International Journal of Technical Research and Applications e-ISSN: 2320-8163,
www.ijtra.com Volume 3, Issue 3 (May-June 2015), PP. 264-268

PERFORMANCE COMPARISON OF AODV AND DSDV ROUTING PROTOCOLS IN WIRELESS AD HOC NETWORKS

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***Abstract*— Change is the only thing which is constant in this today's era. Constant technology updates demand building up and falling down of infrastructure along with cost involvement. Today there is a need of adaptive infrastructure called Ad hoc network.**

Ad hoc network is a collection of two or more nodes with wireless communication having network capability that they can communicate without centralized manner. So, at any time host devices may act as a router or as a node. Ad hoc networks can be erected as wireless technology, comprising of Radio Frequency (RF) and infrared frequency.

Wireless Ad hoc network is Temporary, Infrastructure less, Decentralized, self-organized packet switched network. In this network topology changes dynamically which can results change in link failure or broken. In this paper we evaluate the performance parameters like Throughput, End-to-End Delay and Packet Delivery Ratio of AODV (ad hoc on Demand Vector) and DSDV (Destination Sequential Distance Vector) protocol. The simulation tool used is Network Simulator 2 -2.35.

***Index Terms*— Ad hoc network, AODV, DSDV, QoS, Routing Protocols, NS-2.**

I. INTRODUCTION

In today's infrastructure hungry world, cost involvement dominates the network type and one of the most vivacious and vigorous field today is that of ad hoc networks. Within the past few years the field has seen so rapid expansion of visibility and work due to the spread of inexpensive, widely available wireless devices and the network community's interest in mobile computing.

The ad hoc networks could be classified into first, second and third generation network system. Today ad hoc network considered as third generation. The history of ad hoc network traced back to the DoD1-sponsored Packet Radio Network (PRNET) research for military purpose in 1972's[1]. In 1973's the concept of real time ad hoc networks arrived with computers, notepads, smartphones, PDA's and another worthwhile communication devices. In this period working group on MANET was born and made efforts to standardize the routing protocol[2].

Wireless networks are classified as infrastructured and infrastructure less network. Infrastructure based wireless networks are also called as Cellular network. In cellular network, communication between different nodes are done by fixed base stations or routers[3].Infrastructure less wireless networks are also known as Ad hoc networks .Ad hoc networks differs from other networks because of following characteristics: Infrastructure less, decentralized and temporary network in which data must be routed via intermediate nodes having single or multihop wireless links which results frequent change in network topology[3].

In this paper we carry out a systematic performance study of the two routing protocols for mobile ad hoc network – Ad hoc On Demand Distance Vector Routing (AODV) and Destination Sequential Distance Vector (DSDV) protocol in the hybrid networking environment.

We have used the means of simulation using NS- 2 to gather data about these routing protocols in order to evaluate their performance.

The **FACTORS** which needs to be considered while choosing a routing protocol for MANET are:

a) Finding an optimal route: The protocol should find optimal route while sending the packet to the destination. The parameters that are required to decide the optimal route are Delay, Bandwidth, hop count, traffic and reliability, etc.

b) Energy efficient: Each node in ad hoc network has battery power as a source to use energy optimally. The protocol should have minimum processing and transmission time as a function of energy.

c) Bandwidth efficient: In MANET each node have energy and bandwidth associated with it. If we reduce the number of periodic updates, traffic in the network also reduces proportionally. So, bandwidth utilization is high.

d) Convergence: Whenever the topology of the network changes to choose shortest path, the protocol should adjust himself to get the stable network in minimum time.

e) Loop free: When packet from the sender remains in the network while reaching to the desired destination loops are formed in the network. Because of loops Bandwidth gets wasted. Therefore protocol should be chosen in such manner that network is loop free.

f) Route failure and discovery: Some mechanism is needed to detect the route failure and also route discovery to propogate the information. The new configuration should converge fast to stable state.

g) Multiple route: As in MANET all nodes are arbitarily moving for a single source-destination pair results into link failure. Because of multiple route, alternate route is to be provided for packet delivery which reduces delay and improves packet delivery ratio. Also multiple routes avoid the Congestion (Traffic).

h) Sleep function: As each nodes in ad hoc network should be energy efficient, therefore nodes other than those who are not involved in communication process should go into power saving mode or sleep mode for any random period of time, without affecting the network.

i) Scalability: The performance of the network should not be affected by increasing or decreasing the number of nodes in the network.

II. AD HOC ROUTING PROTOCOLS

Ad hoc routing protocols are divided into two categories:

1. Table-Driven routing protocol: Table driven routing attempts to maintain periodic information about the path from each node to every other node in the network i.e. These protocols require each node to store their routing information and when there is a change in network topology updating has to be made throughout the network[4]. Low latency is suitable for real-time traffic. Bandwidth might get wasted due to periodic updates. The Destination-Sequenced Distance-Vector Routing (DSDV) protocol is a table driven algorithm.
2. On-Demand routing protocol: In on demand routing protocol route between source and destination is created only on demand (or whenever required).Route discovery is done by broadcasting route request (RREQ) packet in the network. There should be significant delay occurs during route discovery[4]. This routing protocol were designed not only to save energy and bandwidth but also to reduce traffic intensity associated with each node.

Comparison of table driven and on demand routing protocol is shown in below table

Proactive(Table-Driven)	Reactive(On-Demand)
Route from each node to every other node in the network	Routes from Source to Destination only
Routes are ready to use instantaneously	Routes constructed when needed, higher connection setup delay
Periodic route-update packets	Route update when necessary
Large routing tables	Small or No routing tables

A. DSDV (Table Driven routing protocol)

DSDV stands for Destination Sequential Distance Vector routing protocol. This protocol is an adaption of RIP (Routing Information Protocol) which adds sequence number to RIP routing table[5]. Each node in the network has routing table associated with it and consists information about next hop (number of hops required to reach destination), address of the destination and sequence number received from that destination. Sequence number determines whether route is fresh or stale[6]. When node receives packet from it's previous node, it compares the present sequence number with old. If new sequence number is greater than old one then it kept new or greater sequence number. If both sequence numbers are same then the number with minimum number of hopes is considered[7].

In DSDV routing table updated periodically during which node generate two updates: Full dump and increament update. In full update whole routing table is sent(bandwidth wasting) and in increamental update just latest information updates are sent. Because of periodic updates in DSDV bandwidth might get wasted[8]. The performance of this protocol is highly depends on periodic updates and latency time which will affect the speed and capacity of the network[9]. So, in real time this protocol is unpropitious for the network which contains the giant number of nodes with high mobility.

B. AODV (On Demand routing protocol)

AODV stands for Ad hoc on demand distance vector routing protocol. In AODV source generates route request packet (RREQ) and broadcast through the entire network to send packet to the destination. Unlike DSDV protocol AODV does not route to the all nodes and maintains its routing table[6].

This protocol uses symmetrical link i.e. it uses same path for send and reply a packet. When route request packet is broadcasted, all neighboring nodes receive that packet and checks its routing table. If the entry in routing table is not present then this node also broadcast the request and record the entry of previous node in its own routing table. This entry is used in future to establishing reverse path. In the same manner each node in network broadcast RREQ packet to forward the information until it reaches to the destination[3]. When packet is reached at destination the route reply packet is generated in reverse path with minimum number of hopes. Each node which receives the route reply packet sets a forward pointer to the node from which packet is received[10]. In this way a forward path is created to propogate information in future.

The AODV protocol contains mechanism which uses periodic Hello message to check the local connectivity. In case of link failure or link broken Route Error packet (RERR) is generated to determine the link broken. Node removes the corresponding route entry after receiving RERR packet. This protocol uses multiple route[9]. If one route is fails or broken another route is provided for packet exchange because of this overhead or data traffic is avoided.

III. METHODOLOGY

- Network creation with number of nodes.
- Ad-hoc routing algorithms.
- ✓ Proactive(Table Driven)Routing e.g. (OLSR, DSDV)
- ✓ Reactive(On Demand) Routing e.g. (AODV, DSR)
  - ➢ Path Discovery
  - ➢ Path Maintenance
  - ➢ Local Connectivity Maintenance
- Simulation of Ad hoc network using NS-2

A. Methodology used in DSDV for communication:

When X receives information from Y about a route to

Z

- Let destination sequence number for Z at X be S(X), S(Y) is sent from Y
- If S(X)>S(Y), then X ignores the routing information received from Y
- If S(X)=S(Y), and cost of going through Y is smaller than the route known to X, then X sets Y as the next hop to Z
- If S(X)<S(Y), then X sets Y as the next hop to Z and S(X) is updated to equal S(Y)

B. Methodology used in DSDV for communication:

i. When source (node'1) wants to communicate with destination (node'8) it first broadcast the route request (RREQ) packet to its neighbourhood nodes as shown in below figure:

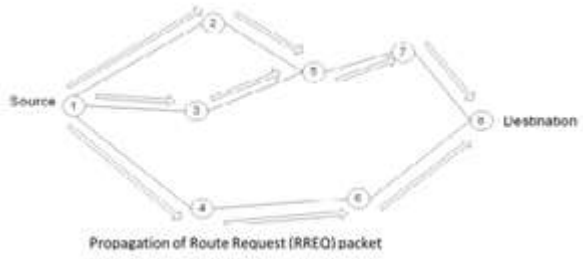

Figure 1: Route Discovery in AODV

ii. After getting the packet from source, destination release a packet named route reply (RREP) in reverse path as shown in below figure:

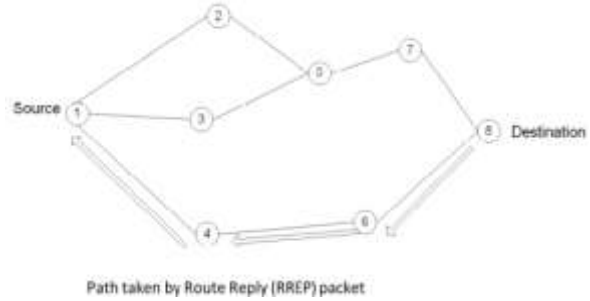

Figure 2: Route Reply in AODV

IV. NETWORK SIMULATOR: NS-2

Simulation is widely used in engineering research. There are a number of simulation tools available to simulate the behavior of various networks and routing protocols.

In this paper we used simulation tool named NS-2 (Network Simulator) of version 2(2.35)[11]. NS-2 is a discrete event driven network simulation tool for simulation and it is freely available.NS-2 is primarily Unix based and works at packet level. It is an open source solution implemented in C++ and Otcl programming languages at UCB (University Of Carolina Berkley).NS-2 provides highly modular platform for simulation of wired as well as wireless networks[12]. It provides substantial support to simulate bunch of protocols like TCP, UDP, FTP, HTTP and DSR. Results of the simulations are obtained in a trace files which records the entire event[1]. The output of simulation is visualized through Nam (Network Animator).The Architecture of NS-2 is as shown in figure:

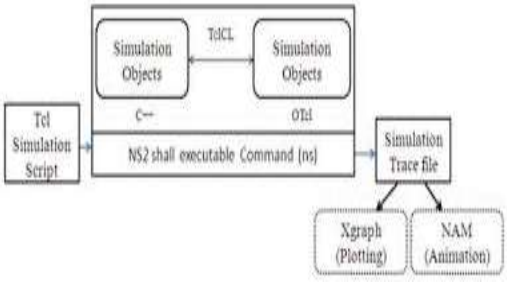

Figure 3: Architecture of NS-2

V. SIMULATION SCENARIO

Simulation process consists preprocessing and postprocessing. In preprocessing we define topology, configure the nodes, protocol type, MAC layer address type, channel type, traffic type (TCP) and in postprocessing we analyze the script written in TCL language and generate the graphs corresponds to each network parameter.

In this paper we proposed a topography of size 500mX400m, with 4 wireless nodes among which 3 nodes move randomly and 1 node is stationary. We did the simulation for 150uS with speed as 3m/s and 5m/s for different nodes.

The network simulation parameters we have used for our simulation purpose shown in the below table.

Network Parameters	Values
No. of nodes	4
Topography Area	500mX400m
Connection type	TCP
Source type	CBR
Routing protocol	DSDV & AODV
Simulation Time	150us
Network Simulator	NS2 -2.35

The paper analyses the simulation results of DSDV and AODV protocol in ad hoc network. It creates two different files: Trace file and Nam file. Trace file store different event statistics events like source-destination address, protocol type, traffic agent, initial time, size of packet, whether packet is delivered or dropped and Nam file gives visualization of simulated network. These two files are useful for checking the performance parameters or QoS (Quality of Services) of the network[13].

VI. PERFORMANCE METRICS

The performance of the protocols depends on various inter-relating metrics which plays important role in analytical observation of the protocol. Following are the some important parameters which we are selected to study the performance of DSDV and AODV protocols in this simulation study:

Throughput: It is defined as the amount of data transferred successfully from source to destination in given period of time. It measures effectiveness of a routing protocol.

Throughput = N/T

Where N is the number of bits received successfully by all destinations and T is simulation time.

Average End-to-End Delay: It is the time or delay required by packet to reach destination from source. It includes all possible delays caused during route discovery, processing delay, Queueing delay, Transmission delay, Propagation delay, etc. It determines the reliability of routing protocol.

Packet Delivery ratio: It is defined as the ratio of packet sent by traffic source to the packet received by traffic sink. PDR determines correctness and efficiency of ad hoc network.

VII. PERFORMANCE RESULTS

The simulation results are presented in the form of graphs. In this paper we generate the graphs by APP tool with analysing trace file in NS2. Following figure show the output of Nam (Network animator).

Figure 4: Network Animator Window

In network animator window we see node'2 is stationary while node'0 and node'1 are source and destination respectively which communicates through intermediate node'3 and node'2 with TCP as a traffic agent.

Graph shows comparison between the two protocols and between a different numbers of sources on the basis of the aforementioned metrics as a function of time.

Throughput

Based on simulation results, throughput of DSDV increases initially and reduces as time increases while in AODV throughput increases initially and remains same throughout the given period of time. Hence, performance of AODV is better than that of DSDV over same interval of time.

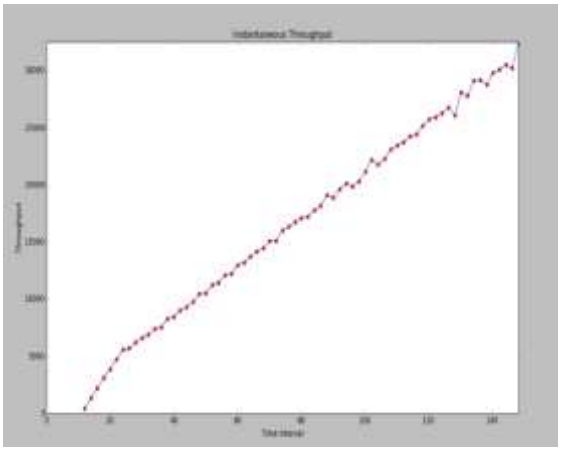

Figure 5: Throughput for AODV

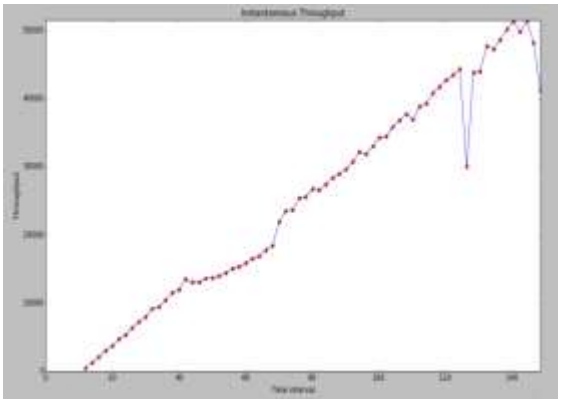

Figure 6: Throughput for DSDV

Average End-to-End Delay

Based on the simulation results, end to end delay of DSDV protocol is less as routing information is already stored in routing table i.e. proactive protocol. In AODV protocol route discovery is on demand hence it has more delay. Therefore reliability of DSDV protocol is higher than AODV protocol.

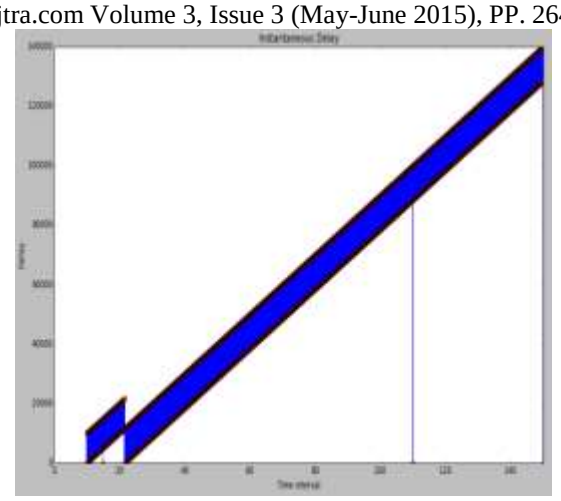

Figure 7: Avg. End-to-End Delay for AODV

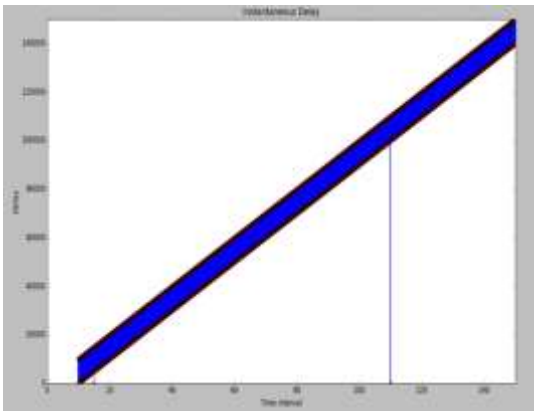

Figure 8: Avg. End-to-End Delay for DSDV

Packet Delivery ratio

From the simulation results it is clear that PDR of AODV protocol is always better than that of DSDV protocol. The PDR of DSDV is low at lower time and suddenly increases to high value as time interval increases. Hence, reliability of AODV protocol is higher than DSDV protocol.

Figure 9: PDR for AODV

Figure 10: PDR for DSDV

VIII. CONCLUSION

In this paper, the performance of the two MANET Routing protocols DSDV and AODV was analyzed using NS-2 Simulator. Comprehensive simulation results of Average End-to-End delay, Throughput, and Packet Delivery Ratio are proposed. From the results we conclude that

*Throughput of AODV is higher than DSDV.
*PDR of AODV is higher than DSDV.
*Delay of AODV Is higher than DSDV.
*DSDV protocol consumes more Bandwidth and has a more overload as compared to that of AODV protocol.

So we can say overall performance of AODV is better than DSDV.

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