NETWORK SIMULATION BASED PARAMETRIC ANALYSIS OF AODV PROTOCOL FOR WIRELESS MOBILE AD-HOC NETWORK

Mr. Amol V. Zade*

Prof. Vijaya K. Shandilya**

Abstract:

A major aspect of ad-hoc networks is that the nodes can move randomly, which requires the routing protocols. The routing protocol should try to minimize control traffic, such as periodic update messages. Instead the routing protocol should be reactive, thus only calculates routes upon receiving a specific request. The On-demand protocol performs better than the table-driven protocol. The simulator that we are using is Network Simulator (NS-2) which is a most widely used network simulator. It has the capabilities to simulate a range of networks including wired and wireless networks. The size of the network and the offered traffic load affects protocols based on routing, like AODV, to some extent. A large network with many mobile nodes will increase the overhead for AODV quite drastically. This paper is subjected to Adhoc On-demand Distance Vector (AODV) routing protocol and evaluated its performance. Furthermore, in this paper the performance of AODV in terms of packet delivery and routing load is analyzed by varying the number of nodes, parameters through simulation results ns2 simulator.

Keywords: MANET, AODV, NS2, PDR, Routing Load

* M.E. II Year. Dept. of CSE, Sipna's COET, Amravati, MH, India.

** Asso. Prof. Dept. of CSE, Sipna's COET, Amravati, MH, India.

1. INTRODUCTION:

The On-demand protocol performs better than the table-driven protocol. The simulator that we are using is Network Simulator (NS-2) which is a most widely used network simulator. It has the capabilities to simulate a range of networks including wired and wireless networks. This paper is subjected to Adhoc On Demand Distance Vector (AODV) routing protocol and evaluated its performance. . The On-demand protocol performs better than the table-driven protocol. The simulator that we are using is Network Simulator (NS-2) which is a most widely used network simulator. It has the capabilities to simulate a range of networks including wired and wireless networks. This paper is subjected to Adhoc On Demand Distance Vector (AODV) routing protocol and evaluated its performance.

The field of wireless communication and networking has experienced considerable advances in recent years. In particular, MANETs have become quite popular. Ad hoc is derived from Latin, meaning "for this purpose." Usually ad hoc networks are created on the fly for a particular one time purpose. Here, each node in the network acts as a router itself and performs network control. Therefore, these networks are easily deployable, unlike infrastructure-based networks. Ad hoc networks are used in the following applications: conferencing, emergency services, sensor networking and intelligent transportation systems.

A wireless *mobile ad-hoc network (MANET)* is a network consisting of two or more mobile nodes equipped with wireless communication and networking capabilities, but lacking any pre-existing network infrastructure. Each node in the network acts both as a mobile host and a router, offering to forward traffic on behalf of other nodes within the network. For this traffic forwarding functionality, a routing protocol is needed.

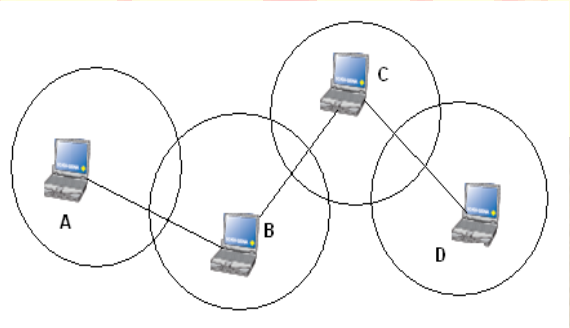

Figure 1: Mobile ad-hoc Network (MANET)

Ad-hoc networks do not rely on any pre-existing network infrastructure. Instead, these networks are formed in an on-demand fashion as soon nodes come sufficiently close to each other. This eliminates the need for stationary network components, such as routers and base stations, as well as cabling and central administration. The functionality and usefulness of an ad-hoc network heavily depends on this forwarding feature of participating nodes.

2. AD-HOC ROUTING PROTOCOLS:

The main purpose of a *routing protocol* is to set up and maintain a *routing table*, containing information on where packets should be sent next to reach their destinations. Nodes use this information to forward packets that they receive. Ad-hoc routing protocols are usually classified by the approach they use for maintaining and updating their routing tables. The three main approaches are:

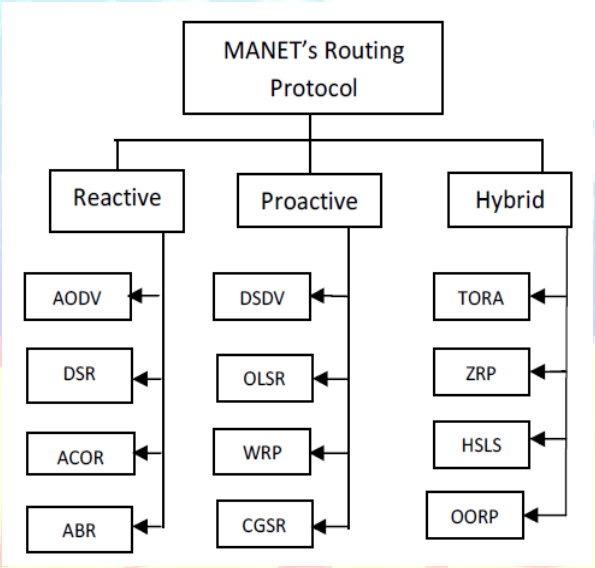

Figure 2: MANET's Routing Protocols.

- *Reactive (on-demand-driven) Protocols:* In this approach, routes to a destination are acquired by a *route discovery* process in an on-demand fashion, i.e., a route is not searched for unless it is needed. The acquired route is maintained by a *route maintenance* process until it has been determined that the route is not needed anymore, or has become invalid. The advantage of

this approach is that unnecessary exchange of route information is avoided, leaving more network resources available for other network traffic. The disadvantage is that route look-ups could take some time. Depending on the application, this may or may not be acceptable.

- *Proactive (table-driven) Protocols:* In this approach, the routing protocol attempts to maintain a routing table with routes to all other nodes in the network. Changes in the network topology are propagated by means of updates throughout the entire network to ensure that all nodes share a consistent view of the network. The advantage of this approach is that routes between arbitrary source-destination pairs are readily available, all the time. The disadvantages are that the routing tables will occupy a large amount of space if the network is large, and that the updates may lead to inefficient usage of network resources if they occur too frequently.
- *Hybrid Protocols*: It is the combination of both proactive and reactive routing protocols i.e. temporary ordered routing algorithm (TORA), zone routing protocol (ZRP), hazy sighted link state (HSLS) and order one routing protocol (OOPR). Proactive and reactive algorithms are used to route packets. The route is established with proactive routes and uses reactive flooding for new mobile nodes. In this paper we have compared MANETs routing protocols from reactive, proactive and hybrid categories, as we have used randomly one protocol from each categories as from reactive AODV, proactive OLSR, hybrid TORA.

3. AODV ROUTING PROTOCOL DESCRIPTION:

When a source node needs to send data packets to some destination, it checks its route table to determine whether it has a valid route. If no route exists, it performs a *route discovery* procedure to find a path to the destination. Hence, route discovery becomes on-demand. These routing approaches are well known as Reactive routing. The route discovery typically consists of the network-wide flooding of a request message. Once a route has been established, it is maintained by some form of route maintenance procedure until either the destination becomes inaccessible along every path or until the route is no longer desired.

A. Route Discovery:

When a node wants to send a packet to some destination node and does not have a valid route in its routing table for that destination, it initiates a route discovery process. Source node broadcasts a route request (RREQ) packet to its Neighbours, which then forwards the request to

their neighbours and so on. A node generates a Route Request with destination address, Sequence number and Broadcast ID and sent it to his neighbour nodes. Each node receiving the route request sends a route back (Forward Path) to the node.

When the RREQ is received by a node that is either the destination node or an intermediate node with a fresh enough route to the destination, it replies by unicasting the route reply (RREP) towards the source node. As the RREP is routed back along the reverse path, intermediate nodes along this path set up forward path entries to the destination in its route table and when the RREP reaches the source node, a route from source to the destination established.

B. Route Maintenance:

A route established between source and destination pair is maintained as long as needed by the source. When a link break in an active route is detected, the broken link is invalid and a RERR message is sent to other nodes. These nodes in turn propagate the RERR to their precursor nodes, and so on until the source node is reached. The affected source node may then choose to either stop sending data or reinitiate route discovery for that destination by sending out a new RREQ message.

4. SIMULATION ENVIRONMENT:

Here we give more focus on the varying number of mobile nodes for the evaluation of performance of Ad-hoc routing protocol AODV. The simulations have been performed using network simulator NS-2. The network simulator ns-2 is discrete event simulation software for network simulations which means it simulates events such as sending, receiving, forwarding packets. The ns-allinone-2.32 supports simulation for routing protocols.

4.1 Simulation Model:

We consider the network of nodes placing within a 1000m × 1000m area, the performance of AODV is evaluated by considering following parameters.

Simulation Parameters

Simulator	Ns-2.32
Protocol	AODV
Simulation Duration	500 Seconds
Simulation Area	1000m × 1000m
Number of Nodes	10,20,30,40,50
Channel Type	Channel/ Wireless Channel
Network Interface type	Phy/ wireless phy
MAC type	Mac/ 802.11
Link Layer type	LL

Table-1: Parameter Values for AODV

4.2 Performance Metrics:

For analyzing AODV protocol, we focused on three performance parameters which are Packet Delivery Ratio (PDR), Average End-to-End delay and throughput.

4.2.1 Packet Delivery Ratio (PDR): The fraction of all the received data packets successfully at the destinations over the number of data packets sent by the sources is known as Packet delivery fraction. The greater value of packet delivery ratio means better performance of the protocol.

$$PDR = \frac{Number\ of\ Packets\ Received}{Number\ of\ Packets\ Send}$$

4.2.2 Routing Load: The number of routing packets transmitted per data packet delivered at the destination. The routing load metric evaluates the efficiency of the routing protocol.

5. RESULTS AND ANALYSIS:

5.1 Packet Delivery Ratio:

- Simulation:

Sr. No.	No. of Nodes	Packet Sent	Packet Received	PDR
1	10	4388	3316	0.7557
2	20	4388	4297	0.9793
3	30	4388	4336	0.9881
4	40	4388	4328	0.9863
5	50	4388	4340	0.9891

Table-2: Simulation Result for PDR

- Analysis:

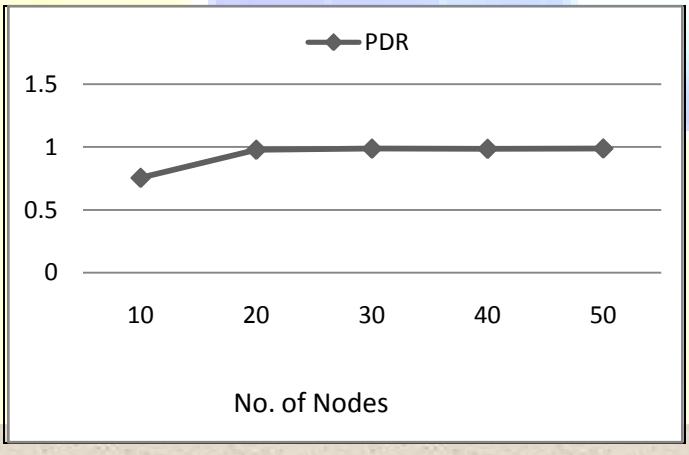

Figure 3: Graphical representation of PDR

The above graphical figure shows us that the value of PDR is in increasing order from nodes 10 to nodes 20, and then it is increases for node 30 and decreases for node 40 slightly and finally increases for nodes 50.

5.2 Routing Load:

- Simulation:

Sr. No.	No. of Nodes	Routing Load
1	10	0.392
2	20	0.351
3	30	0.611
4	40	0.831
5	50	0.971

Table-3: Simulation Result Routing Load.

- Analysis:

From following graphical representation we can say that the value of Routing Load decreasing from nodes 10 to nodes 20. Then it is increasing from nodes 30 to nodes 50 drastically.

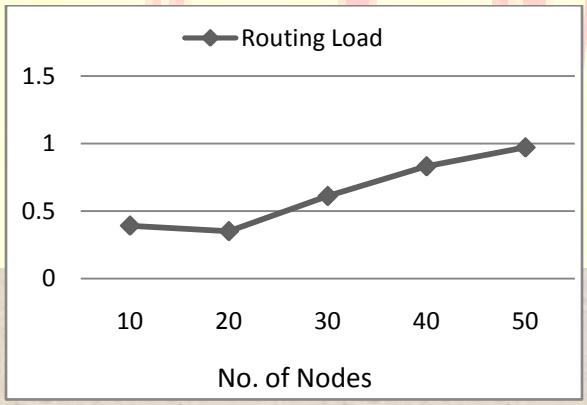

Figure 4: Graphical representation of Routing Load

6. CONCLUSION & FUTURE SCOPE:

Thus we have evaluated the AODV routing protocol for the application oriented performance metrics such as packet delivery ratio and routing load with increasing the number of mobile nodes up to 50. As a result of our studies, we conclude that AODV exhibits a better performance in terms of packet delivery ratio and as the nodes increases the average routing load is also increases. Our result also indicates that as the number of nodes in the network increases AODV exhibits better performance with varying nodes in terms of Packet Delivery Ratio but the routing load on the network increases so the performance decreases for large number of nodes.

Our future work is to find out the performance of AODV protocol under the wormhole attack in mobile Ad-hoc networks.

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AUTHORS PROFILE

Amol V. Zade received his Bachelor of Engineering degree from Sant Gadge Baba Amravati University, Amravati, India in 2008. This author is Pursuing M.E. in Computer Science & Engineering from Sant Gadge Baba Amravati University, Amravati, India. His main area of interest includes Ad-Hoc Networks routing terminologies, Network Security.

Prof. Vijaya K. Shandilya received her degree in CSE from VYWS College of Engineering badnera, Amravati, India, also received her Master of Engineering degree in CSE from badnera, Amravati. This author pursuing Ph.D. from Sant Gadge Baba Amravati University, Amravati, India. She is currently working as Associate Professor in the department of CSE Sipna's COET, Amravati. Her teaching experience is 14 years and 3 months.