes.

3) Autonomous terminal: In MANET, each mobile node is an independent node, which could function as both a host and a router.

4) Dynamic topology: Nodes are free to move arbitrarily with different speeds; thus, the network topology may change randomly and at unpredictable time. The nodes in the MANET dynamically establish routing among themselves as they travel around, establishing their own network.

5) Light-weight terminals: In maximum cases, the nodes at MANET are mobile with less CPU capability, low power storage and small memory size.

6) Shared Physical Medium: The wireless communication medium is accessible to any entity with the appropriate equipment and adequate resources. Accordingly, access to the channel cannot be restricted.

B .MANETs Challenges

1) Limited bandwidth: Wireless link continue to have significantly lower capacity than infrastructured networks. In addition, the realized throughput of wireless communication after accounting for the effect of multiple access, fading, noise, and interference conditions, etc., is often much less than a radio's maximum transmission rate.

2) Dynamic topology: Dynamic topology membership may disturb the trust relationship among nodes. The trust may also be disturbed if some nodes are detected as compromised.

3) Routing Overhead: In wireless adhoc networks, nodes often change their location within network. So, some stale routes are generated in the routing table which leads to unnecessary routing overhead.

4) Hidden terminal problem: The hidden terminal problem refers to the collision of packets at a receiving node due to the simultaneous transmission of those nodes that are not within the direct transmission range of the sender, but are within the transmission range of the receiver.

5) Packet losses due to transmission errors: Ad hoc wireless networks experiences a much higher packet loss due to factors such as increased collisions due to the presence of hidden terminals, presence of interference, uni-directional links, frequent path breaks due to mobility of nodes.

6) Mobility-induced route changes: The network topology in an ad hoc wireless network is highly dynamic due to the movement of nodes; hence an on-going session suffers frequent path breaks. This situation often leads to frequent route changes.

7) Battery constraints: Devices used in these networks have restrictions on the power source in order to maintain portability, size and weight of the device.

8) Security threats: The wireless mobile ad hoc nature of MANETs brings new security challenges to the network design. As the wireless medium is vulnerable to eavesdropping and ad hoc network functionality is established through node cooperation, mobile ad hoc networks are intrinsically exposed to numerous security attacks.

II. RELATED WORKS

Routing in MANETs can be proactive, reactive and hybrid [3]. Reactive schemes maintain routes to the nodes only when required, which reduces the routing overhead. A proactive routing scheme periodically finds the routes to all of the nodes within the network, which causes an increase in routing overhead [4]. Link state routing algorithms are usually used by proactive schemes. The delay encountered, when the packet needs to be sent to a particular node, is less for the proactive schemes as compared to the reactive schemes. However, the routing overhead of the proactive schemes are more as compared to reactive schemes. Moreover, the convergence time for proactive schemes is high as compared to the reactive schemes. Therefore, the efficiency of the proactive scheme decreases for a network where the topology changes frequently. A hybrid routing scheme - Zone Routing Protocol (ZRP) [5] combines the features of both the proactive and reactive schemes. In ZRP, proactive routing is used within the zone around the node and reactive routing is used outside of the zone [5].

III. AODV

Reactive protocols seek to set up routes on-demand. If a node wants to initiate communication with a node to which it has no route, the routing protocol will try to establish such a route. AODV is on-demand source routing scheme that combines the features of Dynamic Source Routing (DSR) and Destination Sequenced Distance Vector (DSDV) routing schemes. AODV adapts the route maintenance and route discovery mechanism of DSR. The use of sequence number to avoid loops and minimum hop routing is adapted by AODV from DSDV. AODV offers fast adaptation to link changes .because of minimum hop routing and has low traffic

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overhead because of its reactive nature. When the source node has a packet to send to a destination node, it first checks for the valid route to that destination if there exists a valid route then the packet is sent. If the valid route does not exist, the node initiates a route discovery process by broadcasting Route Request (RREQ) packets to its neighbors. The receiving nodes of the RREQ packets other than destination and intermediate node having a fresh entry to the destination rebroadcasts the RREQ packet. The area of RREQ dissemination is reduced through the use of expanding ring search technique. Time To Live (TTL) field is used to control the dissemination of the RREQ packets. When the hop count is reached the limit indicated by TTL field, the intermediate node simply drops the packet instead of rebroadcasting it. When the intermediate node having a fresh enough entry to the destination or the destination itself received a RREQ packets it unicast the Route Reply (RREP) packet to the sender of the RREQ packet. An active route between the source and destination is maintained for a particular period of time. When the destination node or the intermediate node moves, Route Error (RERR) messages are initiated to the upstream nodes. The RERR messages are propagated by the intermediate upstream nodes until the source node is reached. When the source node receives a RERR, it stops transmitting the data if the active session is on and starts route discovery process again. AODV is the most efficient on demand routing protocol majority of routing protocol are the modified version or enhanced version of AODV.

IV. AOMDV

Ad hoc On-demand Multipath Distance Vector (AOMDV) is the enhanced version of AODV protocol, it belongs to on demand and reactive routing protocol of ad-hoc wireless networks. The main goal is to compute multiple loop-free and link-disjoint paths between source and destination pair. The merit of AOMDV is estimated in terms of increased packet delivery ratio, throughput and reduced average end-to-end delay and normalized control overhead. The average end to end delay is reduced by introducing multiple loop free paths in this scheme. In multiple routes, the destination contains list of the next-hops along with the corresponding hop counts in routing table entries. Suppose all the next hops have the same sequence number. The advertised hop count is defined as the maximum hop count for all the paths. Route advertisement sends to destination by using this hop count value. If any duplicate route advertisement received by a node then it forwards the packet thro alternate path to the destination. The loop freedom is ensured by selecting the alternate path for destination on the basis of the hop count value of path is less than the advertised hop count for that destination. The destination node sorted all the paths by maximum hop count value. The best paths are selected and data forwarded through this paths. AOMDV may follows node-disjoint or link- disjoint routes. In node-disjoint routes, duplicate RREQs can not immediately rejected. The RREQ and RREP pair arrives through different neighbor of the source in a node-disjoint path. During route discovery, the source node broadcasts a ROUTE REQUEST packet that is broadcasted throughout the network. In contrast to AODV, each recipient node creates multiple reverse routes while processing the ROUTE REQUEST packets that are received from multiple neighbors.

V. SIMULATION RESULTES

The performance comparison of AODV with AOMDV is evaluated in this section using NS2.34. The simulation parameters are reported in Table I. The traffic source used in the simulations generates data at a Constant Bit Rate (CBR). The network topology consists of static nodes placed in such a way that paths with high throughput and high hop count are simultaneously available.

Table 1 Simulation Parameters

Parameter	Value
Number of nodes	50
Schemes	AODV,AOMDV
Simulation Time	10 m
Antenna Model	Omni Direction Antenna
Traffic Model	CBR
Topology Area	1000m*1000m

Throughput is the average rate of successful delivery of packets in a communication channel. It is the total successful transmissions within the time period from simulation starts and ends. Figure 5.1 shows the comparison between AODV and AOMDV in terms of Time and throughput of the network. From the figure we can see that AOMDV have better throughput compared to AODV protocol because of the consideration of the effect off route throughput in route selection process.

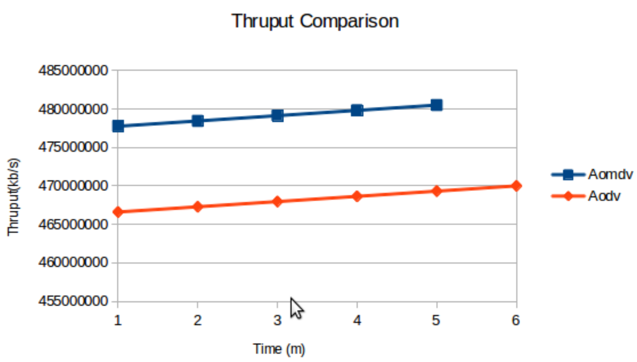

Fig 5.1Thruput Comparison of AODV and AOMDV

Packet loss is the failure of one or more transmitted packets to arrive at their destination. Figure 5.2 shows the performance of AODV and AOMDV in terms of packet loss. Here, we can see that by performing the multiple paths between source and destination, the average packet loss of the network has been reduced significantly compared to the conventional AODV routing protocol. This is because, when we are using multiple paths, the information's can be transmitted to multiple paths between source and destination. Also, AOMDV scheme generally produce less routing traffic on average than the original AODV. Hence, the packet loss

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of the network can be reduced to a great extend.

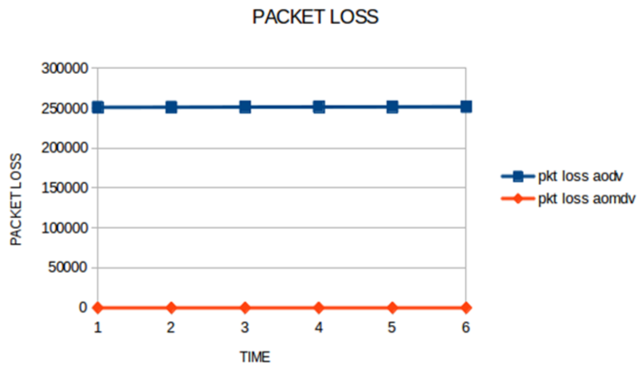

Fig 5.2 Packet Loss Comparison of AODV with AOMDV

VI. CONCLUSION

In this paper, we provide the comparison of two on demand routing protocols, AODV and AOMDV. AODV is the most basic on demand routing protocol most of the routing protocols are the enhanced or modified version of AODV. The Ad Hoc On-demand Distance Vector (AODV) routing scheme is a widely used routing technique in ad hoc networks due to its low routing traffic overhead. However, the performance of the minimum hop routing used by AODV degrades significantly when the underlying system has routes that have high throughput and hop count. Ad hoc On-demand Multipath Distance Vector (AOMDV) is the enhanced version of AODV protocol, it belongs to on demand and reactive routing protocol of ad-hoc wireless networks. The main goal is to compute multiple loop-free and link-disjoint paths between source and destination pair. The merit of AOMDV is estimated in terms of increased packet delivery ratio, throughput and reduced average end-to-end delay and normalized control overhead. Performance evaluation has been done using NS2 simulator tool and comparison with AODV, AOMDV shows that our protocol can effectively reduce end to end delay and energy consumption while maintaining a good packet delivery ratio. The enhanced protocol has been developed for hybrid network with heterogeneous characteristics.

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