A Survey Based Comparative Study of DSR and AODV Routing Protocols In Ad-hoc Network Using NS-2

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Abstract– **Mobile Ad hoc Network (MANET) is an aggregation of wireless mobile nodes which dynamically exchange data without any fixed infrastructure or a base station. Nodes rely on multi-hop routing protocols to forward data packets sent from a source node to a destination node which is out of its transmission range. Consequently this paper is subjected to the comparative study between DSR; AODV reactive (on-demand) routing protocols and evaluates their relative performance in terms of Packet delivery ratio, Average End-to-End delay and Throughput. From the simulation results and analysis, a suitable routing protocol can be identified for a specific network.**

Keywords: **Mobile Ad Hoc Network (MANET), AODV, DSR.**

I INTRODUCTION

Mobile Ad hoc Network, also known as self organized network, is a multi-hop wireless network where nodes can move arbitrary in topology. The basic characteristic of these networks is the complete lack of any kind of infrastructure, and therefore the absence of dedicated nodes that provide network management operations like the traditional routers in fixed networks. In order to maintain connectivity in a mobile ad hoc network all participating nodes have to perform routing of network traffic. The cooperation of nodes cannot be enforced by a centralized administration authority since one does not exist.

The main features of MANET [4] are multi-hop routing, self-governing terminals, distributed operation, dynamic network topology, and uneven link capability. Such networks are used in short range transmissions like Bluetooth (~10m), battle field, personal area network like PDA, laptop, cellular phone, mobile vehicular communication, commercial scenarios like conference room, law enforcement, civilian environments like taxi cab, sports stadium, emergency search-n-rescue operations etc.

Regardless of the amiable applications, the features of MANET introduce several demands that must be taken care of before commercial deployment can be expected. These include: Routing, Security and Reliability, Quality of Service (QoS), Scalability, Power Consumption. Due to the above challenges of MANET [5], traditional fixed network routing schemes like Link State routing, Distance Vector routing algorithm are not effective. The goal of routing algorithms is to provide short and stable routes with minimal routing overhead.

The objective of this paper is to perform comparative study of two MANET routing protocols namely DSR and AODV routing protocols.

The rest of the paper is organized as follows: Section 2 describes an idea of reactive (on-demand) MANET routing protocols, Section 3 presents the overview of both protocols, the comparison of protocols on various parameters like Packet delivery ratio, Average End-to-End delay and Throughput are presented in Section 4, simulation results are described in Section 5 and then the final conclusion is presented in Section 6.

II ROUTING PROTOCOLS

Routing protocols for MANET [6] can be broadly classified into two main categories:

- Proactive or table-driven routing protocols.
- Reactive or on-demand routing protocols.

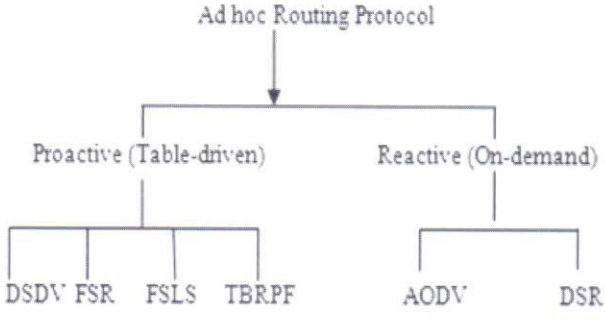

Fig.1.Classification of Routing Protocols in Mobile Ad-hoc Networks

A. *Table Driven Routing Protocols (Proactive)*

In Proactive routing, also called Table Driven routing, routes are calculated before one is needed. The protocol tries to keep routing information to all nodes every time up-to-date. The updated tables can be regularly transmitted throughout the network in order to maintain routing table consistency. Due to its proactive nature, it has an advantage of having the routes immediately available when needed. Thus, if a route has already existed before traffic arrives, transmission occurs without delay. However, for extremely changing network topology, the proactive design requires a significant amount of resources to keep routing information up-to-date and definite. Certain proactive routing protocols are Destination-Sequenced Distance Vector (DSDV), Fisheye State Routing (FSR), Fuzzy Sighted Link State (FSLS), Optimized Link State Routing (OLSR), Topology Broadcast based on Reserve Path Forwarding (TBRPF).

B. On-Demand Routing Protocols (Reactive)

Since reactive routing only finds a route when required, it is considered as more scalable to dynamic, large networks. When a node requests a route to another node, it begins a route discovery process to find a route. Therefore, it consists of the following two main phases: Route discovery: it is the process of finding the route between two nodes whether directly reachable or reachable through one or more intermediate network hops. Once a route has been established, it is maintained by a *route maintenance* process, which is the process of replacing a broken route or discovering a new route in case of a route failure. Route maintenance procedure supervises the operation of the route and informs the sender of any routing errors. Some reactive protocols are Cluster Based Routing Protocol (CBRP), Ad hoc On-Demand Distance Vector (AODV), Dynamic Source Routing (DSR), Temporally Ordered Routing Algorithm (TORA), Associativity-Based Routing (ABR), Signal Stability Routing (SSR) and Location Aided Routing (LAR)

III. OVERVIEW OF DSR AND AODV [4]

A. *Dynamic Source Routing (DSR)*

DSR is one of the examples of an on-demand routing protocol which is based on the concept of source routing. It is designed for use in multi hop ad hoc networks of mobile nodes. The protocol is composed of the two main mechanisms of "Route Discovery" and "Route Maintenance", which work together to allow nodes to discover and maintain routes to arbitrary destinations in the ad hoc network. DSR uses no periodic routing messages like AODV, thereby reduces network bandwidth overhead, conserves battery power and avoids large routing updates. Instead DSR needs support from the MAC layer to identify link failure.

Advantages of DSR are:

- Nodes can store multiple routes in their route cache, which means that the source node can check its route cache for a valid route before starting route discovery.
- Favorable in network with low mobility.
- It does not require any periodic hello message exchanges, therefore nodes can enter sleep node to conserve their power.
- Also saves a considerable amount of bandwidth in the network.

Limitations of DSR are:

- The route maintenance protocol [11] does not repair a broken link. It is only communicated to the sender.
- Problems may arise due to fast moving of hosts.
- Flooding the network may cause collisions between the packets.
- Also there is always a small time delay at the beginning of a new connection because the sender first needs to find the route to the destination.

B. *Ad Hoc On Demand Distance Vector (AODV)*

AODV [2] is both on-demand and table driven protocol. It comes into existence only when source node wants to communicate with the destination node. AODV ensures the use of latest route as every route has a lifetime and routes expire if they are not used.

A route discovery mechanism is invoked only if a route to a destination is not known. The basic message set consists of control packets such as RREQ (route request), RREP (route reply) and RERR (route error) to help communication between nodes.

The algorithm works as follows:

1) When a node wants to communicate [10] with a destination node, it checks its updated routing table entry.
2) If there is an entry, then AODV [3] finds the route and start transmitting the packet.
3) If there is no such entry, then it floods the network with an RREQ message.
4) After receiving this RREQ message, a node checks whether the destination is in its hop limit or not; if it is not then it forwards the RREQ else sends the RREP.
5) When a source node receives RREP, then a path is established to the destination and it starts sending packets using AODV routing. Since the RREP message passes through intermediate nodes, these nodes update their routing tables.
6) When a node in the network determines its next-hop to

be unreachable then it generates an RERR message and removes all route entries. This is ensured by periodically sending a HELLO message to all the neighboring nodes and if that node does not receive any message then it is presumed to be no longer reachable.

Advantages of AODV are:

- On-demand route establishment with small delay.
- Unicast, Broadcast, and Multicast [12] communication.
- Link breakages in active routes efficiently repaired.
- All routes are loop-free through use of sequence numbers.
- Only keeps track of next hop for a route instead of the entire route.
- Use of periodic HELLO messages to track neighbors.

Limitations of AODV Are:

- Requirement of broadcast medium.
- Overhead on bandwidth [7] will occur when an RREQ travels from node to node in the process of discovering the route info on demand.
- AODV lacks an efficient route maintenance technique.
- The messages can be misused for insider attacks including node isolation, and resource consumption.
- AODV does not discover a route until a flow is initiated. This route discovery latency result can be high in large-scale mesh networks.

IV. COMPARISON OF PROTOCOLS

Considering the mobility of nodes and the network size, the overall performance of the protocols can be compared in terms of three parameters:

A. Packet Delivery Ratio:

It is defined as the total number of packets received by all nodes to the total number of packets originated by all nodes.

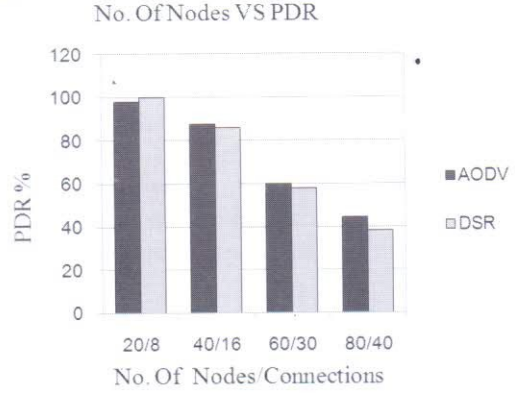

Fig.2. Number of nodes per connections Vs PDR

B. Average end-to-end Delay:

A delay could be due to path chosen [9], delay caused while retransmission of packets lost during collision, due to propagation times etc. So collection of all the delays experienced by a packet is measured here.

C. Throughput:

This metric represents the total number of bits forwarded to higher layers per second. It is measured in bps. It can also be defined as the total amount of data a receiver actually receives from sender divided by the time taken by the receiver to obtain the last packet.

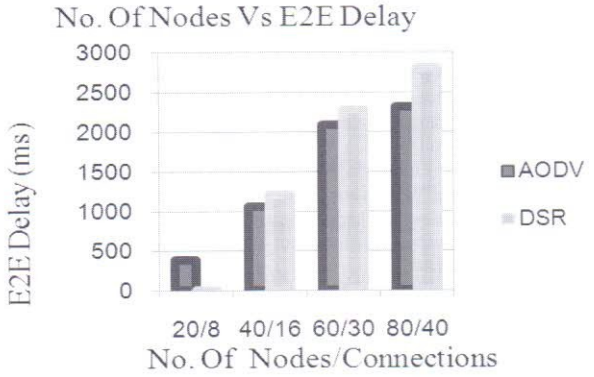

Fig.3. Number of nodes per connections Vs E2E delay

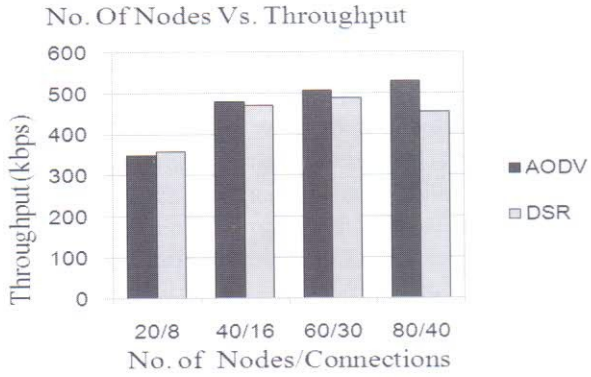

Fig.4. Number of nodes per connections Vs Throughput

V. SIMULATION RESULT

The above graphs show the simulation [8] results based on comparison of the two routing protocols on different performance metrics. It showed that AODV protocol works better when node density is higher as compared to DSR.

VI. CONCLUSION

Based on the above simulation results, an improvement in existing protocols can be made to provide better security, QoS, simplicity and ease of implementation, scalability, secure, reliable and rapid route convergence or a new algorithm could be proposed for fulfilling above requirements.

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