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Study of Routing Overhead and Its Protocols

Kiran Rampurkar, Nikhil Lavande, Santosh Shilgire and Sayali N. Mane

Abstract

Mobile Ad Hoc Network or MANET is basically a popular wireless mobile network, containing multiple nodes without any central hub or administration connecting between them. As nodes are mobile and dynamic topology, routing becomes important aspect in MANET. Routing mainly concentrates on searching the propagation link between source and destination. For node mobility in MANETs, it is quite simple link breakages or moving, hence routing becomes the crucial in Mobile Ad Hoc Networks. To find such proper link, various routing protocols are available. Mainly there are three types of routing protocols Reactive, Proactive and Hybrid also consider for analysis purpose. There are many performance metrics to check for the pros and cons of each routing protocols such as packet delivery ratio (PDR), average delay end to end delay, routing overhead, throughput etc. are also discussed here.

Keywords

Mobile Ad Hoc Networks, Network protocol, Packet delivery ratio, Performance analysis of the routing protocol, Routing protocols analysis, Wireless networking.

I. INTRODUCTION

The MANET is a unique kind of wireless portable system in which transportable/moving host can converse lacking any condition of recognized communications and be able to be used for a lot of submission [1]. MANETs or MOBILE Ad hoc networks are collection of mobile nodes those are move freely. These freely moving nodes without any fix structure are able to dynamically self organized into arbitrary topology network. Lot of direction-finding procedure, such as Ad hoc Dynamic Source Routing (DSR) and Distance Vector Routing (AODV) are useful for MANETs [2]. The Ad hoc On Demand Distance Vector (AODV) routing algorithm is a very popular routing protocol designed especially for ad hoc mobile networks.

The Dynamic Source Routing protocol (DSR) is an easy, simple, less complex and well-organized direction-finding procedure planned specially for utilize in multi-hop wireless informal system of portable nodes [3]. DSR permit the system to be totally self-organizing and self-configuring,

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devoid of the requirement for any obtainable system communications or management.

AODV is able to find the path by using both unicast and multicast techniques. AODV is an on insist algorithm, significance that it construct direct connecting nodes only as wanted by basis nodes [4]. It preserves these direct as long as they are essential by the basis. In the following section we discussed different performance analysis of the routing overhead protocol.

II. ROUTING OVERHEAD TECHNIQUES

In mobile Ad Hoc networks (MANET), breakage of the frequent links occurs due to the mobility of nodes and frequent route searching. This type of overhead route discovery can't be tolerated. But as in MANET nodes are mobile selected path for packet transmission might get interrupted [5]. This leads to rerouting of the path every time a node moves from its position. The process is explained in the following example:

Consider we have to transmit a packet from node A to node L. And the shortest possible path is given by A-B-C-G-J-D-M-L. When transmission has been started packet is sent from node A to node B. When packet reaches node C it is expected that it will send packet to the next node G.

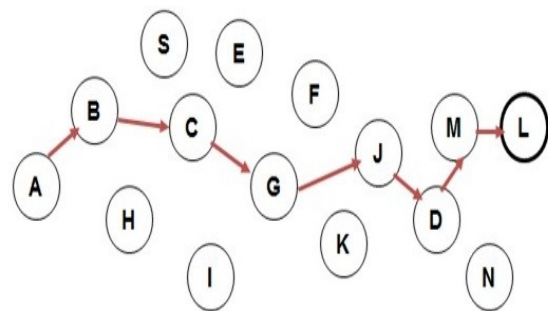


Fig.1. Original path A-B-C-G-J-D-M-L.

But as nodes are mobile consider G has travelled some



distance then G is not within the reach of C as shown in following Fig. 2. Hence path is disconnected and packet is at node C. Now path needs to be rerouted so that packet reaches node L. Node C requests node E and Node I for transmission. Consider Node E has replied with positive acknowledgment to request from Node C. Then Transmission will take place in route as shown Fig. 3.

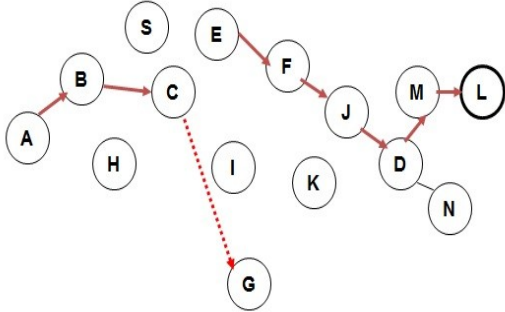


Fig.2. Breakage due to movement of node G

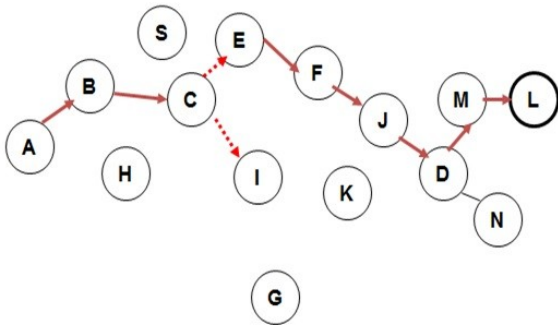


Fig.3. New route discovery A-B-C-G-I-E-F-J-D-M-L.

III. ROUTING PROTOCOLS

A. Proactive routing protocols

Here the entire nodes constantly look for direction-finding in order through in a system, consequently that at what time a direct is essential, the way is previously recognized. If one bump needs to post some data to one more knot, pathway is recognized, consequently, latency is little. Though, when there is a group of nodule faction then the price of preserve all topology information is very high. Examples (i) Optimized Link State Routing Protocol (OLSR), (ii) Destination Sequence Distance Vector (DSDV), (iii) DREAM(Distance Routing Effect Algorithm for Mobility) (iv) Wireless Routing Protocol (WRP) and (v) Cluster Gateway Switch Routing Protocol (CGSR).

B. Reactive Routing protocols

For finding the link from any source to destination a question answer type algorithm is known as reactive. Hence, the latency is high and any type of control messages are not essential. Examples (i) Ad Hoc On-Demand Distance Vector Routing (AODV), (ii) Associatively-Based Routing (ABR), (iii) Signal Stability-Based Adaptive Routing Protocol (SSA), (iv) Temporarily Ordered Routing Algorithm (TORA) and (v) Dynamic Source Routing(DSR).

C. Hybrid routing protocols

These procedures include the qualities of practical in addition to thoughtless direction-finding protocols. A cross direction-finding procedures have to make use of a combination of together practical and thoughtless approach. Therefore, in the new years, some cross direction-finding practice are planned like SHARP, ZHLS, ZRP and NAMP etc.

Examples are (i) Zone Routing Protocol (ZRP), (ii) Zone-based Hierarchical Link State Routing Protocol (ZHLS), (iii) Sharp Hybrid Adaptive Routing Protocol (SHARP)

D. DSR (Dynamic Source Routing):

The dynamic source routing shortly known as DSR protocol is a resting on steering procedure founded on basis direction-finding. In this source-routing method, a correspondent (sender) decides the accurate progression of the nodes throughout broadcast a package. The record of the intermediary nodes for steering is explicitly enclosed in the package's header. In this system each portable node in the set-up requires to keep a direct supply.

Route maintenances and root discovery are basically the two main consideration of the DSR protocol. When any host try to transmit data packet to other host, it verify its route cache for detecting a suitable route to propagate the packet the at the desired destination [6]. If the suitable root not discovered the source node again take initiative to root discovery process again.

The source node is broadcast packet which contains route request. Within its wireless transmission range all neighbour nodes received that packet. This packet mainly contains the host target address, the source address in the particular arrangement, a route recorder with a unique identifier [7]. The host node may receive a reply packet generally contain a list of all available network link nodes. All early hops sequence, initiates the route record like a list containing self information and subsequently neighbour node information appends. There are two possible processes to complete this task. The hop-by-hop acknowledgment at the data link layer configure as an early and re transmission of lost or damaged corrupt packets.

E. Ad Hoc On-Demand Distance Vector Routing (AODV)

The improve version of DSDV is AODV tough it is reactive in nature. The number of broadcasts depends on demand. It broadcasts a route request (RREQ) generate when any source node try to send a packet to a destination like a relay system. For forwarding the RREQ, intermediate nodes may keep record the address of the receiver in their route tables first copy is received. This table may used for establishing a reverse path [8]. These packets are discarded when the additional copies of the same RREQ are later received. Using same route the reply is sent back. If any intermediate node changes the same information passed by using relay process and reach the destination. Based on this information host may take re decision to restart the route discovery phase.

The primary objectives of the algorithms are: (i) To broadcast discovery packets as per requirement (ii) distinguish between local connectivity management and (iii) disseminate information about changes in local connectivity.

Broadcast route discovery mechanism is generally used by AODV. AODV basically relies on dynamically establishing route table entries at intermediate nodes. To keep the latest

routing information in the nodes we borrow the concept of destination sequence numbers from DSDV. In DSDV, each ad hoc node value monotonically increase by using sequence number counter [9]. This process increases the bandwidth by data traffic control mechanism through the responsive changes in topology and unnecessary loop.

F. TORA and DSDV

Temporally Ordered Routing Protocol i.e. TORA is a circulated extremely adaptive routing protocol considered to work in an active multichip set-up. It uses an uninformed elevation restriction to decide the route of relationship involving any two nodes for a specified goal [10]. Subsequently several direction regularly subsist for a given purpose but not any of them are automatically the express transmit. To begin the route, the host node rebroadcasted the same query packet and based on the acknowledgement it decide new route search or search for new route. The Destination-Sequenced Distance-Vector Routing protocol (DSDV) is improved version of the famous Bellman-Ford routing mechanism for achieved freedom from loops execution in routing tables.

IV. RESULT ANALYSIS

From the referred papers we conclude the following results considering the various scenarios, we can get difference in parameters for each routing protocols.

A. Performance Metrics

The performance metrics shown in Table 1, which may be consider evaluating the MANETs routing protocols as:

Average Delay: It may be consider as the average time taken to reach the destination from source, which includes all kind of possible delays due to buffering in route discovery latency, due to interface queue, re transmission delays MAC, and propagation or transfer times.

Number of packets lost: It is the droop of packets at the network layer by routers due to the buffer limitation or may be the packet buffering time go beyond the time limit.

Routing Overhead: It may be consider as the quantity of routing packets sent for maintenance and also for route discovery.

Throughput: It may be consider as the ratio of data packets received by the target receiver and the number of sent packet. This parameter should be high where

B. Routing Overhead and Packet Delivery Ratio

Following table shows how routing overhead and packet delivery ratio will change for DSR, AODV, TORA for (i) Low Mobility, Low Traffics and (ii) High Mobility and High Traffic.

If requirements of the system are less routing overhead and lesser packet delivery ratio(PDR) and system is having less mobility and low traffic, it is better to use DSR or AODV over TORA.

If requirements of the system are less routing overhead and lesser packet delivery ratio (PDR) and system is having High mobility and high traffic which most MANETs have, it is better to use DSR or TORA over AODV [11]. TORA generally used where PDR is essential.

C. Average End to End Delay and Optimum path:

Following table shows how Average End to End Delay and Optimum path will change for DSR, AODV, TORA for Low Mobility and Low Traffics and High Mobility and High Traffic.

Table 1. Comparisons between DSR, AODV and TORA in different traffic condition

| Traffic Condition | Property | Protocol | | |
|--------------------------------|------------------|----------|-----------|----------|
| | | DSR | AODV | TORA |
| Low Mobility and Low Traffic | Routing Overhead | Low | Low | Average |
| | PDR | High | High | High |
| | Avg. E-E Delay | Moderate | Moderate | Low |
| | Optimal Path | Average | Very good | Good |
| High Mobility and High Traffic | Routing Overhead | Average | Very High | High |
| | PDR | Average | Average | Low |
| | Avg. E-E Delay | Average | Average | More |
| | Optimal Path | Less | Moderate | Moderate |

If requirements of the system are less Average End to End delay and optimal path and system has low mobility and less traffic then AODV or TORA can be used over DSR. As AODV can be used where getting optimum path is primary requirement of the system while TORA can be used where end to end average delay is primary concern. If requirements of the system are end to end delay is minimum and optimal path and system has high mobility and high traffic. Then DSR routing protocol should be preferred over AODV and TORA. There are some benefits and limitations in the DSR procedures. There is no requiring to maintain map-reading chart therefore a given information package as the whole way is controlled in the packets header which is one of the important benefits of DSR protocol. On the other hand there is not scalable to big system and still want considerably extra dispensation funds than the majority of the other protocols which is the main restriction of DSR protocol.

V. CONCLUSIONS

To minimizing routing overhead is main aim of the system following protocols should be used. When numbers of nodes are less AODV has lesser routing overhead as compared to DSDV. But as the number of nodes start to increase overhead in AODV increases proportionally as compared to overhead in DSDV. Because the AODV is generally a demand based routing protocol routing overhead increase when the node element increases. TORA has worst performance for routing overhead in comparison with other whereas DSR has best performance for routing overhead problem.

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