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RESEARCH ARTICLE

Prediction of Next Mobile Access Gateway (MAG) in Proxy Mobile Internet Protocol Version 6 (PMIPv6)

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Abstract: Proxy mobile IPv6 (PMIPv6) is a network based mobility management protocol. There are three entities Local Mobility Anchor (LMA) Mobile Access Gateway (MAG) and Authentication, Authorization, and Accounting server: (AAA) required for the proper functioning of PMIPv6. Many of researchers have worked on reducing handover delay by sending MN authentication information directly from current MAG to new MAG but how this new MAG is anticipated is not shown in any of those researches. This paper proposes method to anticipate the new MAG so that handover delay should be reduced. In proposed methodology, MAG is enhanced with respect to functionality so it is renamed as eMAG. (where e stands for enhanced).

Keywords:- Local Mobility Anchor, Mobile Access Gateway, Handover Delay, LOC packet

I. INTRODUCTION

In past few years of technology, mobility gained a lot of attraction in terms of allowing the users to use the resource while roaming. The roaming facility is provided to the users using mobile IP. The difficult issue for the engineering is to maintain the connectivity during the change of Point of attachment (PoA). There are two models to support the mobility, i.e Network-based and Host based. In Network based mobility models, Mobile Node (MN) can continue their IP sessions as they shift from one PoA to another without the participation of MN in the signaling or management of their movement. This makes the MN oblivious of its mobility. This reduces the complication and cost of MN. IP mobility for nodes that have mobile IP client functionality in the IPv6 stack as well as those nodes that do not, would be supported by enabling Proxy Mobile IPv6 protocol. Therefore it enhances compatibility and interoperability between various systems and user equipments. In contrast, in host-based mobility model MN should support Mobile IP to continue their IP sessions while moving from one PoA to another. In this mobility model MN actively participate in the handover management, which includes sensing the new point of attachment, sending binding updates to Home Agent (HA) and correspondent Node (CN) and so on. In comparing to network based mobility model, host based model increases the complication of Mobile node and compatibility with other network entities.

II. PMIPv6

II.1. Short Description of PMIPv6:

PMIPv6 uses the proxy mobility agents in the network to keep track of the MN's attachments and detachments and then signal this information, in the form of binding updates without the active involvement of the MN itself. This scheme defines two core functional elements *Local Mobility Anchor (LMA)* and *The Mobile Access Gateway (MAG)*. When MAG senses MN in its area it confirms MN's authenticity using policy profile. This policy profile is stored at central server called as Authentication, Authorization and Accounting (AAA) server.

II.2. Operation of Proxy MIPv6:

Figure 1 shows there are two core functional entities in the PMIPv6 which are LMA and the MAG[2]. The LMA is responsible for maintaining the MNs reach-ability state and is the topological anchor point for the MNs home network prefix. The mobile access gateway is the entity that performs the mobility management on behalf of a MN and it resides on the access link where the MN is anchored.

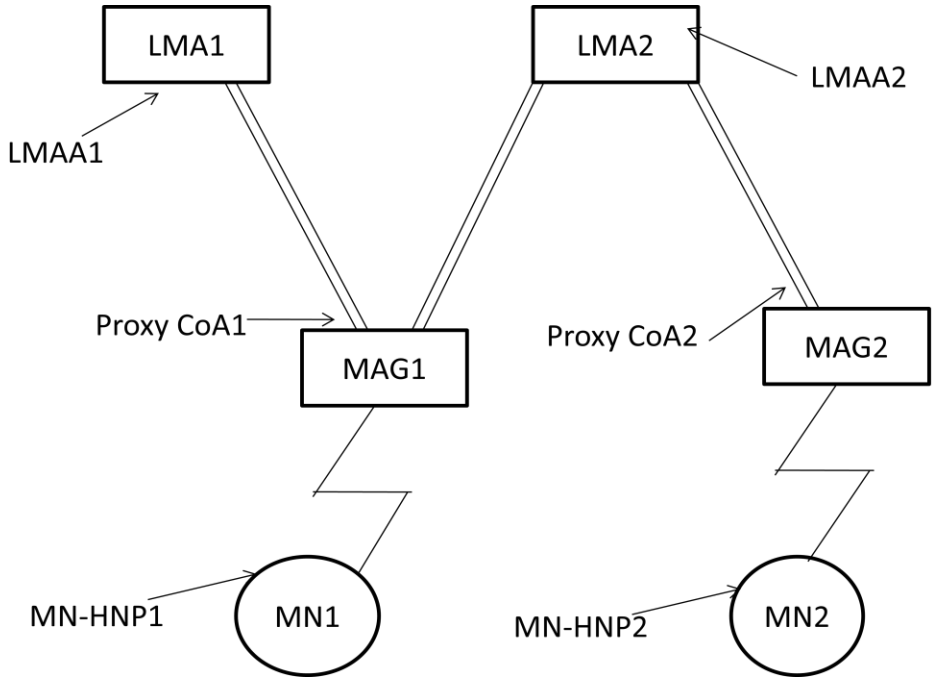

Figure 1: Proxy Mobile IPv6 Domain

Following are the steps in involved in proper working of PMIPv6[8].

1. The Router Solicitation message from the mobile node may arrive at any time after the mobile node's attachment and has no strict ordering relation with the other messages in the call flow.
2. For updating the local mobility anchor about the current location of the mobile node, the mobile access gateway sends a Proxy Binding Update message to the mobile node's local mobility anchor.
3. Upon accepting this Proxy Binding Update message, the local mobility anchor sends a Proxy Binding Acknowledgement message including the mobile node's home network prefix. It also creates the Binding Cache entry and sets up its endpoint of the bi-directional tunnel to the mobile access gateway.
4. The mobile access gateway on receiving the Proxy Binding Acknowledgement message sets up its endpoint of the bi-directional tunnel to the local mobility anchor and also sets up the forwarding for the mobile node's traffic.
5. At this point, the mobile access gateway has all the required information for emulating the mobile node's home link. It sends Router Advertisement messages to the mobile node on the access link advertising the mobile node's home network prefix(es) as the hosted on-link prefix(es).

6. The mobile node, on receiving these Router Advertisement messages on the access link, attempts to configure its interface using either stateful or stateless address configuration modes, based on the modes that are permitted on that access link as indicated in Router Advertisement messages. At the end of a successful address configuration procedure, the mobile node has one or more addresses from its home network prefix(es).
7. After address configuration, the mobile node has one or more valid addresses from its home network prefix(es) at the current point of attachment. The serving mobile access gateway and the local mobility anchor also have proper routing states for handling the traffic sent to and from the mobile node using any one or more of the addresses from its home network prefix(es).
8. The local mobility anchor, being the topological anchor point for the mobile node's home network prefix(es), receives any packets that are sent to the mobile node by any node in or outside the Proxy Mobile IPv6 domain. The local mobility anchor forwards these received packets to the mobile access gateway through the bi-directional tunnel.
9. The mobile access gateway on other end of the tunnel, after receiving the packet, removes the outer header and forwards the packet on the access link to the mobile node. However, in some cases, the traffic sent from a correspondent node that is locally connected to the mobile access gateway may not be received by the local mobility anchor and may be routed locally by the mobile access gateway.
10. The mobile access gateway acts as the default router on the point-to-point link shared with the mobile node. Any packet that the mobile node sends to any correspondent node will be received by the mobile access gateway and will be sent to its local mobility anchor through the bi-directional tunnel.
11. The local mobility anchor on the other end of the tunnel, after receiving the packet, removes the outer header and routes the packet to the destination. However, in some cases, the traffic sent to a correspondent node that is locally connected to the mobile access gateway may be locally routed by the mobile access gateway.

III. PROPOSED WORK

Consider the scenario in which MN is attached to central MAG and that MAG is surrounded by eight other MAGs one on each side. To reduce handover delay authentication information of MN is to be sent to next MAG to which MN will get attached. Whenever, link between MAG and MN will be going down, current MAG will send authentication information of MN to new MAG. But in this case there will be more than one MAGs are present. So to send authentication information of MN to new MAG, it becomes necessary to anticipate new MAG first.

III. 1. Proposed Methodology

a. To predict next MAG, it is required that current MAG should be able to detect movement of MN.
b. For this, MAG should be able to track the locations of MN time to time. This can be achieved by enabling MN to send its locations to MAG on timely basis (Say one packet per 2 minutes).
c. So there is need to introduce new packet called LOC which is used by MN for sending its locations to MAG.
d. MAG will receive number of LOC packets. MAG needs to store these packets in buffer called as LOC buffer.
e. As MN will be sending one LOC packet every minute, buffer may get full in very short period of time.
f. To overcome this problem, older data of LOC buffer can be deleted as they show stale location of MN.
g. When current MAG finds that link between MN is going down, it can track the direction of movement of MN, by using x, y co-ordinates(in NS-2) which are present in entries stored in LOC buffer of particular MN.
h. Once direction is recognized it can be utilized to predict the next MAG to which MN may attach.
i. After prediction of next MAG, current MAG can send the authentication information of MN to predicted next MAG using packet AIMN (newly introduced).
j. After handover, when MN attaches to next MAG, MAG doesn't need to contact LMA for getting authentication information of MN (as in working of PMIPv6) as it is already available at MAG.
k. As after getting attached to new MAG, MN doesn't need to wait for authentication procedure as this new MAG already has authentication information of MN which leads in reducing the Handover delay.
l. As soon as this MN will get attached to new MAG, MN will be able to send/receive packet to/from corresponding node.

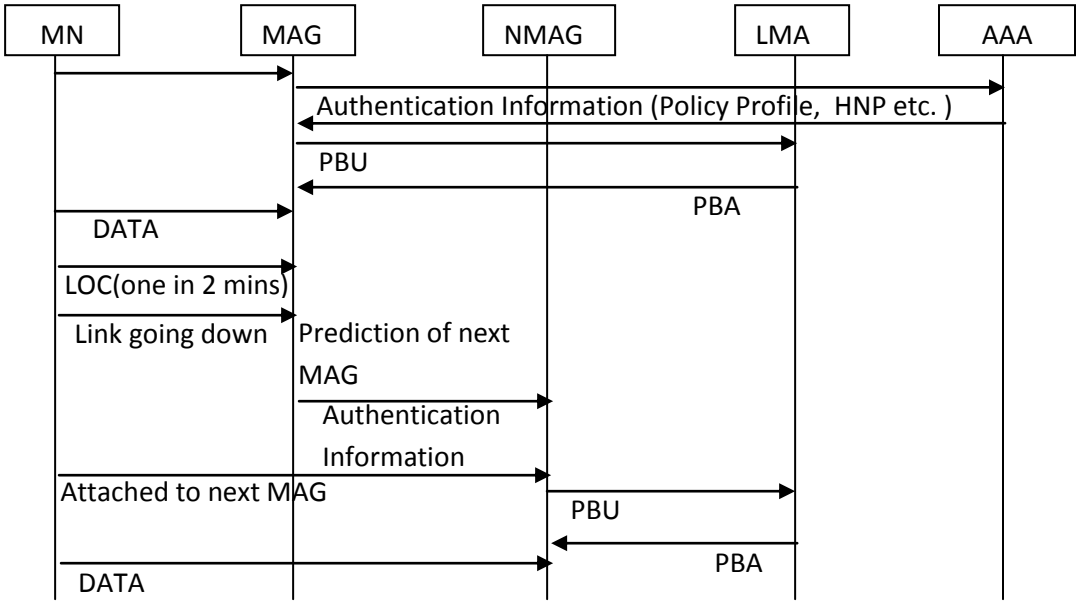

Figure 2: Proposed Methodology

IV. THEORETICAL JUSTIFICATION

In PMIPv6, when MN gets attached to MAG, MAG has to get authentication information from AAA server. If MN is authenticated then it sends PBU to LMA which sends PBA back to MAG and tunnel is established between MAG and LMA.. MN will be able to communicate in network only after MAG receives PBA from LMA i.e. at time t3 (in figure 3(a)). Whereas in case of eMAG, when MN gets attached to eMAG, eMAG also has to send PBU to LMA but eMAG would have already got authentication information of MN from previous MAG. MN will be able to communicate in network as soon as it gets attached to eMAG i.e. at time t2(in figure 3(a)). So handover delay in normal working of PMIPv6 is t3-t1. Whereas handover delay in proposed methodology of PMIPv6 is t2-t1. As t3>t2, t3-t1 > t2-t1.

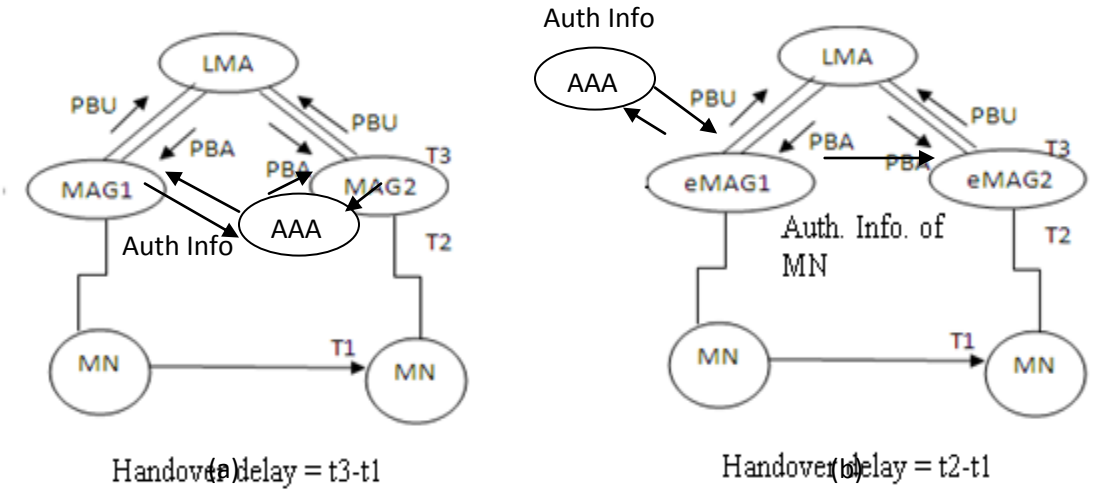

Figure 3: Comparison of working of MAG and eMAG

V. CONCLUSION

Proxy mobile IPv6 (PMIPv6) is a very promising network based mobility management protocol. There are three entities *Local Mobility Anchor* (LMA) *Mobile Access Gateway* (MAG) and *Authentication, Authorization, and Accounting server:* (AAA) required for the proper functioning of PMIPv6. Many of researchers have worked on reducing handover delay by sending MN authentication information directly from current MAG to new MAG but how this new MAG is anticipated is not shown in any of those researches. This paper proposes how to anticipate the new MAG so that handover delay should be minimized. For this new packet LOC will be introduced in PMIPv6 which will be sent by MN to MAG containing x,y co-ordinates of location of MN.

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