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Efficient Handover Mechanism of Proxy Mobile Ipv6 Based on Multi_homing Technology

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Abstract

Proxy Mobile IPv6 is one of the premier network based mobility Management Protocol. This document specifies efficient hand over technique which is referred as Extendible Temporary Binding Mechanism (ETBM). This ETBM solve the problems of multi-homing in ProxyMobileIPv6 (PMIPv6) Domain.

The ETBM of Proxy Mobile IPv6 support multi-homing and optimizes the handover. Here, the handover problem of multi-homing is reduced by New Proxy Binding Update Request (N-PBU-R) and Proxy Binding acknowledgement messages. These N-PBU_R and Proxy Binding acknowledgement messages are having new indicators and identification information. The proposed hand over mechanism explains how Home Agent (HA)/Local Mobility Anchor (LMA) exchange its proxy binding update messages and identification information such as Mobile Node Identification (MN-ID), Home Network Prefix (HNP), Handover Indicator (HO), Interface Identification (Interface-ID), access type to the network.

This proposed ETBM handover mechanism of PMIPv6 has new access type, indicator, and identification information. Using these new parameters, the local mobility Anchor

can respond to the N-PBU- from the mobile node. This N-PBU-R is used to solve the problems of handover in multihoming. The ETBM mechanism also has binding revocation message and expanded trigger field information. This expanded trigger field information is sent from LMA to Mobile Access Gateway (MAG) and this will update the binding cache entry (u-BCE), bind address of the data packets of both Previous-Mobile Access Gateway (P-MAG), modified Mobile Access Gateway (m-MAG).Although the interface of network is changed this technique supports hand over session continuity with (m_MAG) and Home Network Prefix (HNP).

Keywords: PMIPv6, F-PMIPv6, multihoming, N-PBU_R (New proxy Binding Update Request), MAG (Mobility Access Gateway LMA (Local Mobility Anchor), u-BCE, m-MAG

Introduction

Mobile node has essential part in the mobile communication. There are two mobility management protocols present in the mobile environment. One is host based mobility management and the other is network based mobility management protocol. Generally, in the mobile communication hand over latency and multihoming are the challenging concepts. Host based management protocols requires mobile node attachment during communication. But network based mobility protocols does not require mobile node attachment during communication. In the network based mobility management protocol the IP mobility is governed by network instead of host. This concept is explained in the one of the premier mobility management protocol which is referred as PMIPv6 [1].

According to the PMIPv6 base specification, an LMA updates a mobile node's (MN's) Binding Cache Entry (BCE) and switches the forwarding tunnel after receiving a Proxy Binding Update (PBU) message from the mobile node's new MAG (n_MAG). At the same time, the LMA disables the forwarding entry towards the mobile node's previous MAG (p_MAG) in case of an inter-technology handover.

For real time transmission, it is essential that packet loss should be reduced or avoided for the user to enjoy high user perceived QoS. Thus, there should be a fast handover binding mechanism to re-route flows to another interface when one interface has lost its connection with the shortest possible delay.

The successful mobile environment must provide the efficient multi-homing wireless protocols. Several groups in IETF have set out to develop solutions on multi-homing in response to the market demand, e.g.Monami6 [2], Shim6 [3] IETF multi6 working group has produced a layer 3 shim proposal to map between location and identity for IPv6 addresses. The layer 3 shim approach creates a new sub-layer to hosts that support multi-homing. The layer is responsible for mapping between upper layer identifiers and a changing set of locators.

This paper proposes new mechanism named as ETBM which have Extendable handover Scheme of PMIPv6 for the support of multihoming. When the PMIPv6 Mobile Node (MN) is in the handover region, the LMA updates its binding cache entry using Previous-Mobile Access Gateway (P-MAG) and modified Mobile Access Gateway (m-MAG) toward MN.

Over View of Proxy Mobile Ipv6 Based on Multi_Homing

Proxy Mobile IPv6 is one of the protocols that have been developed to mainly enhance the mobility management in mobile IP [1]. This protocol is the focus of our research due to its overall benefits over the previous protocols as discussed below. The main difference between PMIPv6 and MIPv6 along with its other extensions is that MIP is a "host-based" approach while PMIP is a network-based approach. Being a "network-based" approach has the following salient features and advantages:

Deployment: MN does not require any modification which enables service providers to offer the services to as many customers as possible.

Performance: Since MN is not required to participate in the mobility-related signalling, the tunnelling overhead and the number of exchanged messages are reduced as the network is doing the mobility management on behalf of the MN.

Controllability: from the network service provider point of view, having a network-based approach is advantageous as it gives them the opportunity to control the network in terms of traffic and QoS such as differentiated services.

The multihoming support in PMIPv6 [1] is simply simultaneous connection/attachment support for a multiple interfaced MN. However, there are many scenarios in which the simultaneous "usage" of multiple interfaces for a MN and the possibility of moving a single IP flow from a certain access technology to another one require some enhancement/modification to the current PMIPv6 base protocol l[20] explores the merits and the tradeoffs of the basic principle of two PMIPv6 multihoming models such as the same unique prefix across all the interfaces and per interface unique prefix. Our proposal is based on unique HNP for all interfaces of a MN and on the mobility features of HIP [21] in combination with micro-mobility features provided by PMIPv6.

In PMIPv6 protocol, when one of the interfaces undergoes handoff, the other interface might still be attached to the same access router. For example, due to the coverage area differences, the mobile node may change its access router for the WLAN interface while the access router of its 3G interface remains unchanged. If the mobile node suddenly loses connection to the network via the WLAN interface, according to standard PMIPv6 operation, the mobile node needs to trigger vertical handoff at the 3G MAG so as to maintain session continuity via its cellular interface. However, in some cases of disconnection, the mobile node may not have enough time to trigger vertical handoff at 3G MAG without suffering packet loss. Furthermore, according to PMIPv6

protocol, prefixes cannot be dynamically assigned to a connected interface and the mobile node may not be able to transfer the prefix tied to the interface that suddenly loses connection to a connected interface. [4] Figure 1 explains scenario of multihoming with PMIPv6.

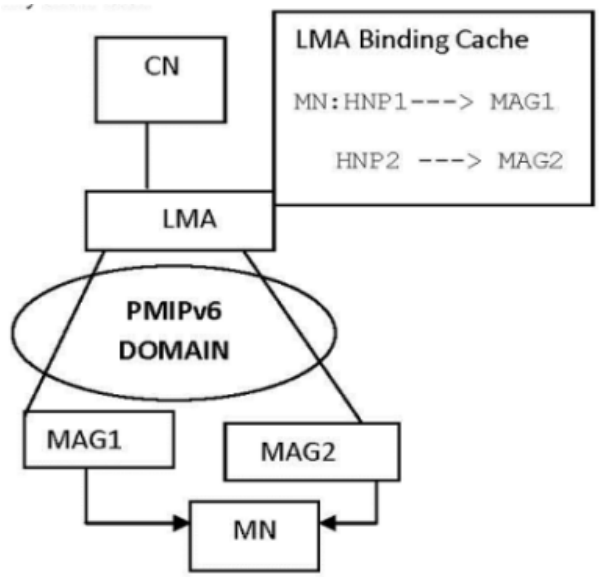

Figure 1: Scenario of Multi_homing in PMIPv6

Issues of Various PMIPv6 protocol based on Multi_homing

In the context of PMIPv6, current specification [RFC5213] does not address the case of a multiple interface node attaching to a PMIPv6 domain other than stating it is possible. We argue it is important to enablePMIPv6 to bring multiple interface nodes the advantages related to the simultaneous use of multiple interfaces. Moreover a multiple interface node could be seen as a not-modified host implementing the right technology for multi interface handling [22].

In the context of FPMIPv6 (RFC5929) fast handoff when one of the interfaces suddenly loses connection and flows need to be transferred via a stable or connected interface. And also highlights enhancement needed to PMIPv6 protocol operations and some optimizations that can be done to the PMIPv6 protocol, when applied to a scenario where multiple interfaces of a mobile node are attached to the PMIPv6 domain via a single MAG. All the enhancements highlighted in this memo are targeted towards a MN that cannot manage its mobility on its own.

One of the primary issues for mobile networking is the multi-homing, in which MN has multiple network interfaces, e.g., WLAN and 3G network [4]. However, it is

noted that the current PMIPv6 was originally designed without consideration of multi-homing.

Proposed System

This proposed ETBM handover mechanism of PMIPv6 having new access type, indicator, identification information. By using these new parameters the local mobility Anchor can respond to a N-PBU-R of a new connectivity request from the mobile node. This N-PBU-R is used to solve the problems of handover in multihoming. The ETBM mechanism also includes binding revocation message with expanded trigger field information sent from the LMA to Mobile Access Gateway (MAG) by will update its binding cache entry (u-BCE) and bind address of the data packets both to the Previous-Mobile Access Gateway (P-MAG) and modified Mobile Access Gateway (m-MAG) toward MN, when MN is in the handover region. Proxy Mobile IPv6 has One Address (Home Network Prefix). The following figure 2 provides the sample topology of the proposed system.

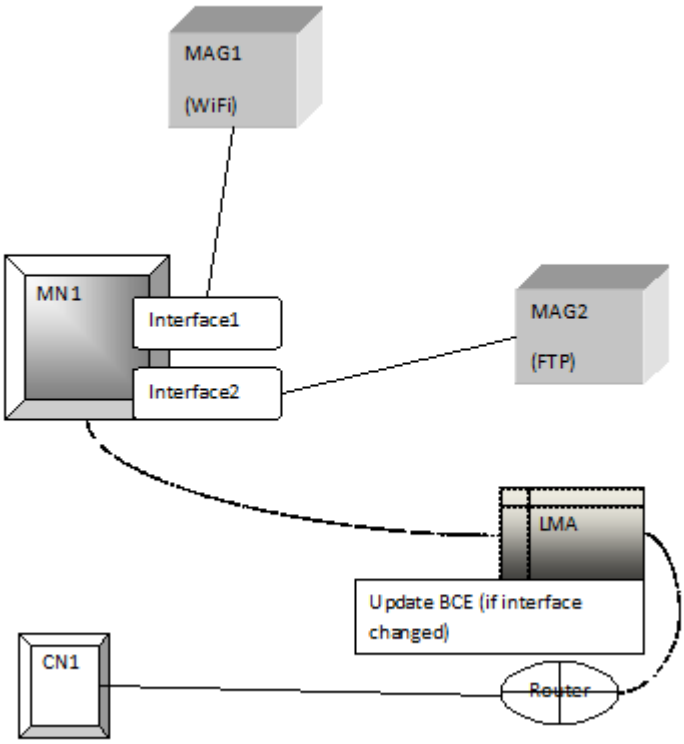

Figure 2: Topology of the Proposed System

Signalling flow of the Proposed System

The mobile node handover the signal to the n_MAG, the LMA received a regular proxy binding update request from n_MAG. The LMA updates its binding cache entry. This represents that the mobile node is presently attached to the n_MAG. The tunnel is bidirectional, now the LMA sends the ACK to the n_MAG and confirms the handover request also LMA deletes the information from the BCE which provided connectivity support to the mobile Node. Table 1 represents system notations of the proposed system

Table 1 Proposed System Notations

System notation	Description
LMA	Local Mobility Anchor
P_MAG	Previous Mobility Access Gateway
N_MAG	New Mobility Access Gateway
BCE	Binding Cache Entry
u-BCE	Update BCE
TD_{MN-AP}	Transmission delay between the MN and Access Point
TD_{AP-MAG}	Transmission delay between Access Point and MAG
$TD_{MAG-LMA}$	Transmission delay between MAG and LMA
TD_{MAG}	Transmission delay between any two MAGs
TD_{MN-MAG}	Transmission delay between the MN and MAG
TD_{ZP}	Transmission delay of the data packet from source to destination

The proposed technique ETBM provides information to the n-MAG by using u-BCE table which have the current details of MN. Also it revokes the old details which reduce to support the signalling cost of the transmission even if the interface is changed. The figure 3 shows the signalling flow of the proposed system

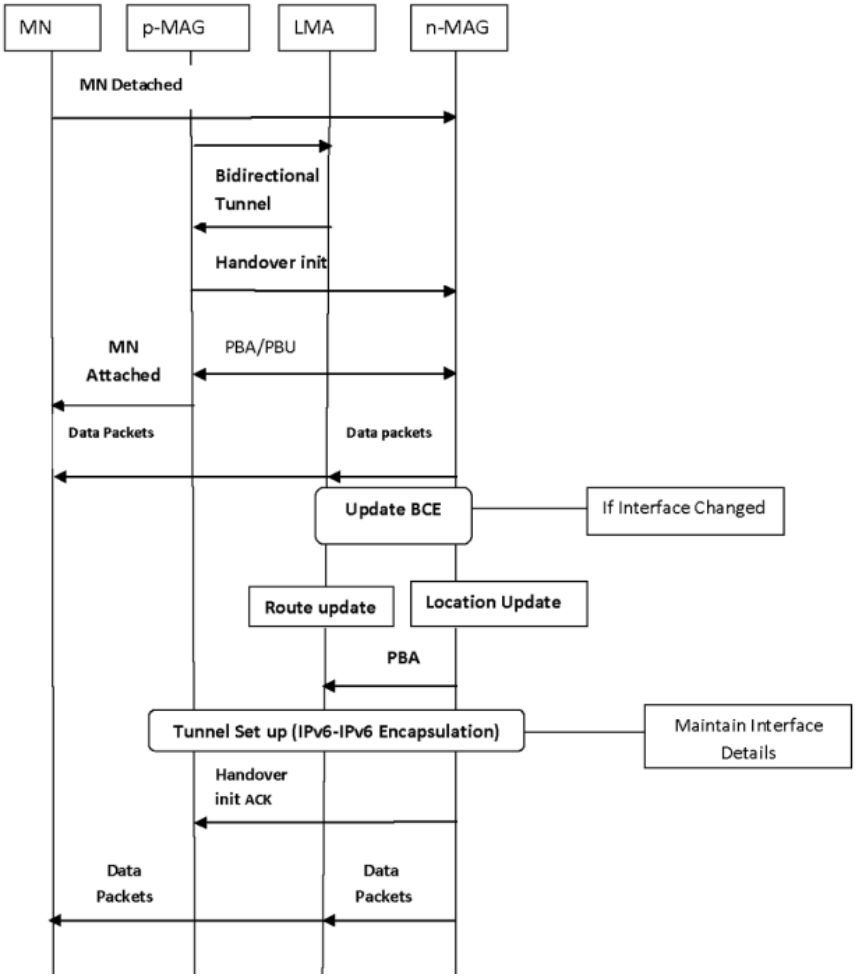

Figure 3: Signaling flow of the proposed system

Hand Over and Signaling Analysis of the Proposed System

ETBM Handover Analysis

The equation 5.1 explains the handover delay D

$$D = TD_{MN\text{-}AP} + TD_{MN\text{-}MAG} + TD_{MAGs} + TD_{DP} \text{---} \quad 5.1$$

In multihoming i.e if more than one interface is involved in the transmission then the Transmission delay in the proposed system is

$$TD_{MN\text{-}MAG} = TD_{MN\text{-}pMAG} + TD_{MN\text{-}nMAG} \text{--------} \quad 5.2$$

ETBM-Signaling Cost

Hand over signaling consists of

i) pMAG sending to nMAG

ii) nMAG sending ACk to pMAG

iii) nMAG sending PBU to LMA

iv) nMAG receiving PBA from LMA

v) nMAG sender Router solicitation with the prefix to MN

In this proposed system localized routing signaling is not have any messages. So the signaling cost and over head is reduced. Table 2 provides Comparison summary between the different IP mobility protocols including PMIPv6 [13-15]

Table 2: Comparison between the different IP mobility protocols

Protocol Criteria	**MIPv6**	**FMIPv6**	**HMIPv6**	**PMIPv6**	**F-PMIPv6**
Mobility Scope	Global	Local	Local/Global	Local	Local
Location management	Yes	Yes	No	Yes	Yes
Required infrastructure	Home Agent	Home Agent, MAP	Home Agent, enhanced Access Router	LMA, MAG	LMA, MAG
MN modification	Yes	Yes	Yes	No	No
Handover latency	Bad	Moderate	Good	Good	Good
Localized Routing	Yes	Yes	Yes	No	No

Simulation Results

In order to analyze the proposed technique ETBM-PMIPv6 is compared with PMIPv6 and F-PMIPv6. It is decided to simulate the three protocols and acquire the results in a similar fashion as the mathematical model. The protocols have been simulated used Network Simulator (NS2). NS2 is an event simulator targeting network research and has a support for many protocols over the different network layers. The simulation is done in the signalling cost vs. the handover of the nodes.

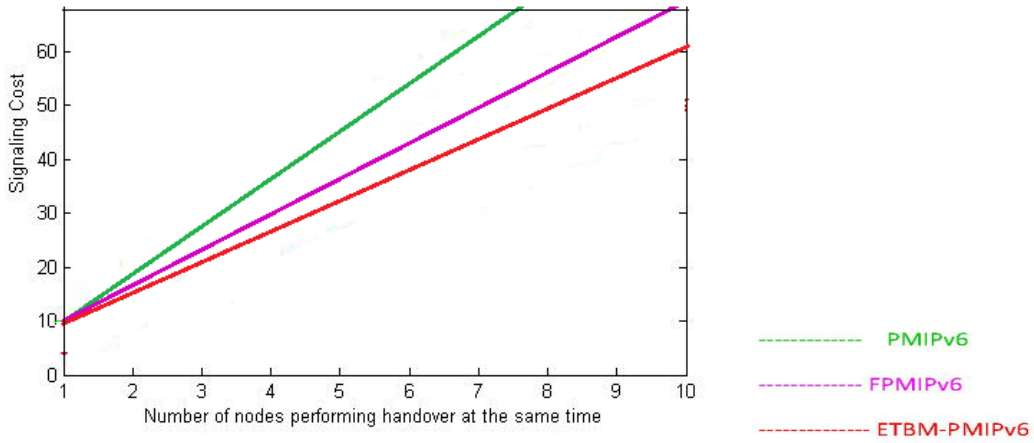

Figure 4: simulation of various Protocols with Single Interface

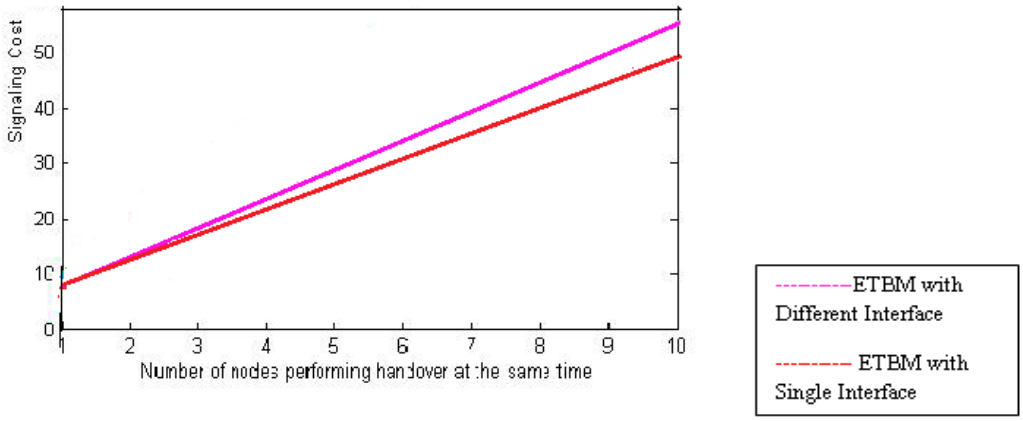

Figure 5: Simulation with ETBM single and multiple Interfaces

Figure 4 provides the simulation result of single interface with PMIPv6, FPMIPv6 and proposed ETBM-PMIPv6 which provides lower signaling cost and handover time than the existing two protocols (PMIPv6, FPMIPv6)

Figure 5 provides the simulation result of ETBM with single interface (FTP - FTP) and multiple interfaces (FTP – WiFi). While compare with the single interface the multiple interface has near equal to single interface also have better performance than the PMIPv6 and FPMIPv6.

Conclusion and Future Work

This proposed technique ETBM provides support for the multiple interfaces which is the main problem of multi_homing. Thus the proposed system supports PMIPv6 in multi_homing. The proposed technique focused multiple interfaces in the multi_hominng domain .i.e. more than various MAGs. In the future different LMA is also done by with the security considerations.

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