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A Study of Multi-Interface Flow Mobility Scheme for Handling Overflowing Multimedia Contents over Mobile Networks

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Abstract

The rapid growth of multimedia contents being processed over a network has required the need for flow mobility management. The network traffic is expected to rise in a huge volume as the evolution of the Internet and mobile technologies continue to grow. In this regard, this paper deals with the study of the flow mobility management that Proxy Mobile IPv6 has to offer optimizing the operations between the local mobility anchor (LMA) and mobile access gateway (MAG) to ensure a reliable and efficient handovers among mobile devices.

Keywords: *multimedia, LMA, MAG, PMIPv6, flow mobility management*

1. Introduction

The varying technological systems that performs similar tasks has brought the evolution of multimedia convergence to which is comprised of communication, voice or telephony, data and productivity applications, and video that has shared resources and interacts with each other collaboratively. Such technologies (e.g., telephony and data communications) has converged into a common interfaces over single devices such as smartphones or tablets. For example, mobile phones in this era can make phone calls, video conferencing, as well as browse the Internet. The relationship of these advancements is directly proportional to the Internet usage, that is, as it develops increasingly, Internet usage is also vastly increasing. As a result, management of distribution for multimedia contents became an issue to which is addressed through the proliferation of flow mobility management that has to be offered by Proxy Mobile IPv6.

The PMIPv6 can provide network based mobility management for mobile hosts that are connected to the PMIPv6 domain [1, 2]. The PMIPv6 addresses the issues on managing the IP mobility that is being handled by the hosts itself in the standard MIPv6 [4]. It does not require the mobile host to participate in the mobility-related signaling and leaves this responsibility to the network to manage the tracking of movements of mobile hosts as well as the initializations of signaling.

This paper aims to provide a pervasive architecture of a PMIPv6 based flow mobility management to address network traffic issues provided by the overflowing multimedia contents over the Internet. The multimedia contents that are being processed over the Internet is continuously increasing and the number of mobile terminals being connected also rises as advancement in technologies is vastly growing. Thus, the need for the flow mobility

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management to address the expected huge volume of traffic in the near future is essentially required.

The rest of this paper is organized as follows: Section 2 discusses the overview of PMIPv6; the framework for the flow mobility management for handling multimedia contents over PMIPv6 is outlined in Section 3; and the concluding remarks in Section 4.

2. PMIPv6 Overview

Network-based mobility management has been provided as a solution for IP mobility issues that limits the signaling that involves mobile hosts in the standard mobile IPv6. The mobile hosts in PMIPv6 are not required to handle the initialization of mobile signaling whenever it moves or detaches its connection to a foreign network. In PMIPv6, instead that the mobile host handles the exchange of signaling between itself and the home agent, the proxy mobility agent within the network will perform the signaling to the home agent and is responsible for the mobility management.

PMIPv6 introduces two functional entities [2, 3]: the Local Mobility Anchor (LMA) and the Mobile Access Gateway (MAG) as indicated in Figure 1. The MAG is the entity detecting Mobile host's attachment and providing IP connectivity while the LMA is the entity assigning one or more Home Network Prefixes (HNP) to the mobile host and is the network anchor or intermediary for all traffic belonging to the mobile host. It enables flow mobility and distributes traffic flows between different interfaces that a mobile host connects within the PMIPv6 domain.

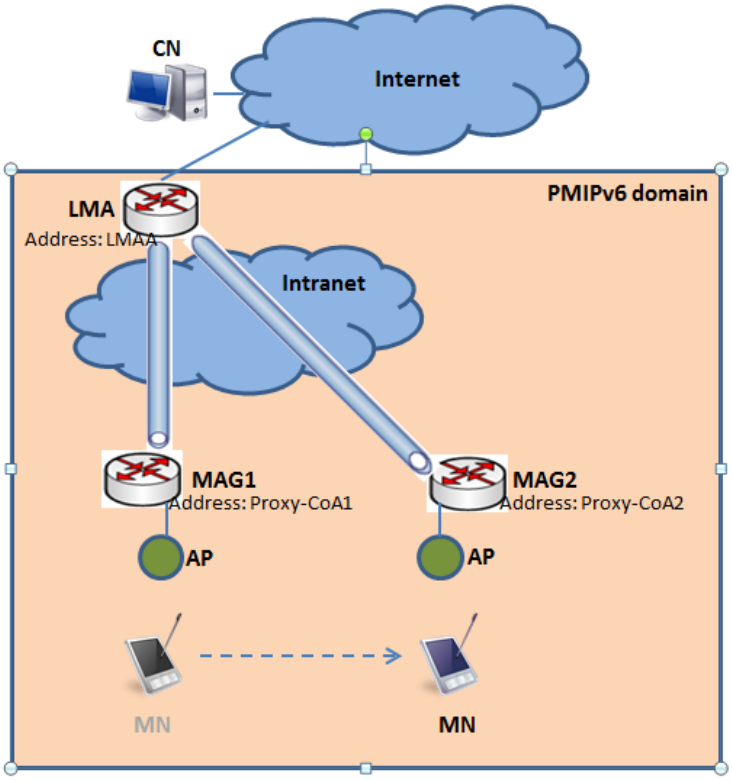

Figure 1. PMIPv6 Domain

Figure 2 depicts the mobile host attaching to a PMIPv6 domain. The mobile host and the LMA agree with local policies in order to ensure that the traffic flow forwards the IP packets for a bidirectional communications. With the mobile host's flow mobility decision, the LMA will direct and update its forwarding state accordingly. The overall flow mobility is being controlled by the LMA.

The MAG provides an access point (AP) for the mobile host (MN) as it enters the PMIPv6 domain. The authorization of the mobile host will then be verified by the MAG in order to gain access in the network-based mobility management service. It send the proxy binding update (PBU) to the local mobility anchor point (LMA) that associates its own address together with the mobile host's profile or identity. The LMA then responds with a proxy binding acknowledgement (PBA) to the MAG which includes the prefix allocated to the mobile host to create a bidirectional tunnel as indicated in Figure 2.

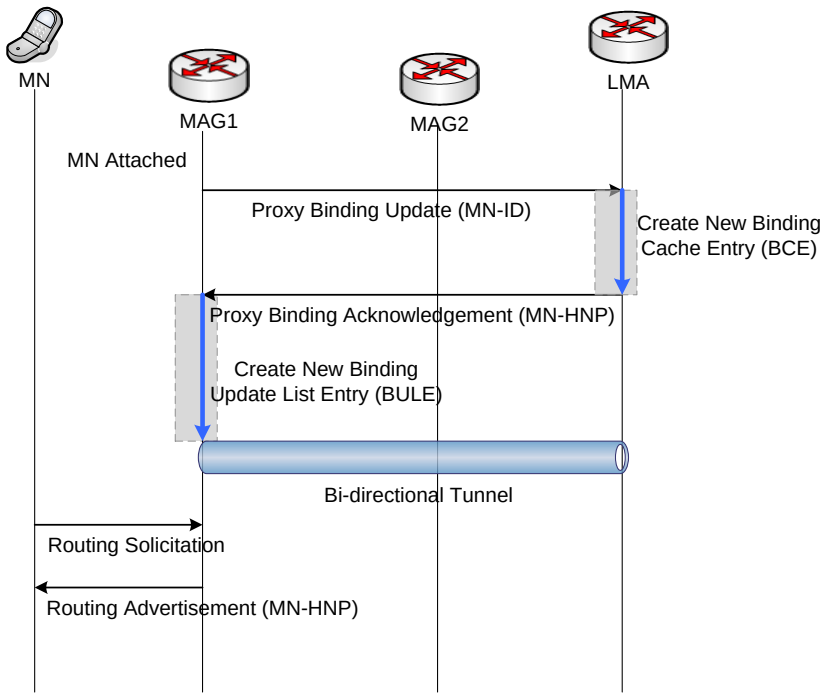

Figure 2. Attachment of a Mobile Host to Local Mobility Anchor in PMIPv6 Domain

The mobile host receives Router Advertisement messages from the MAG with the Care-of address in order for the MN to configure an address (stateless auto-configuration). However, the mobile host can alternatively use stateful address auto-configuration mechanisms. The LMA can then intercept the IP packets that are to be transmitted by the correspondent node (CN) intended to the mobile host (MN) in the MN's home network and forward these IP packets to the MAG through the established bidirectional tunnel. These IP packets received by the MAG are de-capsulated and transmitted directly to the mobile host.

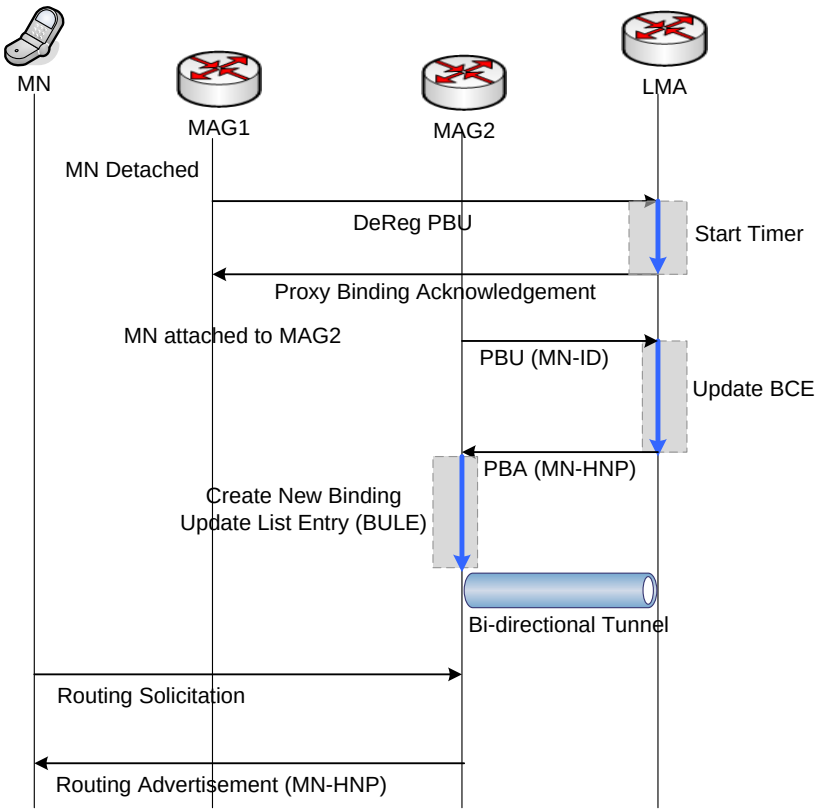

Figure 3. A Mobile Host Changes its Attachment in PMIPv6 Domain

In PMIPv6, a mobile host (MN) can attach to multiple MAGs, given that a mobile host accesses different media. In Figure 3, a mobile host detaches from the first mobile access gateway (MAG1) and establishes its new attachment to MAG2. A new bidirectional tunnel is created between Mag2 and LMA, such that all IP packets that are directed to be transmitted to the mobile host will be intercepted by the MAG2 before it will be directed to the MN. The mobile host is not required to send the signaling in order to register anew to LMA, but instead, it is the mobile access gateway that establishes the detachment from MAG1 and attachment to MAG2.

3. Flow Mobility for PMIPv6 for Handling Multimedia Contents

This section presents a discussion of the pervasive architecture of Proxy Mobile IPv6 based flow mobility management for handling overflowing multimedia contents over the Internet. Recently, technological advancements are rapidly increasing that the number of mobile users keeps on rising as well as the volume of multimedia contents that is being processed over the network. For such reasons, network traffic in the near future will be an essential issue for the transmission of these multimedia contents which could directly affect its handover latency, bandwidth, and transmission speed.

Multimedia generally refers to the combination of digital or computer-based images, text, audio, video, and animation that comes from different forms [5, 6]. It is a field concerned with the computer-controlled integration of different forms of media where every type of

information can be represented, stored, transmitted and processed digitally. Multimedia also provides provisions for the processing or manipulation, storage, and delivery. That simply means there should be an application of image processing techniques, or the like; multimedia can be stored on Web servers; and be able to transmit through the Internet or networked communication. In this regard, an efficient and scalable transmission of multimedia contents over the congested networked devices is essentially important. In addition, an effective flow mobility management is much required for the continuous real-time delivery of multimedia contents. For example, in a video conferencing system, the system is able to simultaneously process speech data, images or videos, stored (buffered), and deliver them from and to every participant's mobile device.

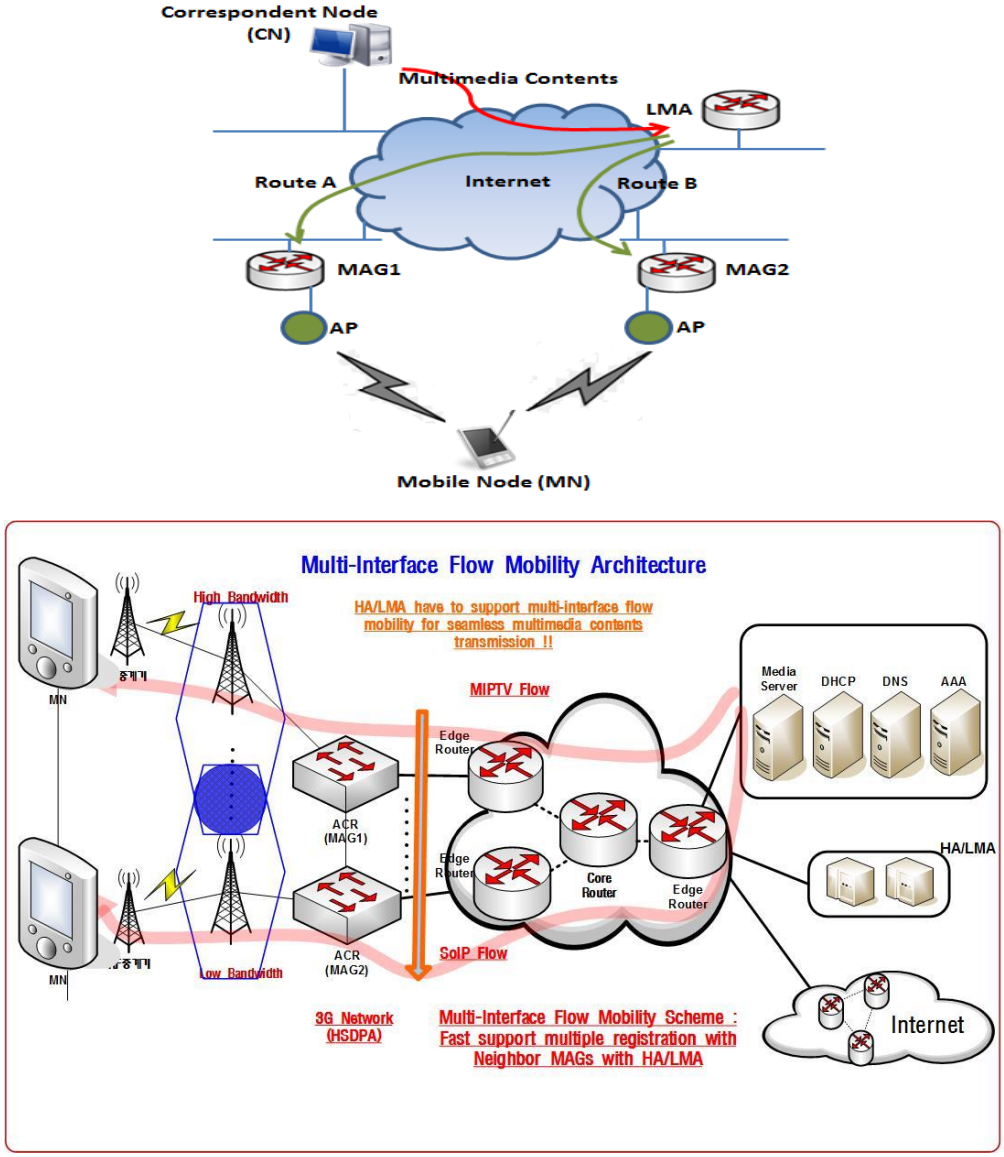

Figure 4. Multi-Interface for a Mobile Host to Receive Multimedia Contents from the Correspondent Node

Figure 4 depicts a mobile host that is connected to multiple MAGs. The Multimedia contents that is to be delivered by the correspondent node towards the mobile host (MN) needs to go through the LMA. The LMA acts as the server or central controller of the mobile hosts that wishes to connect to the PMIPv6 domain. Since the mobile host can go through two routes, either through MAG1 or MAG2, LMA would be sending signaling to classify traffic of which route to take and which mobile access gateway to bind the home network prefix (HNP). The LMA must be able to get the route conditions (e.g., traffic congestions, bandwidth through the number of nodes a MAG serves, the number of flows) as it acts as the intermediary or anchor for all the traffics in the PMIPv6 domain. After the route conditions have been classified, the LMA can start the flow handover with its own decision to transmit the IP packets of the multimedia contents.

In a particular scenario, the mobile host may need to require a particular flow based on the different MAGs. An MN may select a particular MAG over another to receive multimedia contents. In this case, the MN needs to send a request to the LMA for the flow handover. As the LMA approves the request, the MN may receive the multimedia contents over the selected route.

4. Conclusion

As the transmission of multimedia contents have been overflowing in the Internet due to the continuous growth of technological advancements, it is expected that network traffic for the transmission flows will be increased. In this regard, the need for an efficient flow mobility management is essential to address the bulking flow traffic. This paper has presented a study of Proxy Mobile IPv6 network-based mobility to handle the transmission of multimedia contents. The flow mobility for mobile hosts processing the multimedia contents has been presented being controlled by the local mobility anchor (LMA).

Acknowledgments

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