Volume 5, No. 1, Jan-Feb 2014

ISSN No. 0976-5697

International Journal of Advanced Research in Computer Science

RESEARCH PAPER

Available Online at www.ijarcs.info

Optimizing handover performance for heterogeneous wireless networks in pmipv6

A.Prithiviraj
Assistant Professor,
Computer Science and Engineering,
Sona College of Technology, Salem.
prithivipranav@gmail.com

Dr.K. Krishnamoorthy
Head of the Department,
Computer Science and Engineering,
Sudharshan College of Engineering, Pudhukottai.
kkr_510@yahoo.co.in

K.Jaya Bharathy*
Computer Science and Engineering,
Sona College of Technology, Salem.
jayabharathy444@gmail.com

Abstract: In heterogeneous wireless environment, vertical handover is needed for supporting seamless mobility (i.e.) moving from one network to another network. Recently, a mobility management protocol called Proxy Mobile IPv6 (PMIPv6) is a Network based that has received much attention in Next generation IP mobile networks. PMIPv6 does not require a mobile node to participate in any of the mobility related signaling. During handover process in heterogeneous networks, a packet loss and handover latency problem occurred increasingly. However there are many existing methods to overcome these problems but still it's a challenging task. The proposed work concentrate on PMIPv6 domain where the packet loss can be reduced by buffering scheme at MAG's and the handover process is made rapidly by moving the data between two MAGs so that the latency will be reduced. Moreover the False Handover Initialization will be avoided by multicasting the data packets to both previous and new access devices where the out-of-packet sequence problem also reduced.

Keywords: PMIPv6, vertical handover, packet loss, latency, Multicast, Heterogeneous network.

I. INTRODUCTION

Nowadays, a number of mobile users have increased rapidly. Various wireless technologies such as WiFi, WLAN and WiMAX provide services to ensure continuous connectivity with lower handover delay. Recently many internet protocols has been standardized by IETF [1] which mainly addressing the issues of reducing the packet loss and handover delay.

Two categories of these protocols [9] are Host based protocols and Network based protocols. In Host based protocols, the mobile nodes require a stack modification where the mobile nodes are involved in mobility related signalling. Since in Network based protocols stack modification in mobile nodes are not needed.

In Mobile IPv6 (MIPv6) [5], a host based protocol the mobile node (MN) likes to change its point of attachment while moving from one network to another network or from one subnet to another subnet. When MN moves to new network it acquires an IPv6 address either by using stateful or stateless configuration then this address becomes the care-of-address. After that MN sends a binding update message to the home agent in the home network where the message contains care-of-address and home address of MN. After receiving the binding update message the home agent updates its cache table. Then the correspondent node (CN) sends the packet to the MN, home agent intercepts and encapsulates the packet and send it to foreign agent, where the foreign agent in the new network decapsulates and deliver the packets to MN. MIPv6 solves the IP mobility issues but still it affects from performance such as handover delay, signaling overhead and packet loss.

In Hierarchical Mobile IPv6 (HMIPv6) [4] [6], a host based protocol the whole Internet is split into regions where each region is managed by a separate access routers which provides connection to internet. When MN needs to enter into a new region, two addresses are needed to configure they are Regional care-of-address and OnLink care-of-address. Due to this configuration more processing and message signalling are needed to achieve it.

Fast handover for Mobile IPv6 (FMIPv6) [5][6] is another extension for MIPv6 come out to reduce the handover delay and the service disruption that occurs when the MN changes its point of attachment. The idea at the back of FMIPv6 is to rapidly detect the movement of MN. But during handover the Fast Binding Update message can be lost and not processed by Previous Access Router, yet when the MN has left its point of attachment.

Proxy Mobile IPv6 (PMIPv6) [1][6] [7] is a Network based protocol where the current network manages the mobility on the behalf of mobile node (MN).In PMIPv6 two main entities responsible for mobility to the MN are Local Mobility Anchor (LMA) and Mobile Access Gateway (MAG).LMA is responsible for managing the current state of MN which is similar to home agent in MIPv6.Then the MAG is responsible for maintaining and detecting the MN's movement and also act as the connection point between the mobile node(MN) and Network. Handover [8] is a process that provides the continuity of service without any disruptions in network.

Handover is performed either in Horizontal or vertical handover [9] process. The Horizontal handover is mainly used for Homogeneous wireless networks and vertical handover is mainly used for Heterogeneous wireless networks. Types of vertical handover process are Hard &Soft handover, Upward &Downward handover, Mobile Controlled &Network Controlled handover and Imperative &Alternative handover.

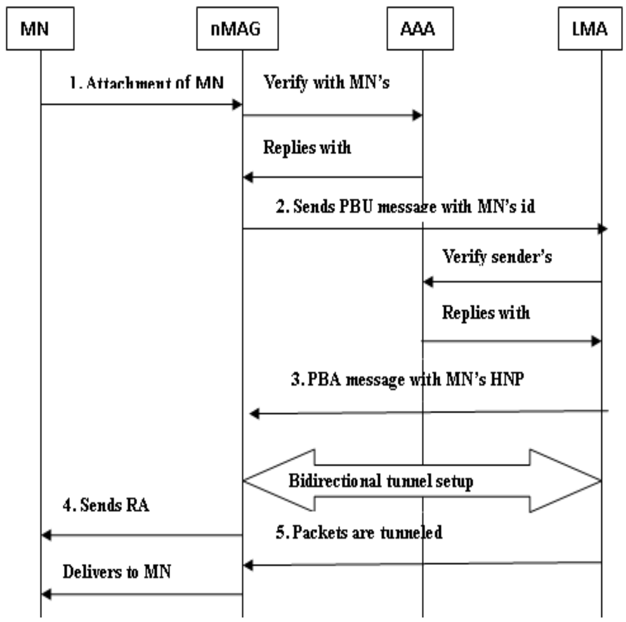

Figure1. Message signalling flow of basicPMIPv6

II. RELATED WORK

The basic handover operation in PMIPv6 [2] is shown in Fig 1 when MN moves from pMAG to nMAG is as follows

a. When MN find its attachment to nMAG, it knows the MN's ID after successful authentication and nMAG obtains a MN's identifier,its LMA address and address configuration mode.
b. The nMAG sends PBU message to the LMA along with MN's ID.
c. The LMA receives the PBU message and check with the AAA server to ensure that the sender is authorized and AAA server replies back to LMA with PBA message along with MN's HNP option and establishes a tunnel to nMAG.
d. The nMAG sends a RA message to MN.
e. Data packets from CN are tunneled from LMA to nMAG and then deliver it to MN.

Fast Handover mechanism of PMIPv6 [3] was proposed by Lei J and X.Fu. In this method handover delay is reduced but a bandwidth resource is wasted.

Moneeb Gohar et al. [10],uses the Multicast Handover Agent (MHA) to reduce the packet loss and handover latency but unnecessary transmission of data occurs.

V.Berlin Hency and D.Sridharan propose [4] the multicast supported fast handover where data packets can be multicasted to both pMAG and nMAG instead of tunnel establishment so that bandwidth resource wastages can be reduced.

The steps involved are as follows

a. When MN attaches to nMAG, nMAG obtains MN's id and its address,then it is authenticated using the identity.
b. nMAG sends PHI message to pMAG and also sends the multicast address to LMA.
c. After receiving the PHI message and pMAG replies with proxy Acknowledgement (PA) message with MN's id,LMA's address and MN's HNP option to nMAG.
d. After receiving multicast address, LMA multicast the subsequent packets to both pMAG and nMAG.

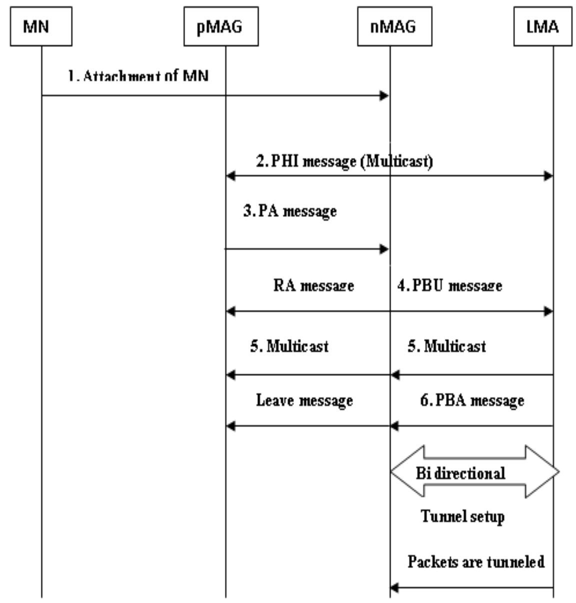

Figure 2. Message Signaling Flow of Multicast supported PMIPv6

e. On receiving the proxy Acknowledgement (PA) message, nMAG sends RA message to MN and also sends PBU message.
f. LMA updating its binding cache entry and replies with PBA message to nMAG and also setup a tunnel with nMAG. Then LMA sends a LEAVE message to pMAG.

A. *Proposed Work:*

PMIPv6 is a Network based protocol, does not involve the Mobile Node modification for mobility operations. It uses a entities like Multicast Manager (MM), Mobile Detecting Device (MDD) and Authentication, Accounting and Authorization (AAA) server. It performs handover between two PMIPv6 domains where the data from Correspondent Node (CN) is transferred through Multicast Manager is shown in Fig 3.

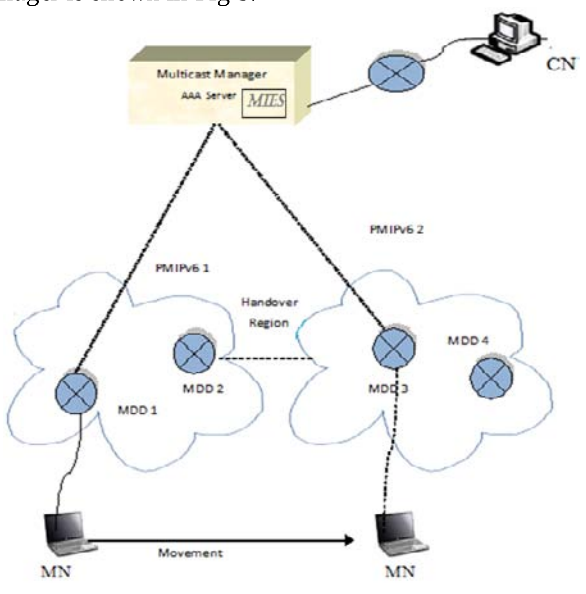

Figure 3 Architecture Design

The Multicast Manager (MM) acts as a server between the two PMIPv6 domains. Mobile Detecting Device (MDD) act as a role of both Local Mobility Anchor (LMA) and Mobile Access Gateway (MAG) which are responsible for tracking the movements of mobile node based on the mobility related signaling and also updates the current location of the mobile node using its MN's ID and MN's Home Network Prefix (HNP).

During handover process between heterogeneous networks False Handover Initiation occur because the current Handover process becomes false when the Received Signal Strength (RSS) from the PBs is greater than the current Bs. The MN moves back to the PBs so that Handover Initialization can be false which resultant in unsuccessful Handover. Packet loss and packet out of sequence problem can occur. To avoid this issue Multicast Manager sends data packets to both Previous Mobile Detecting Device and new Mobile Detecting Device (MDD) through multicasting.

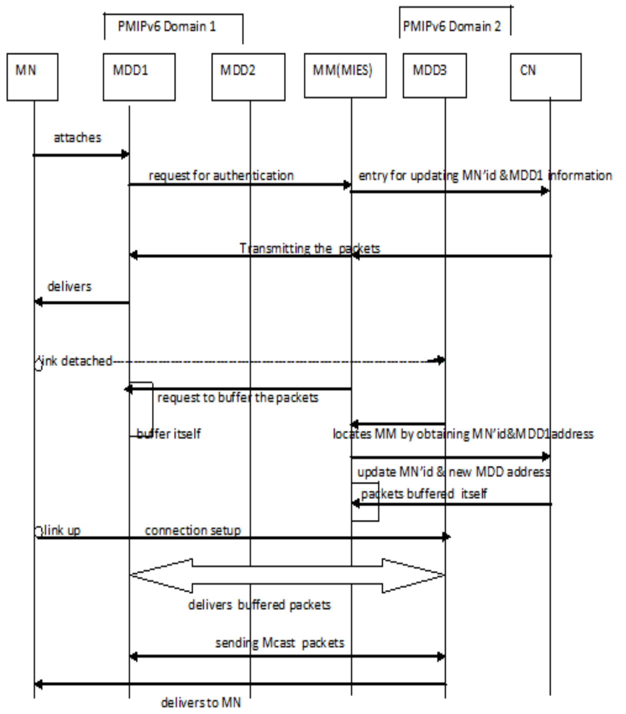

Figure 4. Message signaling flow of proposed Algorithm

Steps:

The message Signaling flow of the proposed handover for PMIPv6 is shown in Fig 4 involves the following steps such as,

a. When MN is attached to MDD1 in PMIPv6 1 domain and MDD1 sends a request for authentication using its MN id and MDD1 address to Multicast manager.
b. Multicast manager sends a request to correspond node (CN) to entry for updating a MN's current location.
c. CN transmitting packets to Multicast manager and then MM transmitting packets to the MDD1 and MDD1 delivers a packet to MN.
d. During Link detached event, a MN finds its attachment with MDD3 in PMIPv62 domain.
e. Milticast Manager sends a request message to MDD1 to buffer a packet itself.
f. While obtaining MN'id and previous MDD1 address, the MDD3 finds it's locate in Multicast manager and Multicast manager contains the information about all MDD's and their configuration mode option.
g. Then MM sends a request to CN to updates its MN'id and MDD3 address , then packets transmitting from CN to Multicast Manager are buffered by itself in Multicast manager.
h. After a link connection setup to MN and MDD3, the buffered packets in the previous MDD1 are delivered to the MDD3 through bidirectional tunnel.

The Multicast manager delivers buffered packets to both the previous MDD1 and the current MDD3 through Multicasting. And finally MDD3 delivers packets to the MN.

III. PERFORMANCE ANALYSIS

A. Packet loss:

Defines the packet lost that are sent to the mobile node during handover. In network based protocols, PMIPv6 packet loss will be reduced using various techniques but still it's a challenging one. We avoids packet loss by buffering the packet at MDD and Multicast Manager(MM) to handover the packets as soon as possible to the mobile node and the packet out of sequence problem can also be reduced.

B. Latency:

Defines that the delay that happens over transmission in IPv6 Domain. PMIPv6 reduces the latency by MIH (Media Independent Handover) services. The Handover Latency can be calculated as follows,

$$HL = T_{LS} + 2T_{AAA} + T_{RS-RA} + T_{REG} \quad \text{.................. (1)}$$

is the handover latency for basic PMIPv6.

$$HL = T_{LS} + T_{AAA,MM} + T_{RS-RA} \quad \text{.............. (2)}$$

is the handover latency for proposed algorithm.

C. Link Switching Delay:

Link switching delay defines the delay that happens during layer2 (i.e.) that the mobile node attaches to the network when the handover is imminent and detaches from the network after completes the handover.

$$T_{LS} = T_{MN_{Detach}} + T_{MN_{Attach}}$$

D. Router Solicitation and Router Advertisement Delay:

$$T_{RS-RA} = T_{MN-MDD}$$

Router solicitation and router advertisement delay is between advertisements that are sent to the mobile node after it get connected to MDD. It defines the delay that the HNP (Home Network Prefix) that are sent to the mobile node from MDD.

E. Authentication Latency:

$$T_{AAA} = 2 * (T_{MN-MDD-MM})$$

It defines the delay between the MN and the MDD for authentication. Each and every MN should be authenticated from Multicast Manager (MM) before performing handover. This delay will be continues before authentication and after authentication

F. Registration Latency:

$$T_{REG} = T_{MN-MDD}$$

Registration latency is the delay between the mobile node and the MDD. Where the mobile nodes have to register its information to the corresponding MDD. MDD collects all the mobile node information like its MN-ID, HNP.

Fig 5 shows the handover latency comparison of basic handover in PMIPv6, multicast supported fast handover in PMIPv6 and the proposed handover method. In Fig, we clearly have seen that handover latency of the proposed method is lower than that of other 2 methods.

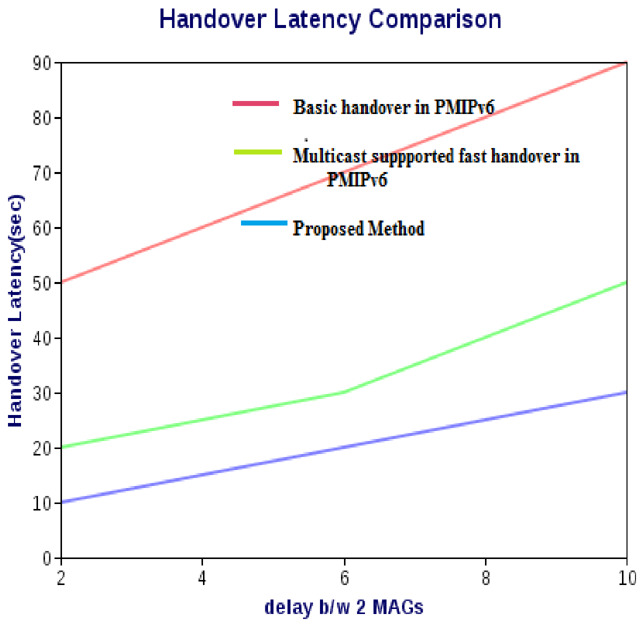

Figure: 5

Fig 6 shows the packet loss comparison of basic handover in PMIPv6, multicast supported fast handover in PMIPv6 and the proposed handover method. In Fig, we clearly have seen that packet loss of the proposed method is lower than that of other 2 methods.

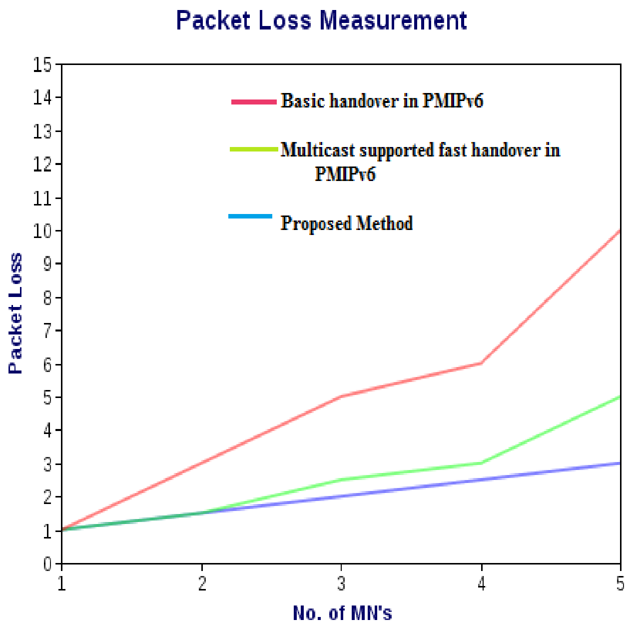

Figure: 6

IV. CONCLUSION AND FUTURE WORK

In PMIPv6 domain, packet loss will be reduced by buffering scheme and by delivering multicast packets to both previous access device and a new access device in the heterogeneous networks. Disordering of packet sequence and Handover latency occurred during a false handover initiation can also be reduced. The future work may include, considering more than two heterogeneous networks and transmitting data between them, and to develop the seamless handover mechanism for real time services.

V. REFERENCES

[1]. S.Gundaveli, K. Leung, V. Devarapalli, K. Chowdhury, and B. Patil, "Proxy Mobile IPV6", IETF refc-5213, August (2008).

[2]. Luo H, H.Zhang, Y.Qin and V.C.M.Leung," An approach for building Scalable Proxy Mobile IPv6 domains", IEEE Trans, Network Service Manager, 8:176 -189, DOI:10.1109/TNSM.2011.071511.20100063.

[3]. Lei J and X.Fu,"Evaluating the benefits of introducing PMIPv6 for localized mobility management", proceeding of the International wireless Communications and mobile computing conference, pp: 74-80, DOI: 10.1109 / IWCMC.2008.14.

[4]. V.Berlin Henry and D,Sridharan ,"Multicast-Supported Fast Handover For Proxy Mobile Ipv6",Journal of Computer Science, ©Science Publications,2013.

[5]. Mun-Suk Kim, Sukyoung Lee, David Cypher and Nada Golmie, "Performance Analysis Of Fast Handover For Proxy Mobile Ipv6" ,©Elsevier Inc,2012.

[6]. Ahmed Rasem,"O-Pmipv6: Optimized Proxy Mobile Ipv6", © thesis April 2011.

[7]. D.Shalini Punithavathani and L.K.Indumathi,"Proxy Mobile Ipv6 with Transient Binding for Support of Multihoming",InternationalConference on Recent Trends in Computational Methods, Communication and Controls (ICON3C), 2012.

[8]. A. Bhuvaneswari and Dr. E. George Dharma Prakash Ra," An Overview of Vertical Handoff Decision Making Algorithms", I. J. Computer Network and Information Security, 2012, 9, 55-62 Published Online August 2012 in MECS.

[9]. Anita Singhrova and Dr. Nupur Prakash,"A Review of Vertical Handoff Decision Algorithm in Heterogeneous Networks", MC'07 (Mobility'07), September 10-12, 2007, Singapore.

[10]. Moneeb Gohar, Sang Il Choi and Seok Joo Koh," Fast Handover using Multicast Handover Agents in PMIPv6-based Wireless Networks", ICOIN 2011, 978-1-61284-663-7 / 11 / $26.00 ©2011 IEEE.