A Survey on Routing Protocols with Performance Parameters for Different Number of Nodes

Rajeev Kumar
Sri Satya Sai Institute of Science and Technology, Sehore (M.P.)

Kailash Patidar
Sri Satya Sai Institute of Science and Technology, Sehore (M.P.)

Megha Jain
Sri Satya Sai Institute of Science and Technology, Sehore (M.P.)

Abstract – A mobile ad-hoc network (MANET) is a self starting dynamic network comprising of mobile nodes that is connected through a wireless medium forming rapidly changing topologies. MANET is infrastructure less and can be set up anytime, anywhere. This paper presents the study of protocol properties of MANET routing protocols and analyzed them with respect to different number of nodes. The routing protocols considered in this study are Bellman-Ford, DSR and WRP. The study among these routing protocols are based on protocol property parameters such as End-to-End Delay, Packet delivery ratio, Drop Ratio and Normalized Routing Load (NRL) with respect to different number of nodes.

Index Terms – Mobile Ad-hoc Network, DSR, WRP, Delay, PDR, NRL.

1. INTRODUCTION

A mobile ad hoc network is a collection of wireless mobile nodes that dynamically establishes the network in the absence of fixed infrastructure. One of the distinctive features of MANET is, each node must be able to act as a router to find out the optimal path to forward a packet. As nodes may be mobile, entering and leaving the network, the topology of the network will change continuously. MANET provides an emerging technology for civilian and military applications.

A fundamental problem in ad hoc networking is routing i.e. how to deliver data packets among mobile nodes efficiently without predetermined topology or centralized control, which is the main objective of ad hoc routing protocols. Since mobile ad hoc networks change their topology frequently, routing in such networks is a challenging task. Moreover, bandwidth, energy and physical security are limited.

The Mobile ad-hoc network is characterized by energy constrained nodes [3], bandwidth constrained links and dynamic topology. One of the important research areas in MANET is establishing and maintaining the ad hoc network through the use of routing protocols. Though there are so many reactive routing protocols available, in this study we consider Bellman-Ford, DSR and WRP for performance comparisons due to its familiarity among all other protocols. These protocols are analyzed based on the important metrics such as End-to-End Delay, Packet delivery ratio, Drop Ratio and Normalized Routing Load with respect to different number of nodes.

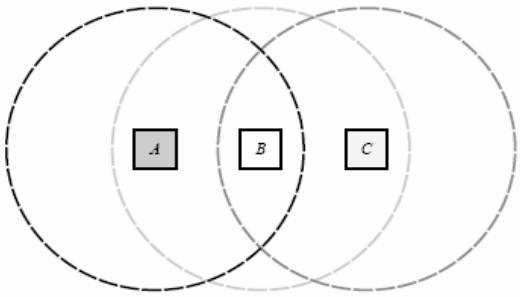

Figure 1. Mobile Ad hoc networks with 3 mobile nodes

A wireless ad hoc network is primarily divided into two areas: Mobile Ad hoc networks (MANET) [2, 3] and Smart Sensor Technology. Mobile ad hoc networks consist of mobile nodes, which can communicate with each other and nodes can enter and leave the network anytime due to the short transmission range of Mobile Ad Hoc Networks, routes between nodes may consist of one or more hops. Thus each node may either work as a router or depend on some other node for routing. Figure 1 shows a simple ad hoc network with three mobile hosts using wireless interfaces. Host A and C are out of range from each other's wireless transmitter. When exchanging packets, they may use the routing services of host B to forward packets since B is within the transmission range of both of them.

•*Energy limitations*: The nodes in the MANET are generally battery operated. Hence, energy conservation techniques and energy-aware routing in MANETs become necessary.

2. RELATED WORK

In one of the paper by Ankit Chopra and Rajeev G. Vishwakarma (2014) title "Comparison of Ad hoc Reactive Routing Protocols: AODV and DSR with Respect to Performance Parameters for Different Number of Nodes" published in IEEE. The authors have compared performance of two protocols- AODV and DSR different number of source and have concluded which protocol is better [1].

In one of the paper by Ashish Bagrani, Raman Jee, et. al. (2012) title, "Performance of AODV routing protocol with increasing the MANET nodes and its effects on QoS of mobile ad hoc networks," published in IEEE International Conference on Communication Systems and Network Technologies, Shri Mata Vaishno Devi University Katra, India. In this paper the author work with AODV routing protocol with varying the nodes [2].

From the above mentioned studies, we can conclude that although routing protocols has been compared from each other with respect to performance under different number of nodes. From the above studies I have decided to go through the study of Routing Protocols like bellman-ford, dsr and wrp with Respect to Performance Parameters for Different Number of Nodes. For our study we choose Bellman-Ford, DSR and WRP routing protocols and four performance metric End-to End delay, Packet Delivery Ratio, Drop Ratio and Normalized Routing Load [5].

3. MOBILE AD HOC NETWORK ROUTING PROTOCOLS

Routing protocols for Mobile ad hoc networks can be broadly classified into three main categories:

3.1 Proactive (table driven) Routing Protocols

Each node in the network has routing table for the broadcast of the data packets and want to establish connection to other nodes in the network. These nodes record for all the presented destinations, number of hops required to arrive at each destination in the routing table [4, 5]. The routing entry is tagged with a sequence number which is created by the destination node. To retain the stability, each station broadcasts and modifies its routing table from time to time.

The proactive protocols are appropriate for less number of nodes in networks, as they need to update node entries for each and every node in the routing table of every node. It results more Routing overhead problem. There is consumption of more bandwidth in routing table.

3.2 Reactive (on-demand) Routing Protocols

In this protocol, a node initiates a route discovery process throughout the network, only when it wants to send packets to its destination. This process is completed once a route is determined or all possible permutations have been examined [6, 7, 8]. Once a route has been established, it is maintained by a route maintenance process until either the destination becomes inaccessible along every path from the source or the route is no longer desired. A route search is needed for every unknown destination. Therefore, theoretically the communication overhead is reduced at expense of delay due to route search.

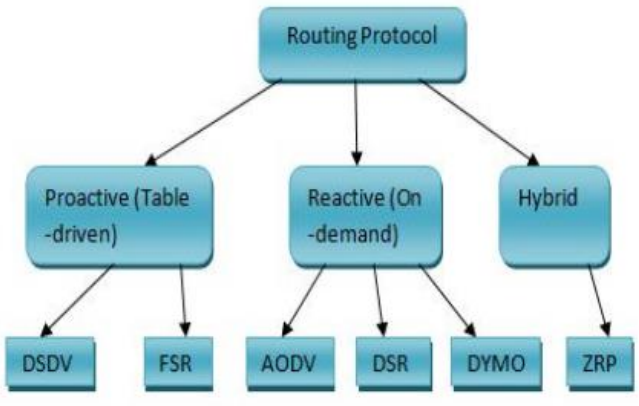

Figure 2. Categorization of Routing Protocols

3.3 Hybrid routing protocols

This protocol incorporates the merits of proactive as well as reactive routing protocols. Nodes are grouped into zones based on their geographical locations or distances from each other. Inside a single zone, routing is done using table-driven mechanisms while an on-demand routing is applied for routing beyond the zone boundaries [8, 9]. The routing table size and update packet size are reduced by including in them only art of the network (instead of the whole); thus, control overhead is reduced.

4. PERFORMANCE PARAMETERS FOR COMPARISON

We will take four performance parameters for study on Bellman-Ford, DSR and WRP which are End-to End delay, Packet Delivery Ratio, Drop Ratio and Normalized Routing Load which are described as below:

4.1 End-to-End Delay

The average end-to-end delay of data packets is the interval between the data packet generation time and the time when the last bit arrives at the destination. A low end-to-end delay is desired in any network [3].

The average time required for transmitting a data packet from source node IP layer to the destination IP layer, including transmission, propagation and queuing delay.

Average End-to-End Delay = Σ (Time when Packets enters in the Queue) - Σ (Time when the Packet is received)

4.2 Packet Delivery Ratio

Packet Delivery Ratio (PDR) is the ratio between the number of packets transmitted by a traffic source and the number of packets received by a traffic sink. It measures the loss rate as seen by transport protocols and as such, it characterizes both the correctness and efficiency of ad hoc routing protocols. A high packet delivery ratio is desired in any network.

Packet Delivery Ratio = Σ (No. of Received Packets) / Σ (No. of Delivered Packets)

4.3 Drop Ratio

Packet Drop rate is one of the indicators for network congestion. In wireless environment, due to the physical media and bandwidth limitations, the chance for packet dropping is increased. Therefore we choose it as one metric.

4.4 Normalized Routing Load (NRL)

Normalized Routing Load (NRL) is the ratio of control packets to data packets in the network. It gives a measure of the protocol routing overhead; i.e. how many control packets were required (for route discovery/maintenance) to successfully transport data packets to their destinations. It characterizes the protocol routing performance under congestion. NRL is determined as:

NRL = Pc /Pd

Where Pc is the total control packets sent and Pd is the total data packets sent.

5. CONCLUSION

In this paper we have studied about the various routing protocols and various performances metric like end to end delay, packet delivery ratio, drop ratio and normalized routing load.

In future work we can simulate the above mentioned routing protocols with the same performance metrics with varying the number of nodes, and concluded their performance that how they behave with increasing the number of nodes.

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