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A Survey on Various Techniques to Minimize Routing Overhead in MANET

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Abstract— Wireless ad-hoc network (or) Mobile Ad Hoc Network is a set of mobile nodes in the combination of some computing contrivances which could be placed randomly everywhere in the network to do a specific task inclusive of dispensing and transferring of messages for sundry applications. The nodes can broadcast information in meticulous range and the host is capable of changing their position very repeatedly. If the information is not transferred within a scrupulous moment, retransmission of data packets is done by the protocols, which enhance the communication overhead in MANET. Broadcasting is playing a vital role for path discovery. Most probably, four types of broadcasting methods are used. They are simple flooding, location-predicated methods, probability predicated strategies and Neighbour cognizance predicated. This article exposes a widespread learning and investigation of various routing overhead reducing techniques proposed by many researchers. This paper additionally reveals the routing overhead percentage achieved using the prominent techniques proposed by contemporary researchers.

Keywords—MANET, Routing Overhead, Flooding, Broadcasting, Probability based, Area based, Neighbor Knowledge

I. INTRODUCTION

A Mobile Ad - Hoc Network is that the set of Wi-Fi portable devices, which establishes a fleeting network with no fortification of pre-deployed base station. The spontaneous networks are a collection of heterogeneous cellular components, they are such as smart phone and laptops are the participants. MANET's Multi hop characteristics may not deliver the data directly to the destination from the source. So, intermediate routers are used to transfer the packets. The nodes are resource constraints, choosing the intermediate router is the maximum vital factor. Intermediate router selection will reduce or avoid the redundancy in the packet forwarding process. Routing is an intricate one because of node mobility. The obligation of a routing procedure consists of changing the path facts; locating a possible direction to a target node, constructing a routing table using the metrics called, hop duration, minimum power required and lifetime of the Wi-Fi hyperlink; gathering statistics about the path breaks; renovating the damaged paths, expending minimum battery processing power and channel bandwidth utilization.

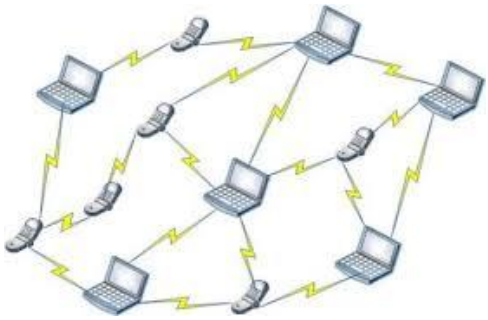

Figure: 1 Mobile Ad Hoc Network

When the mobility of a node is extortionate, the node consumes extra bandwidth for the control packets and retransmission of information packets. In this situation ascertaining the delivery of information is an immensely colossal concern. Numerous routing protocols comprise to surmount these challenges. The protocols which initiate the routing are grouped under 3 schemes: proactive, reactive and hybrid. Most commonly reactive protocols are reducing the retransmission. Commonly used reactive protocols are Ad hoc On demand distance Vector (AODV), Dynamic Source Routing (DSR), Location-aided Routing (LAR) and Zone Routing Protocol (ZRP). Although these protocols may have

a reduced routing overhead, the origin node might also be afflicted by extensive delays for route probing before they can send the data. Reactive protocols can follow source routing techniques or hop-by means of-hop routing. Proactive protocols follow the routing table information to determine the optimal path. Hybrid path finding mechanism combines the traits of reactive and proactive routing protocols. Protocols within the zones follow table driven approaches and beyond the zones follow on demand approach.

As a last paragraph of the introduction should provide organization of the paper/article Section I contains the introduction of Mobile Ad Hoc Networks, Section II contain the problem Analysis Section III contain the some Review of literature, Section IV describes results and discussion, Section V concludes research work with future directions).

II. PROBLEM ANALYSIS

In a dynamic network, a recurrent node movement in MANET causes path breakages which direct to frequent path failures, which in turn requires a new path discovery process. Broadcasting [12] is a most important and proficient data distribution method for route discovery, address resolution and many other network offering in ad hoc networks. Whereas information broadcasting has much compensation it also causes a broadcast storm problem which has the characteristics of acquiring a massive amount of routing overhead, hence it causes many issues like unnecessary retransmission, contention and collision. So, to progress the routing performance, broadcasting optimization is a treasured solution in the path finding process. The protocols performances are evaluated by the performance metrics called, packet deliverance rate, average delay to reach, the end to end node and routing overhead [10].

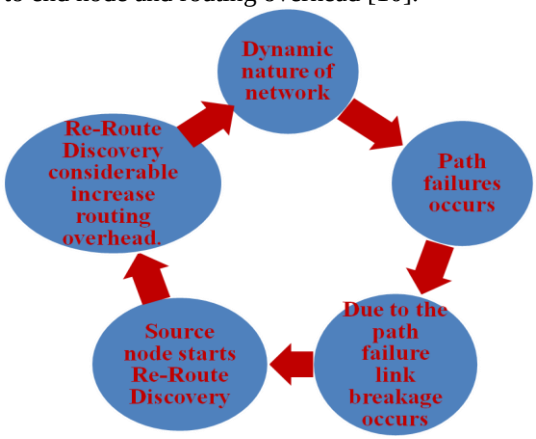

Figure 2 Occurrences of Routing Overhead

Routing overhead [18] is termed as the relationship between the total numbers of routing control packets sent by all the nodes to the successful delivery of original data packets. The control packet does not carry any data so they are considered as a extra overheads associated in the routing process. The overhead packets are RREQ, RREP, RERR and Hello packets. Amongst those metrics, minimum routing overhead is the vital one because of the fact, scalability, network performance of the MANET can be enhanced.

III. REVIEW OF LITERATURE

A considerable number of strategies have been proposed to relieve the aforementioned issues based on the Routing protocols and Broadcasting schemes. Broadcasting techniques in [11] MANET are classified into four main schemes: 1) Simple flooding 2) Probability Based 3) Area Based and 4) Neighbour Knowledge Based.

A. Proactive Routing:

Optimized Link State Routing (OLSR) initiates the routing in reactive form. It gets 2-hop neighbour knowledge using Multipoint Relay Mechanism. MPR reduced the retransmission of broadcast messages. To gain the 1 hop neighbour information author [1] has proposed the OLSR with minor changes. The changes are adapted in the packet arrangement and in route table access, to show the desired results. Packet arrangement phase consists of Route Erasure, Route construction and Route repair procedures. The path construction procedure creates the routes in all directions; exact routes are identified with the help of reply packet. The route repair mechanism is applied when a route is disconnected or connection is failed. The Route Repair mechanisms retrieve the route by spotting a new route, then Listing the damaged destination, invalidate route erasure, strong route updates, spotting near nodes and calculates the power status. The power status determines the lifetime of the node. The power rank is a pitch taking the series from 1 to 10.Lively series is 7 to 10. Critical stage is 4 to 6 and 1 to 3 is jeopardy stage. The route annihilation technique is applied at the evident stage. This route erasure method is appealing when the data broadcasting is disconnected. This involves soothing of route for following broadcast. This development creates the network accessible for upcoming communication. The OLSR scheme is compared with the TORA and DSR routing protocols. The analyze reveals the result as OLSR scheme offers low end -to -end delay, high throughput, reduced the routing overhead and increased the energy utilization than the other two protocols.

The authors in [2] have projected a theoretical model for analyzing the overhead incurred by routing protocols in MANET with non-hierarchical structure in reaction with the mobility of node and network traffic loads. The proposed study contributes two folds. (i) Misrouting overhead (ii) Network updates intervals. Mobility in MANET is confirmed by Random walk mobility model and Semi Markov mobility model by the result of ProbLC (probability of Link change Event). The author proposed aforementioned two folds are the mainly dominating part of

overhead. Avoiding the misrouting overhead and short update interval does save bandwidth.

B. Reactive Routing protocol for data communication:

The authors [8] have designed a "Dynamic Triangular Vision Algorithm" which is a reactive routing algorithm with the prediction of node positional information. Location management manages the positional information of the nodes. When a node initiates its communication, a triangular vision request zone is created with the presence of initial and final node. DTV mechanism concentrates only the source elected, intermediate nodes for the transmission. The source node elect the router based on some weights and grade points. Only that limited intermediate nodes are invoked in the flooding process. Flooding also restricted within smaller geographic region. Thus, nodes with these criteria only transmit the packets unnecessary nodes are not participating in the data transmission or rebroadcasting. So, DTV reveals the minimized control overhead.

C. Dynamic Probability based methods

i) Gossip – Based Method:

The authors in [3] have anticipated a new power aware gossip based routing approach referred as Gossip Based Node Residual Energy AODV (GBNRE-AODV). Using a probability function the nodes calculate the forwarding probabilities with dynamism. Using the Normal Energy the probability function is computed. The purpose of GBNRE-AODV is to maximize network existence time and reduce energy utilization by considering the metrics such as remaining energy and obtained signal strength. When the protocol carried over the route establishment process it excludes the weak link and minimum residual energy node by assigning small retransmitting probabilities for each energy hungry intermediate node and it also minimizes an impulsive death of routing packets using neighbourhood information. The aforementioned nodes are not participating while rebroadcasting the messages so the overhead messages are minimized. To estimate the performance of the GBNRE-AODV, it had been compared with the traditional AODV and Gossip based routing. The simulation results consequences evaluation performed by analyzing the network density and the node mobility. When examining on dense network GBNRE-AODV reduces the normalized routing overhead by an average percentage of 51.72% than AODV and 14.53% than gossip. When the analysis carries out in different node mobility GBNRE-AODV reduced the normalized routing overhead approximately by an average of 16.36% and 50.37% as compared with Gossip and AODV routing protocols respectively.

ii) Dynamic probability:

Dynamic probabilistic scheme partition [17] the network into two groups such as sparse and dense network, based on the node density. The probability for forwarding (FP) is computed by local density and number of local neighbour. FP=1 serves for the rebroadcast of sparse network and FP<1 serves for the rebroadcast of dense network. The authors suggested that piggybacked 2-hop neighbourhood information reduce the mobile nodes quantity occupied in the process of rebroadcasting.

D. Area Based Approach

i) Distance Based Approach:

The authors in [4] have offered a routing protocol Ad hoc On Demand Multipath Destination Vector (AOMDV) with Destination Routing Effect Agent Module (DREAM). The principle of the Multipath Destination Vector Protocol is to generate several paths to reach the receiver node. The sender node initiates routing discovery process with the predicted location table entries and directs the routing packet in the discovered direction. Positional information dependency reveals the result of minimizing routing overhead and energy utilization on the network. The performance of AOMDV-DREAM is matched up with AOMDV. The result shows that routing overhead obtained in AOMDV- DREAM is 0.54KBytes packets/Sec but in AOMDV is 0.96 Kbytes packet/Sec.

ii) Location Based Approach:

The authors in [5] have proposed a new location based path finding protocol inclusive of flooding restriction and directional antennas, called "Adaptive Location-Aware Routing with Directional Antennas (ALAR-DA)". The main aim of this work is to improve the routing performance in a network by hiring the location information. ALAR-DA term describes a tear drop shaped area that includes both the source node and the destination nodes are within the request zone and the expected zone. Top of Form

In a few cases the expected region can be extended to avoid failures of path finding process. The origin node begins the path finding process by pointing out the antenna's direction. When an intermediate node accepts a route request, it updates the routing table by calculating the expected region from the forwarding node location and address. When a receiver node receives RREQ, it replies to the source node via route reply packet using route list obtained from the route discovery packet.

To investigate the performance of ALAR-DA, compared with existing location- aware routing protocols such as LAR, DA-MLAR, and LARDAR. ALAR-DA reduces the routing overhead and achieves a stable performance in the case of the target node's mobility (fast or slow) by initiating the initial path finding process. The first, initiated route discovery

process itself gets succeed, for the reason of its adaptive tear -drop-shaped request zone.

A. Neighbor Knowledge Based Approach:

i) Neighbor coverage Probabilistic Rebroadcasting:

The authors [7][15] designed a unique scheme known as NCPR; calculate the retransmission delay and probability of retransmission to provoke the path discovery process. NCPR uses the conception of aforementioned delay to establish the order of the transmission coverage for the neighbours. Rebroadcast probability is observed with the aid of using the 2 metrics known as connectivity element and further coverage ratio. The coverage ratio covers the quantity of nodes belongs on the single broadcasting. In this case the routers that are blanketed by way of the preceding broadcast will no longer acquire another duplicate RREQ. The exposed nodes most effective gets the RREQ Through this usage, the overhead is decreased. The writer as compared the performance of NCPR with conventional Ad Hoc On-Demand Routing protocol and Dynamic probabilistic routing protocol protocols. In comparisons with the Ad Hoc On-Demand Routing protocol and Dynamic probabilistic routing protocol, the routing overhead attain in NCPR is decreased by using 45.9 and 30.8 percentages respectively. When the community is dense, the routing overhead is reduced through 74.9 and 49.1 percentage.

ii) Loyalty Pair Neighbour Selection:

The author in [6] defined a new protocol called LPNS, Initially HELLO packets are used to exchange the current Queue size and Remaining Battery power across the neighbours. Low and High power nodes are classified. Loyalty Pair Neighbour Set (LPNSS) is formed using High power nodes with more queue size. Retransmission Delay, Retransmission feasibility and Edge facet ratios are computed.

Retransmission delay decides the node order, Retransmission feasibility Get the information about the Uncovered Neighbours (URN). Edge Facet Ratio decides how many neighbours are to be supposed to receive the RREQ packet. The Loyal pair set is updated and Sorted in the routing table. Route through loyal nodes have taken place. The RREQ packet carries the Neighbour – Info list, RREQ update the neighbours until the completion of data delivery. Two finest paths are selected and accumulated in the initial node for the information transmission. The first, best path is selected, if the intermediate node is incapable to find the neighbour, then it refers the routing chart and identifies the next high LPNSS otherwise it regenerate the path. To review the concert of LPNS it is matched up with NCPR. The metrics considered are control overhead, consumed energy and end-end delay. The simulation states that LPNS protocol uses less energy because of less control information transmission. This fact is used to attain an increased PDR and decreased in delay and communication overhead.

B. Clustering Approach :

i) Prediction Based Topology Reconfiguration:

The authors [9] proposed architecture concentrates the local topology updates in network connectivity. To minimize the manipulated overload and lessen the interference the topology reconfiguration method is proposed. To obtain these objectives the followed mechanism is clustering. Within the Cluster the nodes are categorized as Temporary Cluster Head (TCH), Head node of the Cluster (CH) and Normal Member (NM).All the nodes keep the Neighbour information in the Neighbour Stability Data Base. The NSD holds the coverage of transmission and Battery power of each node. The highest transmission coverage and highest battery power holding node are called as the Head node of the cluster. Reconfiguration of the topology structure is triggered by the use of reconfiguration token whenever a topology disconnection occurs. Because of the node mobility, expiration of nodes and link, disconnection the link failures occur. Reconfiguration token carries the message to different neighbour nodes, that the node is in a sleep state or select an alternate route. In case the cluster head is moved out of its current location, reconfiguration token is passed with CH's position, present speed and angle of deviation. The node which receives the token immediately made the changes in its own table and distributes the HELLO packets to the neighbour nodes to convey the changes. Thus the manipulated overhead is reduced without the periodic forwarding of HELLO control packets.

ii) Communication models for data offloading:

To determine the heterogeneity and the routing information overhead the authors [16] have designed a unique algorithm, namely "Heterogeneous Secure-dEed-Reflection Inducement-eState(He-SERIeS)". The proposed algorithm follows the clustering approach. The author used the learning agent to discover the route. To identify the optimal route to initiate the transmission, save and change the neighbor information in the link information database are the responsibilities of the learning agent. The link information database holds the energy of the node, queue length and bandwidth. The learning agents also instruct the valid, invalid paths and fake nodes for the data transmission. Hence the optimal path can be selected based on learning agent knowledge. Through that reduction in the routing overhead can be the result.

IV. RESULTS AND DISCUSSION

The eminent researchers analyzed the routing overhead percentage for the aforementioned techniques using Network Simulator NS2.34 with the simulation area 1000m *1000m,

number of nodes as 20 to 200, pause time as 10,20,30 Milliseconds, Network load as 512 bytes. The Routing overhead percentage achieved is listed in the Table 1.

TABLE 1: ROUTING OVERHEAD OCCURENCES IN EXISTING STRATAGIES

PROTOCOLS AND SCHEMES	Routing Overhead in Percentage	
	Performance parameters	
	MOBILITY	NETWORK LOAD
REACTIVE AND PROACTIVE PROTOCOLS		
TORA [1]	10.45	10.45
DSR[1]	7.094	7.094
OLSR[13]	5.3	5.26
OLSR SCHEME[1]	5.098	5.098
AODV[13]	5.33	5.33
GOSSIP BASED METHODS		
GOSSIP[3]	35% REDUCTION	
GBNRE-AODV[3]	2.58	2.65
NEIGHBOR KNOWLEDGE BASED METHODS		
NCPR[15]	2.88	2.88
NCPR:DPR-AODV[7]	2.34	1.70
LPNS (Compared With NCPR)[6]	Significantly LOW	
LOCATION BASED METHODS		
AOMDV[4]	9.6	-
AOMDV-DREAM[4]	5.4	-

V. CONCLUSION

This paper has discussed many of the techniques for reducing routing overhead and the analysis; results are tabulated as per the background details. As a continuation of this research in the future, a plan to further explore the performance of the Neighbour knowledge based approach route discovery in reactive routing protocols. Further, a plan to refine an analytic model for location based route discovery approaches can be designed in order to smooth the progress of the optimal exploration.

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