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A Survey of Congestion Control in Proactive Source Routing Protocol in Mobile Ad Hoc Networks

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Abstract: In mobile ad hoc networks (MANET) congestion can take place between the two intermediate nodes, when the packet is transferred from the source to the destination. The congestion in MANET is mainly due to frequent change to topology and high mobility of nodes, which lead to high loss of packet. In ad hoc network the congestion control techniques with TCP becomes difficult to handle since in ad hoc network there is high density of nodes in the network and there is frequent change to topology in the network. In this paper to control the congestion in proactive source routing protocol an error message is generated by the receiver to reduce the packet sending rate. We are using a new control message i.e., Packet Error Announcing Message called (PEAM) messages.

Keywords: Mobile ad hoc networks (MANETs), proactive routing protocol, reactive routing protocol, Mobile Networking.

I. INTRODUCTION

Networking is a process of transferring files between two or more computing devices using wired or wireless communication.

A. *Wired and Wireless communication*

In wired communication the data is passed through wired-cables, whereas in wireless communication the packets are transferred through wireless data connection. A mobile ad hoc network is an example of wireless communication, where devices are connected without any wired**.** In particular, the error-prone communication links and the unstable network structure are two of the most critical aspects in networking. Numerous efforts have been exerted to address these issues so that a multi hop wireless network could be a good as a wire line network. In contrast, interest is increasing in utilizing a wireless communication channel by harnessing its broadcasting nature directly. Indeed, it is this nature that separates wireless networks from the rest, and no requirement exists to turn wireless links into wired lines [14].

A mobile ad hoc network is a network that consists of a collection of distributed nodes which communicate with each other through the wireless communication network. In MANET, the wireless mobile node exits without any existing infrastructure and there is no any centralized access point. An example of ad hoc network can be found in military application. A general example can be understood by the simple scenario such as a employees in the company in the conference which consist of laptops, which is a temporary mobile ad hoc network. The MANET can also be included in the complicated scenario such as in vehicular ad hoc network [2].

Routing is a process to find the shortest path between the source and the destination. Routing protocol in MANET is categories into two parts: (i) Proactive routing protocol (table-driven), where every node maintains tables which consist of the information of the entire topology of the network. The protocols that include in proactive routing protocols are optimized link state routing protocol (OLSR) [3], destination sequence distance vector (DSDV)[4]. (ii)Reactive routing protocol (on-demand), it searches the node on-demand and send packets from the source to the destination. Dynamic source routing (DSR)[5] and Ad hoc on-demand distance vector(AODV)[6]are the examples of reactive source routing protocol.

In mobile ad hoc network, congestion can take place between two intermediate nodes, when the packets are transferred from the source to the destination. Due to the congestion there are high loss packets in the network. In this article we review on lightweight proactive source

routing protocol [1] and on congestion control in the routing.

Once the route discovery is done, the multi-paths are discovered. The source nodes start distributing the packets along with the discovered paths to their respective receivers. The receiver nodes are informed with the number of packets to be sent and packet sent interval and these information have been included in the RREQ itself. The receiver nodes calculate the amount of packet lost periodically. Based on the packet losses, an error message is generated by the receiver to reduce the packet sending rate. We are using a new control message Packet Error Announcing Message called (PEAM) message.

II. LITERATURE SURVEY

A. *Reactive And Proactive Protocols*

A mobile ad hoc network (MANET) is a network consisting of a set of mobile nodes with no centralized administration. MANET is self-configuring, self-organizing and self-maintaining. MANET may have dynamic topology. In addition, each mobile node has limited resources such as battery, processing power and on-board memory (i.e., RAM). In MANETs, mobile nodes communicate with each other in a multi-hop fashion. That means a mobile node sends a packet to a destination through intermediate nodes. Hence, the availability of each node is equally important. Otherwise, the overall performance of the network may be affected. In order to meet these peculiar characteristics and design constraints, an efficient routing protocol is essential for MANET. Designing an efficient routing protocol for MANET is a very challenging task and it has been an active area of research. Different routing protocol are present are used in mobile ad hoc network depending upon the environment. Basically in MANET the routing protocol is classified into two types: Reactive routing protocol and proactive routing protocol. The following Fig.1 shows the hierarchy of routing protocols in mobile ad-hoc network.

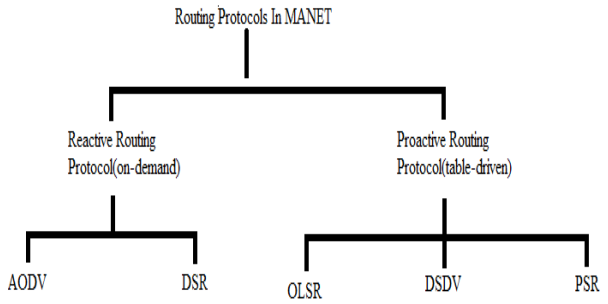

Figure1. Routing protocols in mobile ad-hoc network.

1) *Reactive Routing Protocols:* Reactive routing protocols are those protocols which find the route between the source and destination on "on-demand". The common examples of reactive routing protocols are DSR [5] and AODV[6]. The main disadvantage of reactive routing protocol is that it takes long latency time to discover the route, since every time it has discover the new route.

*a) Dynamic Source Routing :*The Dynamic Source Routing (DSR) [5] is a simple and efficient routing protocols designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. DSR allows the networks to be completely self-organizing and self-configuring, without the need for any existing network infrastructure or administration. The protocol is composed of the two mechanisms of Route Discovery and Route Maintenance, which works together to allow nodes to discover and maintain source routes to arbitrary destinations in the ad hoc network. The use of source routing allows packet routing to be trivially loop-free, avoids the need for up-to-date routing information in the intermediate nodes through which packets are forwarded, and allows nodes forwarding or overhearing packets to cache the routing information in them for their own future use. All aspects of the protocol operate entirely on-demand, allowing the routing packet overhead of DSR to scale automatically to only that needed to react to changes in the routes currently in use.

b)Ad-hoc On-Demand Distance Vector Routing: In ad-hoc on demand distance vector routing(AODV) [6], each mobile host operates as a specialized router, and routes are obtained as need(i.e., on-demand) with little or no reliable on periodic advertisements. AODV provides loop-free routes even while repairing broken links. Because the protocol does not require global periodic routing advertisements, the demand on the overall bandwidth available to the mobile nodes is substantially less than in those protocols that do necessitate such advertisements. AODV uses a broadcast route discovery mechanism[12],as used in the Dynamic Source Routing(DSR) [5] algorithm. Instead of source routing, however, AODV relies on dynamically establishing route table entries at intermediate nodes. This difference pays off in networks with many nodes, where a larger overhead is incurred by carrying source routes in each data packet.

2) Proactive Routing Protocols: Proactive routing protocols are those protocols in which every node maintain routing table for the possible destination. The common examples of the proactive routing protocols are OLSR [3], DSDV [4] and PSR [1]. The main disadvantage of proactive routing protocol is to maintain of data at each nodes.

a) Optimized Link State Routing: Optimized Link State Protocol (OLSR)[3] is mainly suitable for the dense and the large network. The protocol uses the link-state algorithm. Since OLSR is a proactive in nature it can easily

finds the route to the destination. The protocol inherits the stability of the link state algorithm. Due to its proactive nature, it has an advantage of having the routes immediately available when needed. OLSR protocol is an optimization of a pure link state protocol for mobile ad hoc networks. First, it reduces the size of control packets: instead of all links, it declares only a subset of links with its neighbors who are its multipoint relay selectors. Secondly, it minimizes flooding of this control traffic by using only the selected nodes, called multipoint relays, to diffuse its messages in the network.

b) Destination-Sequenced Distance-Vector Routing: In Destination-Sequenced Distance-Vector Routing (DSDV) [4], each mobile host act as specialized router, this periodically advertises its view of the interconnection topology with other Mobile Hosts within the network. The DSDV protocol requires each mobile station to advertise, to each of its current neighbors, its own routing tables. The entries in this list may change fairly dynamically over time, so the advertisement must be made often enough to ensure that every mobile computer can almost always locate every other mobile computer of the collection. In addition, each mobile computer agrees to relay data packets to other computers upon request.

c) Proactive Source Routing: Proactive Source Routing (PSR) [1] is a table-driven protocol, which uses tree-based routing as in Path-Finding Algorithm (PFA)[11]. In PSR every node has breadth-first spanning tree (BFST) of the entire network. At each iteration, the nodes periodically broadcast the tree structure. The PSR involves three steps in its process: Route Update, Neighborhood Trimming and Streamlined Differential Update. In route update, based on the information collected from neighbors during the most recent iteration, a node can expand and refresh its knowledge about the network topology by constructing a deeper and more recent BFST. This information will be distributed to its neighbors in the next round of iteration. In neighborhood trimming, when a neighbor is lost, a procedure is triggered to remove its relevant information from the topology repository maintained by the detecting node. The Streamlined Differential Update is a combination of both route update and neighborhood trimming. All unreachable nodes are eliminated from network and all available nodes list is updated to each reachable node in list. The basic idea in the lightweight proactive source routing protocol [1] is to use a compact tree representation in full-dump and differential update messages to halve the size of these messages.

III. Related Work

A global search procedure issued by the route discovery mechanism in which a source node uses flooding mechanism to discover all the available paths to a destination. Once all paths have been discovered, a source node chooses a path, which is the shortest. When the shortest path algorithm is used, nodes located around the center of a network carry more traffic compared to other nodes that are located at the perimeter of the same network. Particularly, when multiple connections are setup in a network, the wireless links located at the center of the network carry more traffic and get congested. This type of congestion problem may affect the performance of a network in terms of delay and throughput.

The ad-hoc network does not have any fixed network infrastructure which leads to frequent changes in topology. In mobility scenarios, the shortest path may break due to node movement. Moreover, communication through a wireless medium is inherently unreliable and is also subjected to link errors. Nowadays many congestion control techniques have been implemented with TCP that tell the congestion problem to the source node. The TCP congestion control mechanisms [7] are Tahoe TCP, Reno TCP, New Reno TCP and SACK TCP.

When congestion takes place, packets transferring from the source to the destination, it leads to many problems such as packet loss and long delay. This problem becomes more visible when there is large scale transmission network. There are many congestion control techniques such as EDAPR (Early congestion detection and adaptive routing in MANET)[9],where in EDAPR the node detects the congestion early and send a warning message to non-congested nodes(NHN). The non-congested nodes finds then alternative path by using adaptive path mechanism.

Another approach for the congestion control is DCDR (Dynamic congestion detection and control routing in ad hoc networks) [8]. In DCDR, the congestion is detected by the average queue length of the node. When the congestion is detected the node sends the warning message to its neighboring nodes. The nodes then detect the alternative path to send the packets to its destination.

IV. Proposed Work

In mobile ad hoc networks (MANET) congestion can take place between the two intermediate nodes, when the packets are transferred from the source to the destination. The congestion in MANET is mainly due to frequent change to topology and high mobility of nodes, which lead to high loss of packet. In ad hoc network the congestion control techniques with TCP becomes difficult to handle since in ad hoc network there is high density of nodes in the network and there is frequent change to topology in the network.

In route discovery procedure, a source node uses flooding mechanisms to discover all the available paths to a destination. This is done by using RREQs. Once the route has been discovered the source node start sending packets along the discovered path. At the receiver side the congestion is identified by calculating the Tw. The receiver nodes are informed with the number of packets to be sent and packet send interval and this information have been

included in the RREQ itself. The receiver nodes calculate the amount of packet lost periodically.

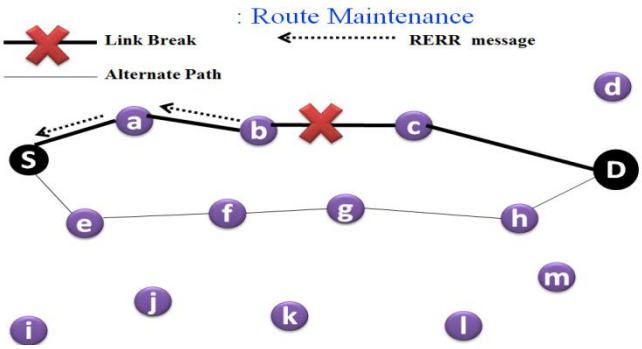

Figure 2: Generation of PEAM message at link failure.

V. Conclusion

The multipath routing protocols proposed for MANET is widely used depending upon the environment. The OLSR protocol is suitable for large and dense network but it has high loss rate of packets due to higher routing overhead compared to other proactive routing protocol such as DSDV and PSR. When the nodes are neither too sparse so that the network connectivity is good nor too dense so that the channel can be spatially reused, these protocols have a fairly high Packet Delivery Ratio(PDR) of over 70% for PSR,DSDV and DSR and of 60% -70% for OLSR.

So as per above paragraph we can conclude that we are having PDR (Packet Delivery Ratio) for PSR is about 70%. As we compare PSR, Packet Delivery Ratio with other protocols likes OLSR, DSR and DSDV. Packet Delivery Ratio it is relatively better cause after all its having improvement over 0%-10%. So this scenario to get works on Packet Delivery Ratio of PSR and increases the PDR from 70 to near about 90[1].

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