An optimized approach over hybrid scheme through removing unidirectional links

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Abstract- **Mobile ad-hoc networks (MANET) are those networks which do not have any infrastructure. Mobile ad-hoc network is autonomous system of mobile node connected by wireless links. The mobile nodes are free to move about and organize theme selves in to a network. Ad-hoc network do not have any centralized server. Therefore routing in mobile ad-hoc network is challenging task and this has lead to the development of many difference routing protocols. MANET is a self configured dynamic network comprising of mobile nodes, where each and every node voluntarily transmit the packet to some other node using wireless transmission. Which can support multi-hop wireless communication through routing protocols with proactive, reactive or hybrid schemes. In this paper proposed an optimized approach over hybrid scheme through removing unidirectional links and relieving blindly broadcast of route discovery packets over mobile nodes and Internet gateway which impact correctness and efficiency of connectivity so much. Simulation show keeping the overhead low the improved performance of packet delivery.**

Keywords- **Mobile ad-hoc network (MANET), Dynamic sequence distance vector (DSDV), optimized link state routing (OLSR), Ad-hoc on-demand Distance vector (AODV), Dynamic source routing (DSR), Hybrid routing.**

General Terms- **This paper is subjected to the mobile routing protocol on ad-hoc network, Reactive, Proactive and Hybrid.**

I. INTRODUCTION

Mobile ad-hoc network (MANET) [1] is a wireless network which is created dynamically without the use of any existing network infrastructure or centralized administration. A wireless network is a growing new technology that will allow user to access service and information electronically irrespective of their geographic position. Routing protocol implementation for mobile ad-hoc networks has become increasingly abundant, but experiences from real world scenarios are still limited. A mobile unit which is mobile communicates to nearest base stations. When it moves out of the coverage area of one base station, a process called hand-off and it comes in the coverage area of other base stations. So the effective connectivity to Internet gateway (IGW) gives MANETs routing protocols more challenge because of unidirectional links and broadcast storm of current routing algorithm. Mobile Ad-hoc Networks (MANETs) are multi-hop ad-hoc wireless networks which can provide convenient infrastructure-free communication. So an effective approach to Internet connectivity becomes one of the key points to enable the use of MANETs in the future.

In this paper, problem analysis of current schemes Section 2, an optimized approach Section 3, Simulation results Section 4, Conclusion and future work Section 5.

II. PROBLEM ANALYSIS

Currently two classes of approaches have been proposed to support connectivity between MANETs and Internet, Reactive schemes routing protocols are more popular routing algorithms and are also called "on-demand" protocols, In a reactive routing protocol, routing paths are searched only when needed. When a source node wants to send packets to the destination but no route is available, it initiates a route discovery operation. The MNs to broadcast solicitation (RREQ-I) to find IGW when they need, IGW will send a unicast GWADV which creates reverse route on its way back to the originator. Such approaches decrease the overhead of maintaining connectivity to external but negatively result in larger packet delay. Examples of reactive protocols are DSR [2], and AODV. Proactive schemes is also called "table driven" routing protocol [3]. A proactive routing approach every node always maintains completes routing information of the network. Using a proactive routing protocol, nodes in a mobile ad-hoc network continuously evaluate routes to all reachable node sand attempts to maintain consistent, up-to-date routing Information. [2]

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flood routing advertisements (GWADV) periodically from nodes acting as IGW throughout the whole Ad-hoc network and base on assumption that route to IGW is the reverse direction of GWADV message, Such approaches provide good connectivity, but impose a high overhead especially when not all the mobile nodes (MNs) in the Ad-hoc network require external connectivity. Examples of proactive protocols are OLSR [3], and TBRPF [4]. A hybrid approach [8] combines the advantages of both proactive and reactive schemes, which GWADVs are flooded within a limited number of hops from IGW and nodes outside the hop limit use reactive techniques to solicit IGW, This scheme provides good connectivity while keeping overhead costs low but lack of adaptive to network scale.

On broadcast mechanism to provide MNs with multi-hop path to gateways, nodes will rebroadcast those packets blindly and result in broadcast storm problem [7]. For example, in Figure 1, node F, C and E should not rebroadcast their first heard GWADV packets because their broadcasting cannot provide additional coverage.

On the other hand global route (route to IGW) and local route (route in MANETs) computation of existing approaches rely on assumption that all links are symmetric (i.e. bidirectional), however heterogeneous nodes and interference over wireless channel will cause the asymmetric links (i.e. unidirectional) very common. If no additional actions are taken to remove unidirectional links from route computation, the performance of hybrid Ad-hoc networks will be affected negatively. For example, due to the unidirectional link between IGW and node A in Figure 1, the reverse path established by node A as a response of receiving GWADVs originated by the IGW is not valid. Furthermore, if node H receives the GWADVs rebroadcast by node A, it will draw the conclusion that there is a 2-hops path to the gateway and 3-hops global route via node G will be refused. Without taking unidirectional links into consideration, H loses the chance to access Internet.

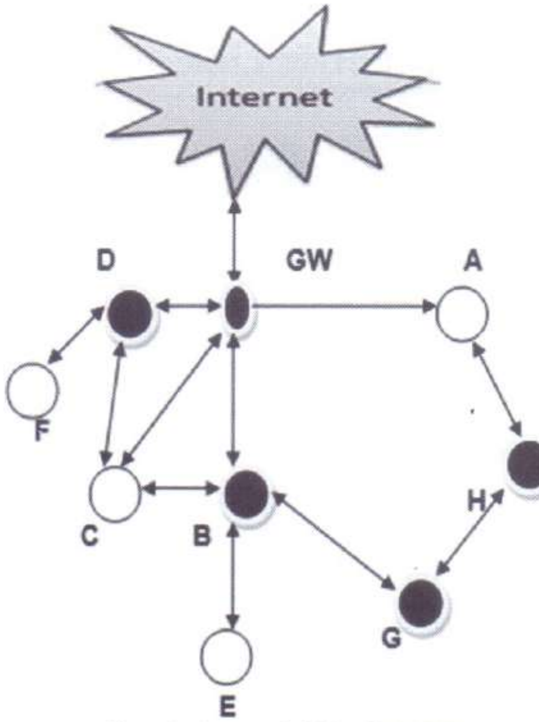

Figure 1. Asymmetric links of MANETs

III. OPTIMIZED GATEWAY DISCOVERY APPROACH

In the approach, MNs will broadcast RREQ-I to retrieve route information when accessing Internet in case they can't get route information from adaptive broadcasting GWADV packets of IGW [8]; ADOV HELLO packets are also optimized to separate neighbor list as symmetric neighbor list and asymmetric neighbor list, which can be used to compute unidirectional links. Based on problem analysis in section 2, an optimized hybrid approach which will enhance AODV against unidirectional links and blindly broadcast is responsible for establishing route for MNs and IGW.

3.1. Additional Data Fields

Source Node List: Each IGW will maintain source node list (SNL) for MNs which maintain its hop number from IGW to each MN. Obviously each MN should broadcast RREQ-I to specify its demand at first time and IGW will update related MN information into SNL, each item in SNL will be invalid because of lifetime timeout. Neighbor Node Cache: Each MN, say x, maintains a Neighbor Node Cache (NNC) which include Symmetric Link, Share Neighbor, lifetime and other fields to store its local connectivity information. The rules are as follows:

R1: When x receives a HELLO packet originated by another node, say h, it creates an entry for h in its NNC with the IP address of h (If this entry has existed, it will be updated).

R2: Symmetric Link field indicates whether the wireless link between x and h is symmetric in case x will find its IP in HELLO packets from h. If this link is symmetric, node x defines node h as its symmetric neighbor, otherwise, asymmetric neighbor.

R3: If h is one of its symmetric neighbors, x will set Share Neighbor field of node h if x has different symmetric neighbors besides symmetric neighbors of x.

R4: the Lifetime represents the minimum period that x must receive HELLO packets from h.

3.2. Removing Asymmetric Links and Relieving Blindly Broadcast

As in Figure 1, node D will add the gateway in a NaA because it does not find itself in the HELLO packet originated by the gateway. Later when node A receives GWADV from the gateway, it discards the GWADV to avoid forming a reverse path to the gateway with unidirectional link. This gives a chance for GWADV from an alternative path (e.g., via H in Figure 1)

The basic idea of using HELLO packets to relieve broadcast storm is: Node x will rebroadcast a broadcast packet from h only when it believes that there exists at least one symmetric neighbor not received the packet yet, in other words the Share Neighbor field of h in x' s NNC is set. The rules are as follows:

S1: Upon node x receiving a broadcast packet P

from one of its neighbor, say h, node x will judge

whether this is a duplicate packet from node h based on pair of source IP and broadcast ID. If yes, drop it, otherwise proceed S2.

S2: x checks its NNC to learn whether h is symmetric neighbor. If yes, proceed to S3, otherwise drop it.

S3: x checks whether x owns symmetric neighbor

which not owned by h, if yes, broadcast it, and otherwise drop it.

We can also relieve broadcast storm in following ways: (1) using Piggybacking technology to fetch HELLO; (2) only active MNs will broadcast HELLO; (3) HELLO packet will send at different time as other broadcast packet to decrease collision.

There are two main reasons to classify all neighbors into symmetric neighbors and asymmetric neighbors. The conclusion can be drawn that unless the neighbor set include in HELLO packets is classified into symmetric neighbors and asymmetric neighbors, it is impossible to accomplish the discovering unidirectional links and relieving broadcast storm.

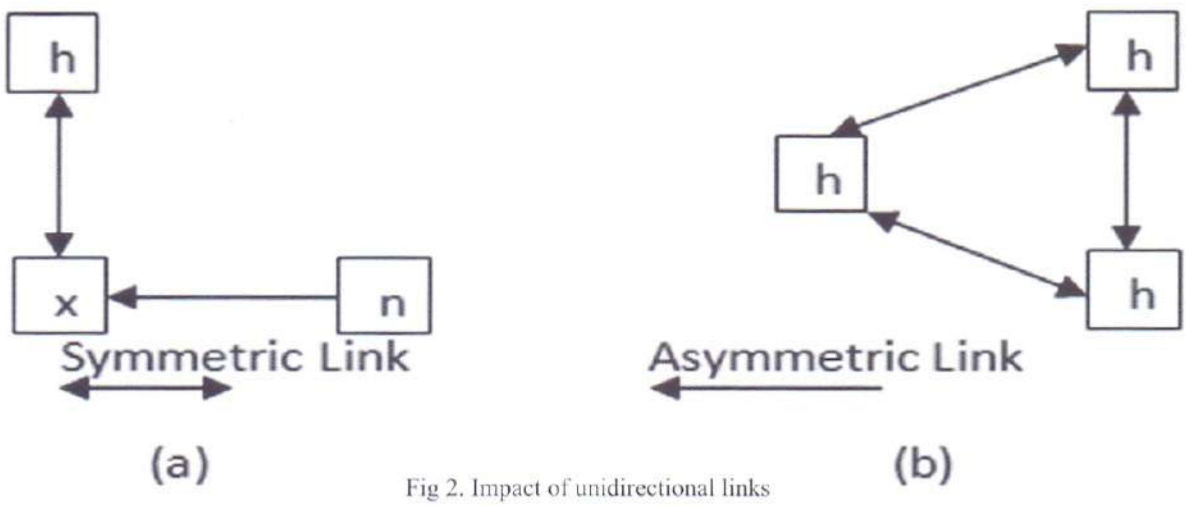

Fig 2. Impact of unidirectional links

IV. OBSERVATIONS

Under varying number of unidirectional links and node speeds, the performance of following metrics has been evaluated,

Broadcast Control Overhead: The total transmission number of control broadcast packet. Each hop forward of a control packet is counted as one transmission.

Packet delivery fraction: The number of data packets received by the destination compared with the number of data packets generated by the source.

End-to-end packet delivery latency: The average delivery delay of the data packets from the source to the destination.

V. CONCLUSIONS

Cooperated with adaptive coverage policy of gateway discovery packets and optimized HELLO broadcasting algorithm, it will provide better performance over Internet connectivity with unpredictable location and mobility of MNs and as well as Internet access demand.

The future direction will consider multi-path approach to improve the performance and QoS of Internet connectivity for MANETs.

Simulation results show that with symmetric neighbor lists and asymmetric neighbor lists in AODV HELLO packet, the optimized gateway discovery approach remove the unidirectional links from route computation and relieve broadcast storm because of blindly broadcasting of gateway discovery packets.

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