AODV+, FSR, M-DART: Analysis of Reliable and Scalable Routing Protocols in MANETS

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Abstract— As in today's world wireless become an emerging field for research. Mobile Adhoc Network (MANETs) is the one part of wireless technology. In MANETs, there are Hybrid (AODV+), proactive (FSR, M-DART) routing protocols. This paper provides the performance analysis of these different routing protocols under various network density and traffic using ns-2 simulator. The study of this analysis provides which routing protocol is best suited for network density and offered load. Metrices used for the performance evaluation are packet delivery ratio, end-to-end delay, throughput and routing overhead are considered with respect to pause time and source-destination pairs (SDPs).

Key words: AODV, FSR, MDART, MANETs

I. INTRODUCTION

Wireless networking is an emerging technology that allows users to access information and services electronically, regardless of their geographic position. Wireless networks can be classified into two types: one is infrastructure less (Ad Hoc) network which is used to form a wireless ad hoc network among users wanting to communicate with each other with no pre-established infrastructure and other is infrastructure networks, in this type of network a mobile host communicates with the network through an access point within its communication radius. An ad hoc network uses no centralized administration. Every node acts both as a host and as a router. The topology of ad hoc networks varies with time as nodes move, join or leave the network. This topological instability requires a routing protocol to run on each node to create and maintain routes among the nodes. For instance, if a node leaves the network and causes link breakages, affected nodes can easily request new routes. Although there are incremental delays, the network continues to remain operational. Wireless ad hoc networks take advantage of the inherent nature of the wireless communication medium. Ad hoc networks are useful for the applications such as disaster recovery, automated battlefields, agriculture fields, security and vigilance, search and rescue, crowd control, conferences, meetings and lectures where central or fixed infrastructure is not available. MANETs are characterized by the mobility of nodes, which can move in any direction and at any speed that may lead to arbitrary topology and frequent partition in the network. This characteristic of the network makes the development of routing protocols as one of the most challenging issue. MANETs routing protocol can be categorized into three categories as shown in figure 1.1.

In view of the necessity of developing efficient routing protocols, the present work focuses on comparative performance analysis of Ad hoc On-demand Distance Vector (AODV), FSR and M-DART when network density and offered load changes with respect to different performance metrics.

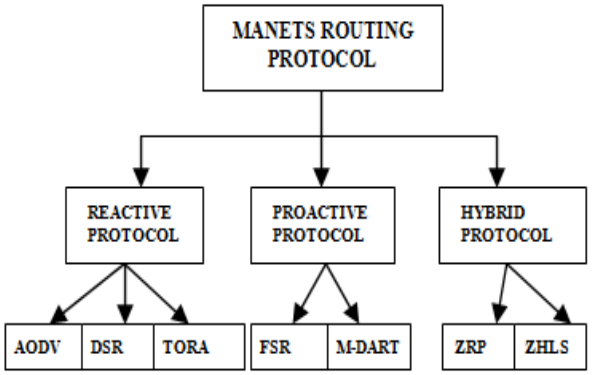

Fig. 1: Classification of Ad Hoc Network Routing Protocols

II. PROPOSED METHODOLOGY

From the literature survey it was found that there is a lot of work done on evaluating the performance of various MANET routing protocols for Constant Bit Rate (CBR) traffic but there is very little work done for mobility and network density. Understanding the performance of routing protocols in ad hoc networks is a challenging task to determine which routing protocol is best suited for which type of network scenario. In this paper it is proposed to evaluate and analyze the performance of AODV+, FSR and M-DART routing protocols based on CBR traffic using TCP agent under different network scenarios like pause time, offered load(i.e. number of source destination pairs).

III. SIMULATION AND RESULTS

In this paper, we present the performance Evaluation of AODV+, FSR and M-DART routing protocols using NS-2. First simulation scenarios and model will be discussed; the network topology and movement of nodes with traffic models will be discussed next. Then detail simulation results and analysis will be presented.

Simulations are performed for different routing layer protocols in a multihop ad hoc network environment. The impact of mobility, offered load on the performance of these protocols is shown with the help of graphs in terms of packet delivery ratio, end-to-end delay and normalized routing load.

Figure 1.2 shows the end-to-end delay when the network density is varied. The end-to-end delay of MDART, AODV+ is higher than that of the FSR protocols when the network size is varied from 5 to 25 nodes . MDART inludes all the aviable path and also AODV+ protocol uses the route cache which many a times contains stale routes, as a result of which its end-to-end delay is comparatively higher.

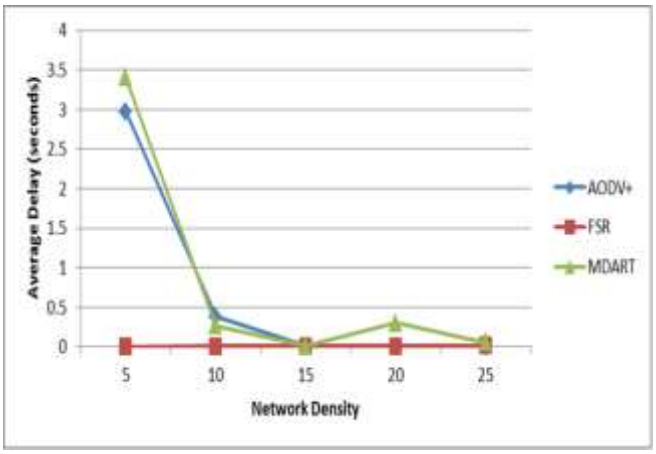

Fig. 1.2: Impact of network density on the average end-to-end delay of AODV+, FSR and M-DART Protocols

The Figure 1.3 shows the impact of network density on the packet delivery ratio. It is observed that the packet delivery ratio of AODV+ protocol is better than both M-DART and FSR routing protocols

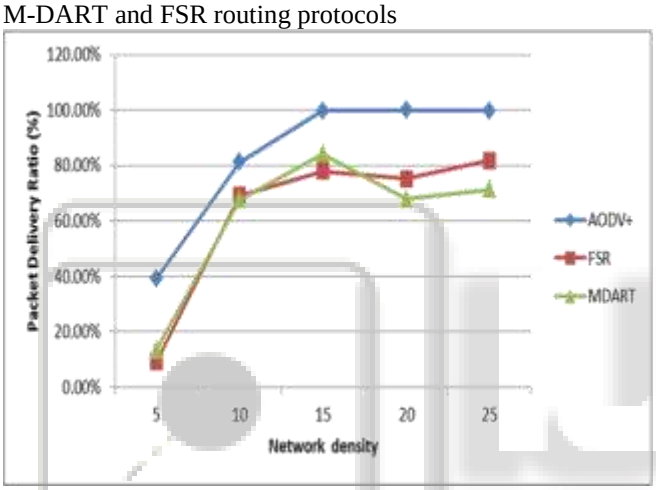

Fig. 1.3 Impact of network density on the packet delivery ratio of AODV+, FSR and M-DART Protocols

The figure 1.4 shows the impact of network density on the throughput. It is observed that the throughput of M-DART and AODV+ routing protocols is better than both FSR protocol. When the Network density is minimum; the throughput is minimum as network size increases thedistance between nodes to create hierarchical structure increases and as a result throughput also increases. The throughput is representative of number of bits received per second.

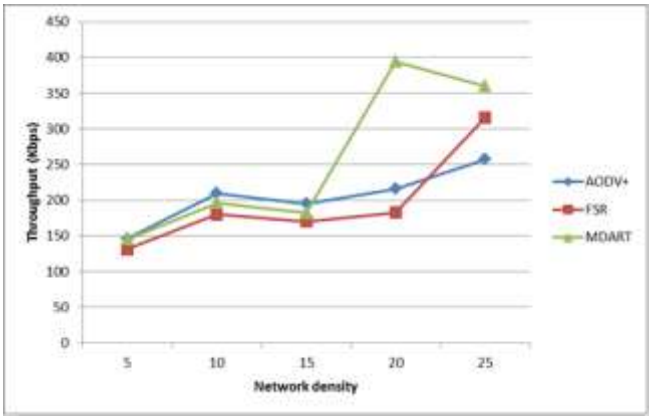

Fig. 1.4: Impact of network density on the throughput of AODV+, FSR and M-DART Protocols

IV. LITERATURE REVIEW

A. *Routing in MANETs:*

A lot of research has been done on routing in MANETs and a number of routing protocols have been designed and developed. Some of them are popularly used and always been the areas of study. In [1] a survey on MANET routing protocols has been done categorizing unicast, multicast and broadcast routing algorithms. Unicast algorithms are further categorized as reactive, proactive and hybrid routing algorithms. If source and destination mobile nodes are within each other's transmission range, they can communicate with each other directly; otherwise, the intermediate nodes in between have to forward the packets for them. In such a case, every intermediate mobile node has to function as a router to forward the packets for others. Thus, routing is a basic operation for the MANET. [10] provided a broad classification of ad hoc network routing protocols. To overcome the problems associated with the link-state and distance-vector algorithms a number of routing protocols have been proposed for MANETs. These protocols can be categorized into three categories : ondemand /reactive, global/proactive and hybrid routing protocols. In reactive protocols, routes are determined when they are required by the source using a route discovery process. In proactive routing protocols, the routes to all the destination are determined at the start up, and maintained by using a periodic route update process. Hybrid routing protocols combine the best properties of the first two classes of protocols into one. That is, they are both reactive and proactive in nature. [4] Proposed a reactive routing protocol for ad hoc networks known as Ad hoc On-demand Distance Vector (AODV). The authors of AODV classify it as a pure on-demand route acquisition system, since nodes that are not on a selected path do not maintain routing information. In [6], AODV is an improvement on DSDV because it typically minimizes the number of required broadcasts by creating routes on a demand basis, as opposed to maintaining a complete list of routes as in the DSDV algorithm. Hybrid routing protocols are a new generation of protocol, which are both proactive and reactive in nature. Hybrid protocols proposed to date are zone-based, which means that the network is partitioned or seen as a number of zones by each node. In ZRP [3], the nodes have a routing zone, which defines a range (in hops) that each node is required to maintain network connectivity proactively. Therefore, for nodes within the routing zone, routes are immediately available. For nodes that lie outside the routing zone, routes are determined on-demand (i.e. reactively), and it can use any on-demand routing protocol to determine a route to the required destination.

B. *Performance Analysis of Routing in MANETs:*

In [2] E. M. Royer examined routing protocols for ad hoc networks and evaluated these protocols based on a given set of parameters. The article provides an overview of eight different protocols by presenting their characteristics and functionality, and then provides a comparison and discussion of their respective merits and drawbacks. In [5], performance analysis of four routing protocols namely DSDV, TORA, AODV and DSR is done using ns2 simulator. A number of scenarios are generated with different mobility patterns and traffic loads of Constant Bit

Rate (CBR) Traffic. The performance of each protocol is analyzed and explained the design choices that account for their performance. Results indicate that reactive routing protocols are more suitable for ad hoc networks and AODV performs almost as well as DSR at all mobility rates and movement speeds and accomplishes its goal of eliminating source routing overhead, but it still requires the transmission of many routing overhead packets and at high rates of node mobility is actually more expensive than DSR. In [6], Comparative Study of Routing Protocols for Mobile Ad-hoc Networks is done where Proactive and reactive protocols are compared using CBR traffic and in conclusion it was found that the two classes of protocols complement each other, providing advantages in different domains. It is clear, that neither of the two protocol classes outperforms the other in every domain, and that there, therefore, is a need to keep both solutions available. In [7], Performance evaluation and traffic analysis for routing protocols in a real MANET is conducted highlighting that CBR traffic does not reflect the complex nature of traffic in real applications and hence the relationship between traffic and routing is well worth investigation. It performed simulation studies for traffics based on different patterns and characteristics. The results show that the performance is sensitive to the routing protocol, path loss, and traffic characteristics. This provides rationale and insight for choosing the right protocols to provide quality of service in terms of different metrics in different environment. [8] evaluates the impact of a routing protocol on the overall performance when the HTTP traffic is produced by the web servers or when multimedia traffic is modeled as a variable bit rate traffic because these traffic scenarios are more representatives of the network loads placed on a real world MANET. In [9], the proactive and reactive protocols are compared using VBR traffic and the results show that the reactive protocols outperform the proactive protocols using ns-2 simulator.

V. CONCLUSION AND FUTURE WORK

In this paper the effect of Network density is examined on to evaluate the performance of three protocols FSR (proactive), M-DART (proactive) and AODV+ (hybrid) under the CBR traffic. From the simulation results it is observed that proactive protocol M-DART and AODV+ under hybrid gateway discovery scheme has best all-round performance under different network density scenarios considered. FSR in terms of average end to end delay and routing overhead performs better than other two routing techniques considered but for packet delivery ratio AODV+ under hybrid gateway discovery scheme performs better than M-DART and FSR whereas for throughput M-DART and AODV+ under hybrid schemes performs almost similar.

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