# Performance Evaluation using PWAODV Protocol in Energy Constraints Manet's

MayuriD.Dondal
Department of Electronics &
Telecommunication
BDCE, Sewagram

## ABSTRACT
Mobile Ad-hoc networks (MANETs) composed of a group of mobile wireless nodes which while forwarding data packets to each of the other node, form a network independently of centralized administration .This paper addresses energy conservation which is a very important factor in Energy Constraint Mobile ad-hoNetworks (MANETs) and also try to reduce routing overhead forefficient functioning of the network. Every protocol givesdifferent results depending upon the application. There are different protocols for handling the routing in the mobile environment..This paper will focus on three well know protocol: 'Ad hoc On-Demand Distance Vector', 'Optimized Link State Routing Protocol' and 'Dynamic MANET on Demand protocol. The implementation of AODV, OLSR and DYMO routing protocol and their comparison based on the performance metrics: Throughput and End–to–End delay is carried out using NS-2 (Network Simulator version -2) simulator. With the help of NS-2 (Network Simulator -2) AODV protocol provides a flexible and effective routing in any environments, an improved protocol PWAODV based on piggyback mechanism and weighted neighbor stability for low energy and packet delivery ratio is implemented.[1][11]

## Keywords
Mobile Ad-Hoc Network (MANET), Ad-hoc On-demand Distance Vector (AODV), Optimized Link State Routing Protocol (OLSR), Dynamic MANET on Demand Protocol (DYMO), Piggyback and Weighted Neighbor Stability Algorithm –AODV (PWAODV).

## 1. INTRODUCTION
A mobile ad hoc network (MANET) is a collection of wireless mobile nodes that are communicating with each other using multi-hop wireless links without a centralized network infrastructure .Mobility and absence of any fixed infrastructure make used in taxi service operation .MANET very attracting for mobility and rescue operation and time critical application and military network environments in the battle fields, disaster operations, search and rescue operations, conference rooms and also in commercial applications such as vehicle ad hoc networks used. Due to host mobility, network topology often changes and so finding and maintaining routes is very important problem.[1][2][12]

## 2. SIMULATION SYSTEM AND IMPLEMENTATION

### 2.1 Routing Protocol
Routing in MANET means to choose a right and suitable path from source to destination. Routing terminology is used in different kinds of networks such as in telephony technology, electronic data networks and in the internet network. The routing of traffic between nodes is performed by a MANET routing protocol. MANET routing protocols can be divided into three categories.

- Table driven / Proactive routing protocol
- On-demand /Reactive routing protocol.
- Hybrid routing protocol.

#### *2.1.1 Table-Driven or Proactive Routing Protocols*
Proactive routing protocols maintain routing information continuously. Typically, a node has a table containing information on how to reach every other node and the algorithm tries to keep this table up-to-date. Changes in network topology are propagated throughout the network. Examples of proactive protocol are OLSR, DSDV.

#### *2.1.2 On-Demand or Reactive Routing Protocols:*
On-demand routing protocols only maintain routes that are actually used. On-demand protocols use two different operations to find and maintain routes: the route discovery process operation and the route maintenance operation. When a node wishes to communicate with some other node it tries to find a route to that node, i.e routing information is acquired on-demand. This is the route discovery operation. Route maintenance is the process of responding tochanges in topology that happens after a route has initially been created. The nodes in the network try to detect link breaks on the established routes.[1]

#### *2.1.3 Hybrid Routing Protocols:*
Protocol belonging to this category combine the best feature of the above two categories. Nodes within a certain distance from the node concerned, or within a particular geographical region, are said to be within the routing zone of the given node. For routing within this zone, a table driven approach is used. For nodes that are located beyond this zone, an on-demand approach is used.

#### *2.1.4 Ad-hoc ON Demand Distance Vector (AODV)*
The Ad Hoc On-Demand Distance Vector (AODV) routing protocol is a reactive protocol.Each AODV router is essentially a state machine that processes incoming requests fromthe SWANS network entity. When the network entity needs to send a message to anothernode, it calls upon AODV to determine the next-hop.Whenever an AODV router receives a request to send a message, it checks its routingtableto see if a route exists. If a route exists, the router simply forwards the message to the next hop. Otherwise, it saves the message in a message queue, and then it initiates a route request to determine a route. As is the case with all reactive ad hoc routing protocols, AODV consists of two protocol operations: Route discovery and route maintenance.

Route discovery is the process of creating a route to a destination when a node lacks a route to it. Route maintenance is the process of responding to changes in topology.

### *2.1.5 Optimize Link State Routing Protocol (OLSR)*

The OLSR protocol is a pro-active routing protocol, which builds up a route for data transmission by maintaining a routing table inside every node of a network. The routing table is computed upon the knowledge of topology information, which is exchanged by means of Topology Control (TC) packets. OLSR makes use of HELLO messages to finds its one hop neighbor and its two hop neighbor through their responses .The sender can then selects its multi point relays based on the one hop node which offer the best routes to the two hop nodes .By this way ,the amount of control traffic can be reduced. Each node has also an MPR selector set which enumerates nodes that have selected it as an MPR node. In OLSR code, simple RFC-complaints heuristic is used to compute the MPR nodes. Every node computes the path towards a destination by means of shortest path algorithm, with hop –count as target metric.

### *2.1.6 Dynamic MANET on Demand Protocol (DYMO)*

DYMO routing protocol enables reactive, multihop unicast routing between participatingDYMO routers .The basic operation of the DYMO protocol are routediscovery and route maintains .During route discovery, the originator's DYMO router initiates dissemination of a RREQ throughout the network to finds a route to target's DYMO router .During this hop-by-hop dissemination process, each intermediate DYMO router receives the RREQ, it responds with a RREP sent hop-by –hop towards the originator .When the originator's DYMO router receives the RREP, the routes can be established between the originating DYMO router and the target DYMO router in both direction. . In order to react tochanges in network topology nodes maintain their routes and monitor their links.

### *2.1.7 Piggyback and Weighted Neighbor Stability Algorithm (PWAODV)*

The PWAODV is implemented with following concrete steps described as first, in AODV protocol, introduce the piggyback mechanism to restrict the redundant transmission of Hello messages, and in the RREQ and RREP add the parameter of neighbor stability *NCRpath* which will be updated when intermediate nodes forward packets; then onlycache the recent *K NCR*s in the table by covering and updating the oldest *NCR*. Finally, select the route with the largest sequence of destination node or equal sequence but more stability or the two aspects equal but less hops to send the data. As the same as AODV, our protocol also broadcasts a RREQ if the source node needs to send a data and no valid route. But the difference is that in PWAODV the *NCRpath* will be copied in the routing table when the intermediate node receives the RREQ firstly. Then, for the same RREQ received later, just update the routing table and reverse path only if the item of *NCRpath* is greater. In this way, the RREQ reaches the destination node and the final path will be the most stable one. Next, the destination node will reply a RREP and reply again only if the later received RREQ has greater sequence or equivalent one but greater *NCRpath*.[2]

## 2.2 Implemented Work

Simulations are done to compare AODV, OLSR and DYMO routing protocols. The implementation of the protocol has been done using C++ language in the backend and TCL language in the frontend. TCL (Tool Command Language) is compatible with C++ programming language. During interpretation two files trace files and nam files are to be generated. Network Animator (.nam) file, records all the visual events that happened during the simulation. Trace files (.tr), records the entire network event that occur during the simulation. And file is post analyzed with the help of awk scripts.[11]

**Table 1. Simulation Parameter for AODV, OLSR and DYMO routing.[12]**

| Parameters | Values |
|---|---|
| Simulation Time | 120 sec |
| No. of Nodes | 7 |
| Traffic Type | CBR |
| Packet Size | 512 |
| MAC Protocol | 802.11 |
| Routing Protocol | AODV ,OLSR, DYMO |
| Observation Parameter | Throughput, End to End delay, No, of Received Packets |

# 3. METHODOLOGY

Simulator ns-2 is used for performance comparison. The network simulator ns-2 developed by the VINT research Group at University of California at Berkeley in 1995. The network simulator NS2 is a discrete event network simulation. NS2 is used to simulate the proposed algorithm. It work on network layer and inform about link breakage.

## 3.1 Movement Model

In this paper, the analysis and implementation of MANET simulation system considering AODV, OLSR and DYMO for wireless multi-hop networking is being carried out. This work considers two models: 'Stationary Model' (STA)' and Random Way Point Model. The simulation is carried out using Network simulator 2 software and there are 7 numbers of nodes i.e. from node (0) to node (6). The Scenario for STA model and RWP model are shown in below figures (3) & (4).[1]

1 .Stationary Model (STA)

In this model, all nodes are stationary during the simulation.

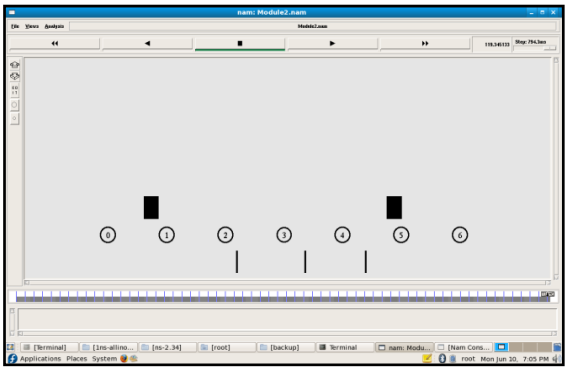

**Figure 1. Stationary Model**

2.Random Way Point Model (RWP):

In RWP mobility model, the nodes move from one way-point to the next .A specific speed and duration is chosen for every

transition .After the stipulated transition duration ends the nodes way pause for a specific duration of time before starting its transition towards the next way-point. In this model all nodes are considered mobile.

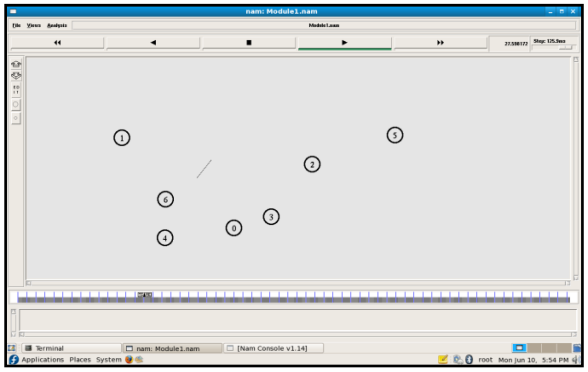

**Figure 2 Random Way Point**

## 4. METRICS OF EVALUATION

1. Throughput

Throughput is the average rate of successful message delivery over a communication channel. The throughput is usually measured in bits per second (bps) or kbps.

2. End to End Delay:

End-to-end delay is the average times it taken by the packet to reach to destination in seconds. End-to-end delay refers to the time taken for a packet to be transmitted across a network from source to destination.

3. Received Packets:

Received Packets shows that the total number of packets which is received at destination node during simulation.

4. Packet Delivery Ratio:

This is the ratio of total number of packets successfully received by the destination nodes to the number of packets sent by the source nodes throughout the simulation. PDR is calculated by using below formula.

PDR= Number of Received Packet / Number of Sent Packets

**Table 2. Comparision of Simulation Result**

| Parameter | | Protocols | | |
|---|---|---|---|---|
| Throughput | Models | AODV | OLSR | DYMO |
| | STA | Better | Good | Poor |
| | RWP | Better | Good | Poor |
| End to End Delay | STA | Poor | Good | Better |
| | RWP | Poor | Good | Better |
| Packet Delivery Ratio: | STA | Better | Good | Poor |
| | RWP | Better | Good | Poor |
| No.of Received packets | STA | Better | Good | Poor |
| | RWP | Better | Good | Poor |

As the AODV protocol provides flexible and effective routing in any environment an improved PWAODV based on piggyback and weighted neighbor stability algorithm is implemented. The parameters for evaluation of PWAODV protocol are Route Cost , Delay, PDR and Avg Energy Consumption.

**Table 3. Simulation Parameter for PWAODV protocol.**

| Parameter | Values |
|---|---|
| Simulation Area | 1000 × 1000 m |
| MAC: data Rate | 1 Mbps |
| Traffic Type | CBR |
| Packet Size | 2000 Bytes |
| No. of nodes | 50 |
| α | 3 |
| Routing Protocol | PWAODV |
| Observation Parameter | Route cost , End to End delay, PDR, Energy Consumption |

4) Route Cost For PWAODV Protocol

Route cost is defined as the ratio of the total number of bytes of transmitted control packets and the total number of bytes of transmitted data packets.[3

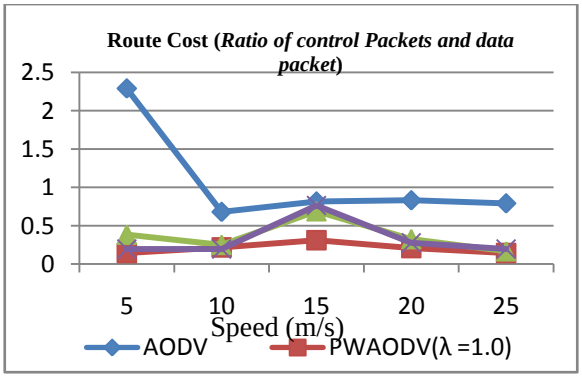


**Figure.4 Route Cost Vs Speed**

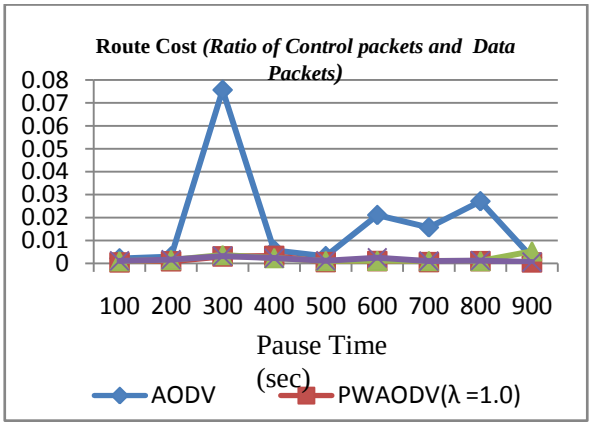


**Figure 5 Route Cost Vs Pause Time**

The route cost increases with the increasing of max speed and pause time for bringing bigger path break probability. Apparently, AODV protocol has highest route cost. But the

lowest route cost is reflected in PWAODV protocol because of introducing piggyback mechanism that reduces the number of control packets directly and weighted neighbor stability algorithm which makes the path more stable Furthermore, with less λ the path is more stable at lower speed, but at higher speed, the larger λ can avoid the redundant messages for stability. PWAODV (λ=1.0) shows less route cost than PWAODV (λ=0.4) and PWAODV (λ=0.7).

5) End to End Delay

End-to-end delay is the average times it taken by the packet to reach to destination in seconds.

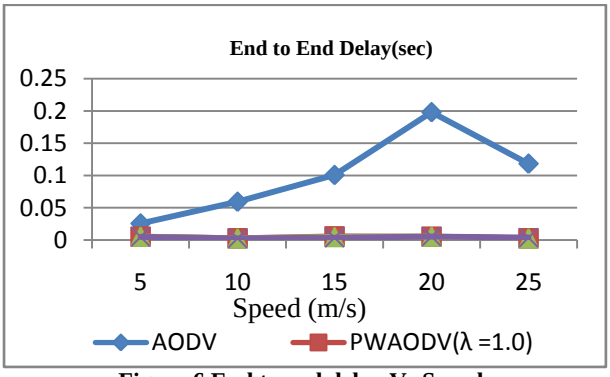


**Figure 6 End to end delay Vs Speed**

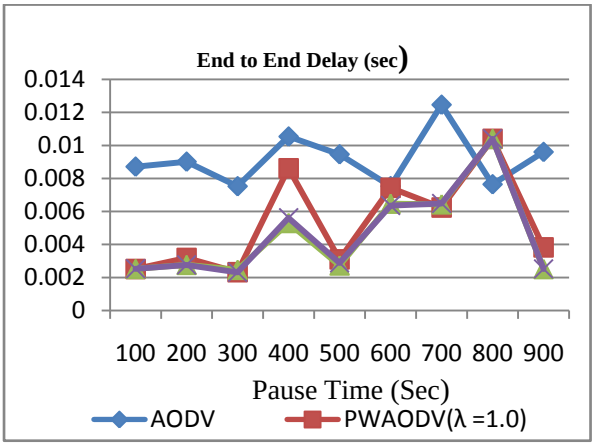


**Figure7 End to end delay Pause Time**

The delay increases with incremental maximum speed and pause time due to the more broken links and more serious network congestion. Due to the improvement of all of two aspects, the advantage of our protocol obviously. As the same as route cost, at lower speed, the less delay is reflected in PWAODV ($\lambda$ = 0.4); otherwise, PWAODV ($\lambda$ =1.0) is better. AODV protocol shows more delay than PWAODV protocol. The less delay is achieved due to introducing neighbor stability algorithm.

6) Average Energy Consumption

The Average energy consumption states that the average of energy consumed by the nodes. It is measured in joules.

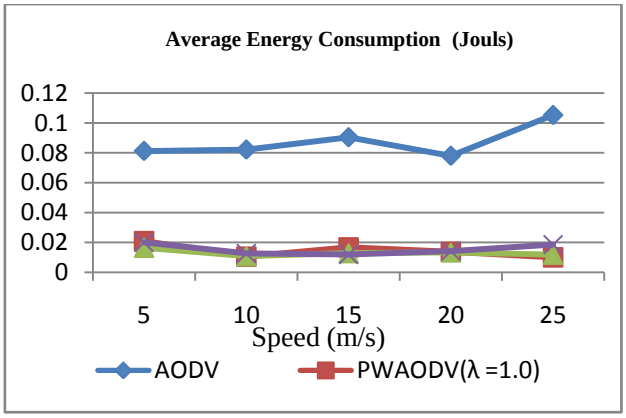


**Figure 8 Avg Energy Consumption Vs Speed**

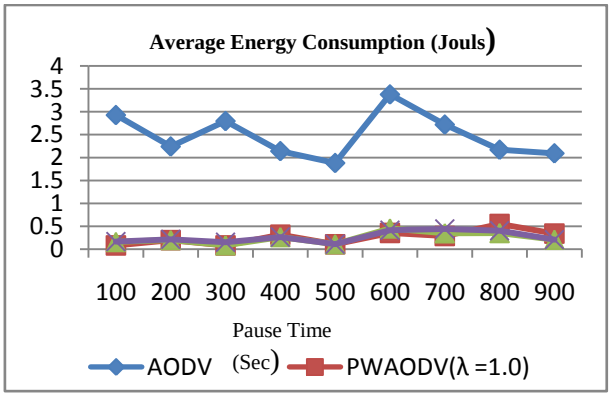


**Figure 9 Avg Energy Consumption Vs Speed**

Average Energy Consumption Vs Speed and Figure 8 and 9 Average Energy Consumption Vs Pause time states that, In AODV protocol, some periodic Hello messages are redundant when control packets or data packets which include many messages of nodes to its neighbors are transmitted correctly. Obviously, such redundancy will increase energy consumption. This fault is overcome by the use of PWAODV routing protocol. The energy consumption of PWAODV protocol with all λ shows low energy consumption

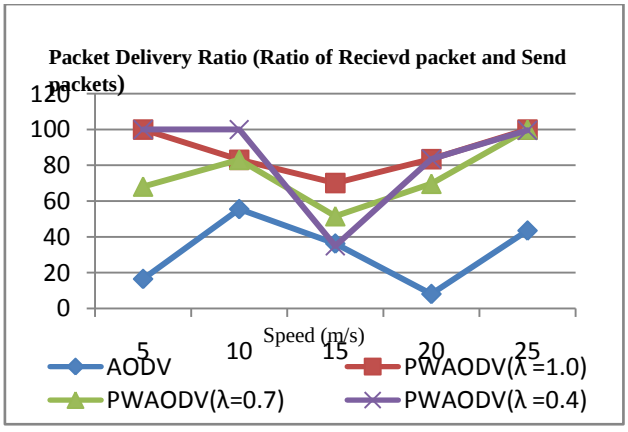


**Figure 10 PDR Vs Speed**

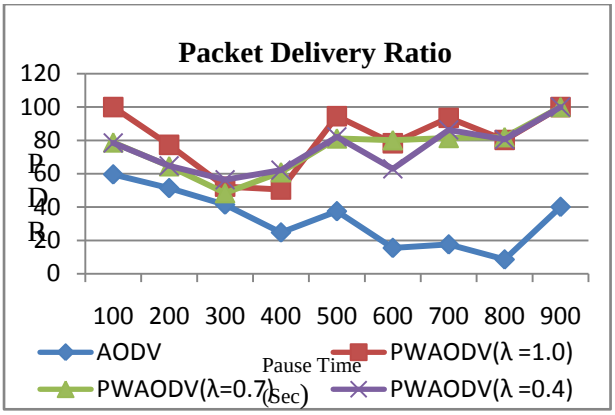


**Figure 11.PDR vs Pause Time**

Figure 10 Packet Delivery Ratio vs. Speed and 11 Packet Delivery Ratio vs. Pause time, gives an idea of how successful the protocol is in delivering packets to the application layer. But due to piggyback mechanism, the network topology may get damaged in the case of accidental losing of control packets or data packets this result shows that the performance of packet delivery ratio is weak.

## 5. CONCLUSION

In this Paper, the implementation and simulation of MANET routing protocol is carried out using AODV, OLSR, and DYMO protocol. The simulation considers two models: Stationary (STA) and Random way point model. In STA, all nodes are in stationary state.In RWP; all nodes are moving based on RWP model.

As the AODV protocol provides a flexible and effective routing in any environments, an improved protocol PWAODV based on piggyback mechanism and weighted neighbor stability is implemented. The path selected in this protocol is more stable and effective. It can reflect the mobility of nodes accurately; the advantage reflected in the simulation result is brought by reducing transmission of redundant packets and improving the robustness of the route. The direct result is that the performances of route cost, end to end delay, and average energy consumption have been improved greatly. The PWAODV protocol is energy efficient than other protocol.

The Future scope of this paper would be to implement more realistic moving scenarios and to evaluate their performance with other Parameters.

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