Analysis of Routing Protocols between 802.11 and 802.16 in MANET

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***Abstract*— In recent years, a number of routing protocols for Mobile Ad Hoc wireless networks have been developed and have found many applications including multiple routing protocols. In mobile Ad-hoc network, multi-hop wireless links are popular applications as they are less routing overhead in order to reduce the network congestion as well as bandwidth Utilization Wimax stands for Worldwide Interoperability for Microwave Access. This technology is a telecommunications technology that offers transmission of wireless data via a number of transmission methods; such as portable or fully mobile internet access via point to multipoint links. In this paper, we investigate the evolution and performance of different routing protocol in 802.11 and 802.16 networks. The simulation results show that the Ad-hoc on demand Vector Routing Protocol (AODV) has the best performance in terms of the packet delivery fraction, network load, packet loss and E-E delay comparison with other protocols.**

Keywords— AODV, DSR, 802.11, 802.16

I. INTRODUCTION

A mobile ad-hoc network or MANET is a collection of mobile nodes sharing a wireless channel without any centralized control or established communication backbone. They do not have fixed routers with all nodes capable of movement and arbitrarily dynamic. These nodes can be work as both end systems and routers at the same time. When acting as routers, they discover and maintain routes to other nodes in the network. The topology of the ad-hoc network depends on the transmission power of the nodes and the location of the mobile nodes, which may change from time to time [1]. One of the main problems in ad-hoc networking is the efficient delivery of data packets to the mobile nodes where the topology is not pre-determined nor does the network have centralized control. So due to the frequently changing topology, routing in Ad-hoc networks can be viewed as a challenge.The wimax technology offers around 72 mega bits per second without any need for the cable infrastructure. This technology is based on IEEE standard 802.16, it generally called as broadband wireless access. To encourage compliance and interoperability of the wimax IEEE 802.16 standard Wimax forum created the name for wimax technology that was formed in mid june 2001. It is actually based on the standards that making the possibility to delivery last mile broadband access as a substitute to conventional cable and DSL lines. Wimax is the next stage to a broadband as well as a wireless world, extending broadband wireless across to new locations and over longer distances, as well as appreciably reducing the cost of bringing broadband to new areas. Wimax technology offers greater range and bandwidth then the other available or forthcoming broadband wireless technologies such as wireless fidelity (Wi-Fi) and ultra-wideband (UWB) family of standards. It provides a wireless substitute to wired backhaul. MANET is a wireless infrastructure less network having mobile nodes. Communication between these nodes can be achieved using multi hop wireless links. Every node will act as a router and forward data packets to another node. MANET is operating without any centralized base station. Mobile ad-hoc networks uses multi hop relaying. Since the nodes are free to move in any direction, it may be possible that there may be frequent link breakage. The basic advantage of MANET is its instant deployment. Various protocols have been developed for adhoc networks such as DSR, AODV. All of these protocols offer varying degrees of efficiency. It also proposes further research into more efficient protocols or variants of existing protocols such as AODV. AODV has three novel aspects compared to other on-demand multipath protocols. First, it does not have high inter-nodal coordination overheads like some other protocols (e.g., TORA [3], ROAM [7]). Second, it ensures disjointness of alternate routes via distributed computation without the use of source routing Finally, AODV computes alternate paths with minimal additional overhead over DSR; it does this by exploiting already available alternate path routing information as much as possible. The main objective of this paper is to analyze AODV protocol for ways it could be improved. This can be done by varying simulation time with respect to packet delivery fraction, network load, packet loss and E-E delay in the WIRELESS(802.11) and WIMAX (802.16) environment.

II. WIRELESS ROUTING PROTOCOLS

a. AODV

The Ad hoc On Demand Distance Vector (AODV) routing protocol builds on the DSDV algorithm. AODV is

advancement on DSDV because it typically minimizes the number of required broadcasts by creating routes on a demand basis, as just opposed to maintaining a full list of routes as in the DSDV algorithm. AODV declare as a pure on-demand route receiving system, since nodes that are not on a selected way do not maintain routing information or participate in routing table exchanges. When a source node wants to send a message to the destination node and does not already have a valid route to that destination, it starts a path discovery process to locate the other node. It broadcasts a route request (RREQ) packet to its neighbor nodes, then after forward the request to their neighbor nodes, and so on, until either the destination or an intermediate node with a fresh enough routes to the destination is found. AODV use destination sequence numbers to ensure all routes are loop free and contain the most recent route information. Every node maintains its own sequence code, as well as a broadcast ID. The broadcast ID is incremented for every RREQ the node starts, and together with the node's IP address, uniquely recognized an RREQ. Once the Route request reaches the destination node or an intermediate node with a fresh enough route, the destination intermediate node responds by unicasting a route reply (RREP) packet back to the neighbor from which it first received the route request. As route reply is routed back along with the reverse path, nodes along this path set up forward route entries in their route tables which point to the node from which the RREP come. These forward route entries indicate the active forward route. Associated along with each route entry is a route timer that will cause the deletion of the entry if it is not used within the specified lifetime. Because the RREP is forwarded along the path established by the RREQ, AODV supports the use of symmetric links only [1][2].

Including detailed description of the route update rules used at each node and the multipath route discovery procedure [2][5][6].

b. DSR

DSR is a reactive routing protocol that is determines the proper route only when packet needs to be forwarded. For restricting the bandwidth, process to find a path is only executed when a path is required by a node (On-Demand Routing). In DSR the sender (source, initiator) determines the whole path from the source to the destination node (Source-Routing) and deposits the addresses of the intermediate nodes of the route in the packets. DSR is beacon-less which means that there are no hello-messages used between the nodes to notify their neighbours about their presence. DSR was developed for mobile Ad-hoc networks with a small diameter between 5 and 10 hops and the nodes should only move around at a moderate speed. DSR is based on Link-State Algorithms which mean that each node is capable to save the best way to a destination. Also when a change appears in network topology, then the whole network will get this information by flooding. DSR protocol is composed the two main mechanisms that work together to allow discovery and maintenance of source routes in MANET.

III TRAFFIC AND MOBILITY

1. Traffic: - Traffic Patterns describe how the [8] data is transmitted from source to destination. The widely used traffic pattern in MANET is CBR.

2. Constant Bit Rate (CBR)- The qualities of Constant Bit Rate (CBR) traffic pattern are

I) *Unreliable:* since it has no stabilized connection phase, there is no guarantee that the data will transmitted to the destination.

II) *Unidirectional:* there will be no acknowledgment from destination for confirming the data transmission.

III) *Predictable*: fixed stream duration, fixed interval between packets, and fixed packet size.

IV METHODOLOGY

1. Simulation Environment

Simulation environment is as follows

Parameter	Value
MAC Layer	802.11, 802.16
Traffic Type	CBR
Simulation Time	100 to 500 sec.
Number Of Nodes	60
Pause Time	1s
Maximum Connection	30
Maximum Speed	10 meter per second
Transmission Rate	2.0 packets per second
Area of Networks	400m X 700m

2. NS-2 (Network Simulator-2)

The NS-2 is a discrete event driven [8] simulation and in this the physical activities are translated to events. Events in this are queued and processed in the order of their scheduled occurrences. The functions of a Network Simulator are to create a network, to create the event scheduler, for computing routes, to create traffic, to create connections. It is also useful for inserting errors and tracing can be done with it. Tracing packets on all links by the function trace-all and tracing packets on all links in nam format using the function nam trace-all.

3. Performance Metrics:

We report the four performance metrics for the protocols:

Packet Delivery Fraction (PDF): The ratio between the number of data packets received and the number of packets sent.

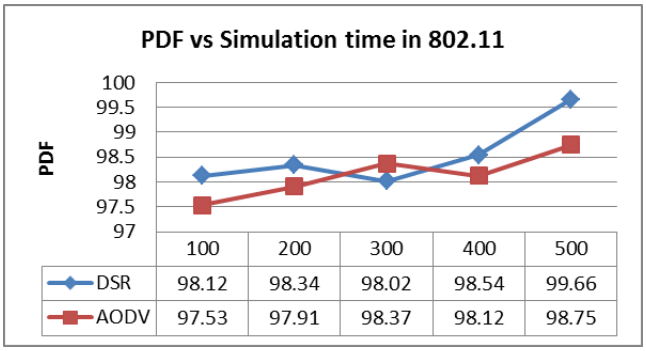
Packet loss (%): Packet loss is the failure of one or more transmitted packets to arrive at their destination [9].

V SIMULATION RESULTS ANALYSIS

We ran the simulation environments with simulation time varying from 100 to 500 second. Packet delivery fraction, routing load, end to end delay and throughput are

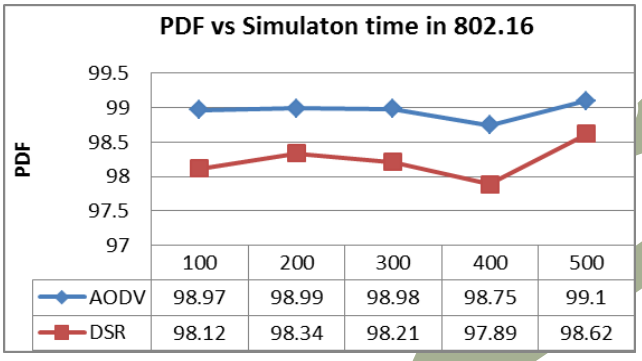
calculated for AODV and DSR. The results are analyzed below with their corresponding graphs.

1. Packet delivery fraction



	100	200	300	400	500
DSR	98.12	98.34	98.02	98.54	99.66
AODV	97.53	97.91	98.37	98.12	98.75

Figure 1: Comparison of AODV and DSR on basis of PDF in 802.11.



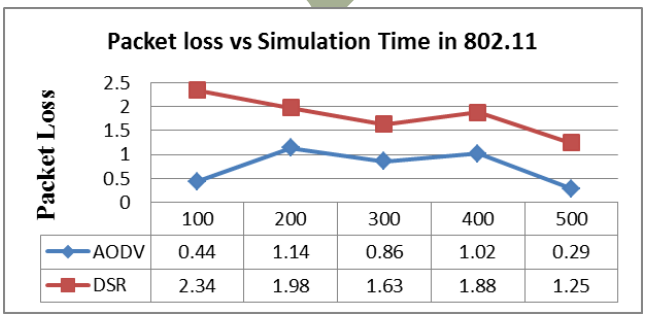
	100	200	300	400	500
AODV	98.97	98.99	98.98	98.75	99.1
DSR	98.12	98.34	98.21	97.89	98.62

Figure 2: Comparison of AODV and DSR on basis of PDF in 802.16.

Analysis of the result:

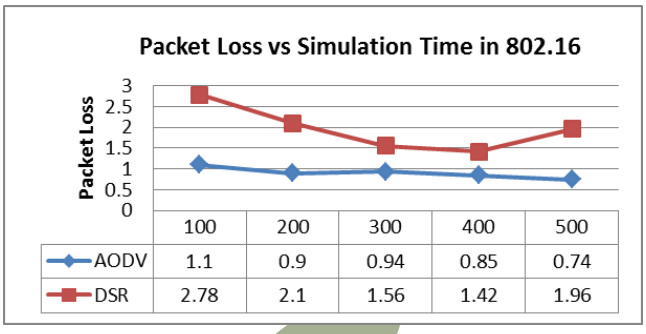
Here we see that when we used the varying simulation time for MAC802.11 and 802.16. That time AODV has best PDF value in 802.16 Compared to AODV in 802.11 and DSR for each set of connections.

2. Packet loss



	100	200	300	400	500
AODV	0.44	1.14	0.86	1.02	0.29
DSR	2.34	1.98	1.63	1.88	1.25

Figure 3: Comparison of AODV and DSR on basis of Packet Loss in 802.11.



	100	200	300	400	500
AODV	1.1	0.9	0.94	0.85	0.74
DSR	2.78	2.1	1.56	1.42	1.96

Figure 4: Comparison of AODV and DSR on basis of Packet Loss in 802.16.

Analysis of the result:

AODV has minimum Packet Loss value in 802.16 for varying simulation time compared to AODV in 802.11 and DSR for each set of connections.

CONCLUSION

This paper evaluated the performance of AODV, and DSR for MAC 802.11 and 802.16 using ns-2.31. Comparison was based on the packet delivery fraction and Packet Loss. Finally AODV in 802.16 has best performance in all performance matrices simulation.

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