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R. Wakikawa
Softbank Mobile
R. Pazhyannur
S. Gundavelli
Cisco

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Separation of Control and User Plane for Proxy Mobile IPv6
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Abstract

This document describes splitting of Control Plane (CP) and User Plane (UP) for a Proxy Mobile IPv6 based network infrastructure. Existing specifications allow a MAG to perform splitting of its control and user plane using Alternate Care of address mobility option for IPv6, or Alternate IPv4 Care of Address option for IPv4. However, the current specification does not have semantics for allowing the LMA to perform such functional split. To realize this requirement, this specification defines a mobility option that enables a local mobility anchor to provide an alternate LMA address to be used for the bi-directional tunnel between the MAG and LMA. With this extension, a local mobility anchor will be able to use an IP address for its user plane which is different than what is used for the control plane.

Table of Contents

1. Introduction

Widely deployed mobility management systems for wireless communications have isolated the path for forwarding data packets from the control plane signaling for mobility management. To realize this requirement, Proxy Mobile IPv6 requires that the control plane functions of the local mobility anchor to be addressable at a different IP address than the IP address used for the user plane. However, the current specification does not have semantics for allowing the LMA to perform such functional split. The local mobility anchor is required to associate the IP address of the tunnel source with the target IP address of the control messages received from the MAG. Note that the concept of control- and user- planes are well established and understood in cellular networks.

A PMIPv6 infrastructure contains of two primary entities: MAG and LMA. The interface between MAG and LMA consists of two components: control plane and user plane. The control plane is responsible for signaling messages between MAG and LMA such as the Proxy Binding Update and Proxy Binding Acknowledge messages to establish a mobility binding. In addition, the control plane components in the MAG and LMA are also responsible for setting up and tearing down of the bi-directional tunnel between the MAG and LMA. The user plane is

responsible for forwarding the mobile node's IP packets between the MAG and the LMA over the bi-directional tunnel.

In most deployments, the control plane and user plane components (of the MAG and LMA) are co-located in the same physical entity. However, there are deployments where it is desirable to have the control and user plane of the MAG and LMA in separate physical entities. For example, in a WLAN (Wireless LAN) deployment, it may be desirable to have the control plane component of the MAG to be on Access Controller (also sometimes referred to as Wireless LAN Controller) while the user plane component of the MAG on the WLAN Access Point. This would enable all the signaling messages to the LMA to be centralized while the user plane would be distributed across the multiple Access Points. Similarly there is a case to split the control and user plane component of the LMA motivated by different scaling requirements on the control and user plane components or need to centralize the control plane in one geo-location while distributing the user plane component across multiple geo-locations

[RFC6463] and [RFC6275] contains a mechanism of splitting the control and user plane in MAG. Specifically, [RFC6463] defines an Alternate IPv4 Proxy Care of Address Option while [RFC6275] defines an Alternate Care of Address for IPv6 address. The MAG can provide an Alternate Care of Address in the Proxy Binding Update (PBU) and if the LMA supports this option then a bidirectional tunnel is setup between the LMA address and the MAG's alternate Care of address. However, there is no corresponding option for the LMA to provide an alternate address to the MAG.

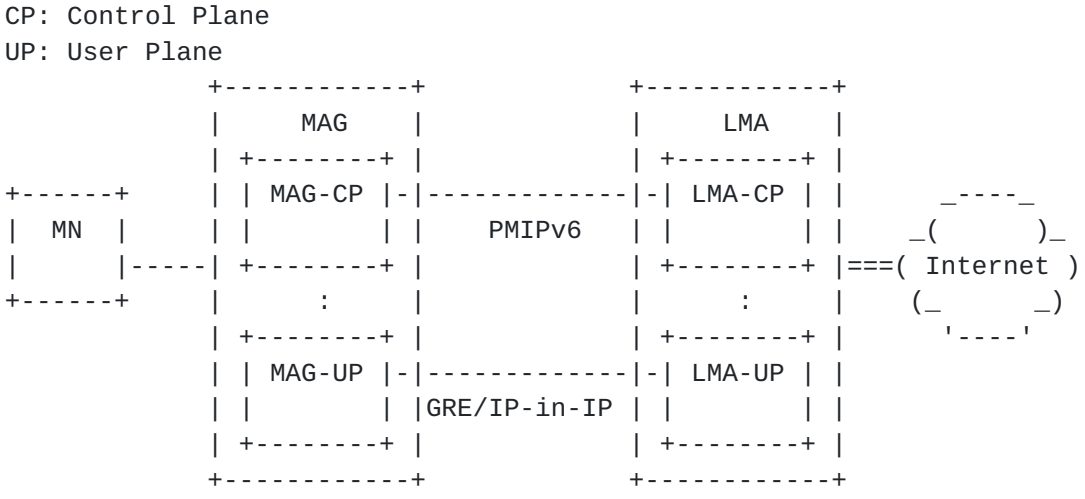


Figure 1: Functional Split of the Control and User Plane

This specification therefore defines a new mobility option that enables a local mobility anchor to provide an alternate LMA address to be used for the bi-directional tunnel between the MAG and LMA.

2. Conventions and Terminology

2.1. Conventions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

2.2. Terminology

All the mobility related terms used in this document are to be interpreted as defined in [RFC5213] and [RFC5844]. 3GPP terms can be found at [RFC6459]. Additionally, this document uses the following terms:

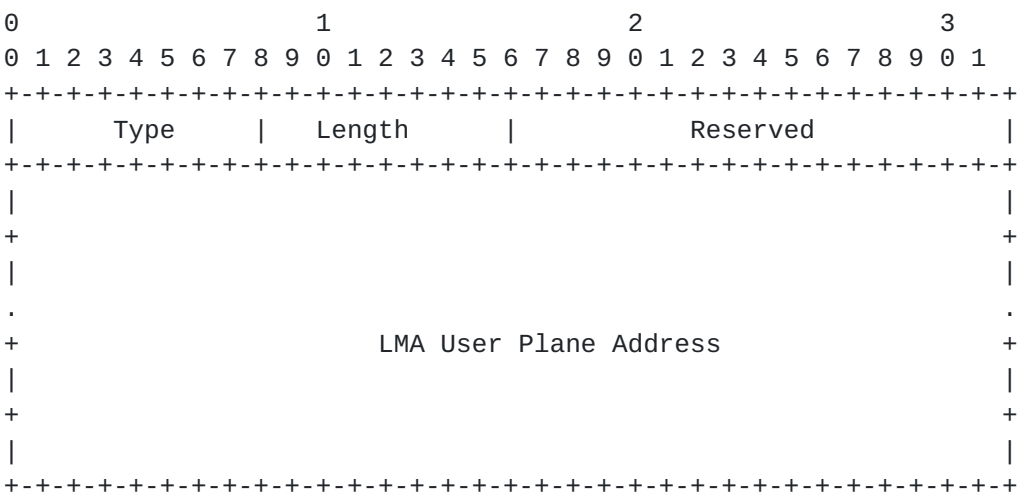
LMA User Plane Address (LMA-UPA)

The IP address on the LMA that is used for establishing tunnels with the mobile access gateway.

3. LMA User Plane Address Mobility Option

A new mobility header option, LMA User Plane Address mobility option is defined for use with Proxy Binding Acknowledgment message sent from the local mobility anchor to the mobile access gateway. This option is used for notifying the LMA's user plane IPv4/IPv6 address. There can be multiple instances of the LMA User Plane Address mobility option present in the message, one for IPv4 and the other for IPv6 transport.

The LMA User Plane Address mobility option has an alignment requirement of 8n+2. Its format is as follows:



Type

To be assigned by IANA.

Length

8-bit unsigned integer indicating the length of the option in octets, excluding the type and length fields.

Reserved

This field is unused for now. The value MUST be initialized to 0 by the sender and MUST be ignored by the receiver.

LMA User Plane Address

Contains the IPv4/IPv6 user plane address of the LMA.

4. IANA Considerations

This document requires the following IANA action.

- Action-1: This specification defines a new Mobility Header option, LMA User Plane Address mobility option. This mobility option is described in Section 3. The type value <IANA-1> for this message needs to be allocated from the Mobility Header Types registry at http://www.iana.org/assignments/mobility-parameters. RFC Editor: Please replace <IANA-1> in Section 3 with the assigned value, and update this section accordingly.

5. Security Considerations

The LMA User Plane Address mobility Option defined in this specification is for use in Proxy Binding Acknowledgement message. This option is carried like any other mobility header option as specified in [RFC5213]. Therefore, it inherits from [RFC5213] its security guidelines and does not require any additional security considerations.

6. Acknowledgements

Authors would like Acknowledge all the discussions on this topic in the NETLMM Working group.

7. References

7.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

[RFC5213] Gundavelli, S., Leung, K., Devarapalli, V., Chowdhury, K., and B. Patil, "Proxy Mobile IPv6", RFC 5213, August 2008.

[RFC5844] Wakikawa, R. and S. Gundavelli, "IPv4 Support for Proxy Mobile IPv6", RFC 5844, May 2010.

7.2. Informative References

[RFC6275] Perkins, C., Johnson, D., and J. Arkko, "Mobility Support in IPv6", RFC 6275, July 2011.

[RFC6459] Korhonen, J., Soininen, J., Patil, B., Savolainen, T., Bajko, G., and K. Iisakkila, "IPv6 in 3rd Generation Partnership Project (3GPP) Evolved Packet System (EPS)", RFC 6459, January 2012.

[RFC6463] Korhonen, J., Gundavelli, S., Yokota, H., and X. Cui, "Runtime Local Mobility Anchor (LMA) Assignment Support for Proxy Mobile IPv6", RFC 6463, February 2012.

Authors' Addresses

Ryuji Wakikawa
Softbank Mobile
1-9-1,Higashi-Shimbashi,Minato-Ku
Tokyo 105-7322
Japan

Email: ryuji.wakikawa@gmail.com

Rajesh S. Pazhyannur
Cisco
170 West Tasman Drive
San Jose, CA 95134
USA

Email: rpazhyan@cisco.com

Sri Gundavelli
Cisco
170 West Tasman Drive
San Jose, CA 95134
USA

Email: sgundave@cisco.com