Network Working Group F. Xia
Internet-Draft B. Sarikaya
Intended status: Standards Track Huawei USA
Expires: September 3, 2007 March 2, 2007

FMIPv6 extension for Multicast Handover <draft-xia-mipshop-fmip-multicast-01.txt>

Status of this Memo

Copyright Notice

Abstract

FMIPv6 extends Mobile IPv6 for reducing handover delays. But it does not deal with the scenario that an MN joins multicast trees using it's CoA in a visited link. The document proposes an extension to FMIPv6 to handle local multicast traffic during handover.

Table of Contents

1. Introduction

[MULTICASTPS] specifies the problem scope for a multicast mobility management. The attempt is made to subdivide the various challenges according to their originating aspects and to present existing proposals for solution. There are two general multicast mobility problems, that is, Multicast Source Mobility and Multicast Listener Mobility. This draft only deals with the latter.

The mobility support for IPv6 protocol [MIP] has specified two basic methods for mobile multicast:

1. via a bi-directional tunnel from a MN to its Home Agent. The MN uses its home address to send MLD(Multicast Listener Discovery) messages. The MLD messages are tunneled to its Home Agent.

2. via a local multicast router on the foreign link being visited. the MN MUST use its care-of address when sending MLD packets

Fast Mobile IPv6 [FMIPv6] extends Mobile IPv6 for reducing handover delays. But it does not deal with the scenario that an MN joins multicast trees using it's CoA in a visited link. The scenario occurs in emerging mobile IPTV deployments. This draft proposes an elaborate way to handle the problem, that is, in handover preparation, a PAR informs a NAR to build related multicast deliver trees; during handover, the NAR buffers multicast traffic; after handover, The NAR sends the buffered traffic as soon as possible. These benefits can be achieved through extension of Fast Handover for Mobile IPv6 [FMIPv6]

The document continues in Section 2 to define the terminology used and then Section 3 states the problem, Section 4 defines the protocol operation, Section 5 introduces a new option, Section 6 discusses the security considerations. Finally, Section 7 concludes the document.

2. Terminology

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 BCP 14 [STANDARDS].

The terminology in this document is based on the definitions in [FMIPv6], in addition to the ones specified in this section

Local Multicast Traffic: Multicast traffic delivered to an MN not through the MN's HA. In this case the MN joins multicast trees using it's CoA. But in fact, the MN joins multicast group using local link address as source address [MLDv2] not CoA, but it does not affect the problem statement and solution proposed in this document

3. Problem Statement

FMIPv6 extends Mobile IPv6 for reducing handover delays. But it does not deal with the scenario that an MN joins multicast trees using it's CoA in a visited link when handover occurs. There are two problems in this scenario. One is that PAR can't deliver temporarily multicast traffic to the MN at NAR during handover, because PAR has no idea about the MN's multicast membership. This could be handled by a small extension of FMIPv6 proposed in this document. The second problem is how to prevent multicast joins and this needs to be addressed with other context transfer [RFC4067] which is out of the memo's scope .

4. Operation of Multicast Fast Handover

In Multicast Fast Handover (MFH), the mobile node joins multicast groups such as IPTV sessions using its care-of address (CoA).

MFH extends FMIPv6 signaling as follows:

1. An MN sends FBU message with Multicast Group Information to notify PAR tunneling related multicast traffic to NAR .
2. PAR sends HI message with Multicast Group Information to notify NAR establishing related multicast deliver trees in advance.
3. PAR tunnels all multicast packets to NAR.

We explain MFH operation for the predictive and reactive fast handover modes of FMIPv6.

4.1. Predictive Fast Handover

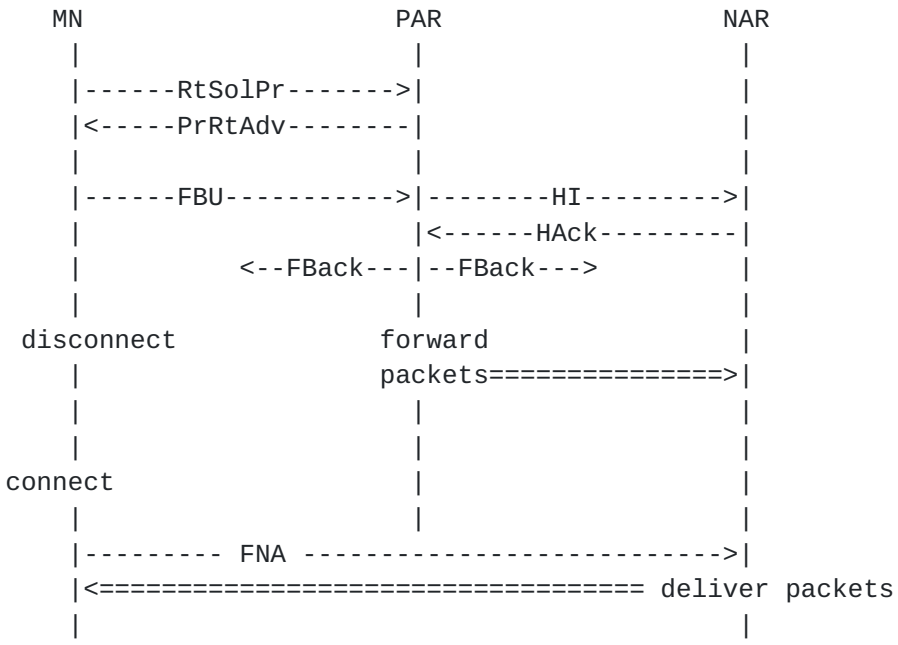

Figure 1: Predictive Fast Handover

Figure 1 is characterized as "predictive" mode of operation.

1. With interaction of RtSolPr and PrRtAdv, the MN formulates a prospective NCoA and learns some information about the NAR.
2. The purpose of the FBU is to authorize PAR to bind PCoA to NCoA, so that arriving packets can be tunneled to the new location of MN. Upon receiving FBU, PAR sends HI message. FBU and HI include Multicast Group Information Option (MGIO). The option which is defined in Section 5.1 consists of the multicast groups that the MN is a member of and other related information needed in [MLDv2].
3. If NAR already has the state for the multicast groups in MGIO, no action is required. Otherwise, NAR constructs new multicast delivery trees for any new multicast group. For example, in PIM-SM [PIM-SM], On receiving the MN's expression of interest, NAR then sends a PIM Join message towards a router which is the root of the non-source-specific distribution tree for the multicast group. The Join message travels hop-by-hop towards the root router for the group, and in each router it passes through, multicast tree state for the group is instantiated
4. When HAck message is received, the PAR MUST deliver all the traffic , unicast and multicast traffic, to NAR for buffering through the established tunnel.

5. Once FNA is received, the NAR delivers all the buffered packets to the MN.
6. On finishing IPv6 network attachment, the MN initiates multicast signaling procedure using its new CoA. At the same time, the MN receives buffered multicast traffic from the NAR and tunneled traffic from the PAR. When multicast delivery trees are constructed, the PAR stops delivering multicast traffic to MN while the NAR delivers multicast traffic directly.

4.2. Reactive Fast Handover

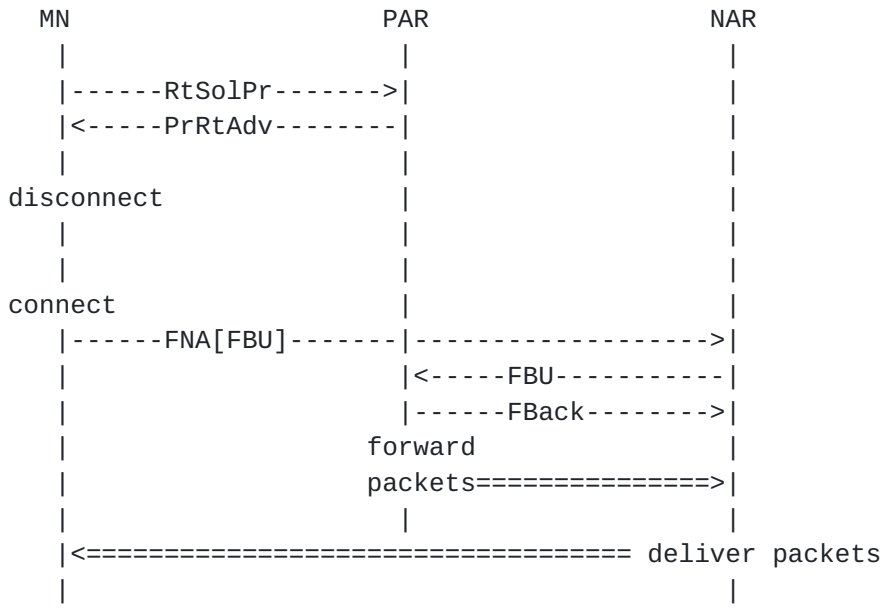

Figure 2: Reactive Fast Handover

Figure 2 is characterized as "reactive" mode of operation. An MN MUST include Multicast Group Information Option in FBU which is encapsulated in FNA. Once receiving FBU, the PAR establishes a tunnel to MN and delivers related multicast traffic to the MN. At the same time, the MN initiates multicast signaling with NCoA in the visited network. Once the NAR has constructed related multicast deliver trees the NAR delivers multicast traffic directly.

4.3. Handover Latency Analysis

When an MN moves from one AR to another AR, the overall multicast handover consists of link layer(L2) delays, network layer(L3) attachment delays, and multicast signaling delays:

HO time = L2 delay + L3 network attachment delays + multicast signaling delays.

FMIPv6 reduces HO time especially in predictive mode. L2 delay is unavoidable, while buffering related multicast traffic in an NAR can reduce the affect of a handover delay. IPv6 network attachment commonly includes activities such as default router discovery, CoA configuration and its DAD. Through RtSolPr and PrRtAdv interactions, an MN can finish the network attachment before link layer handover. Multicast signaling consists of joining multicast groups and constructing multicast delivery trees. Through tunnel between a PAR and a NAR, older delivery trees can be used before new delivery trees are constructed.

5. New Options

This draft introduces one new option.

5.1. Multicast Group Information Option

One or more Multicast Group Information Options SHOULD be included in the message FBU and HI.

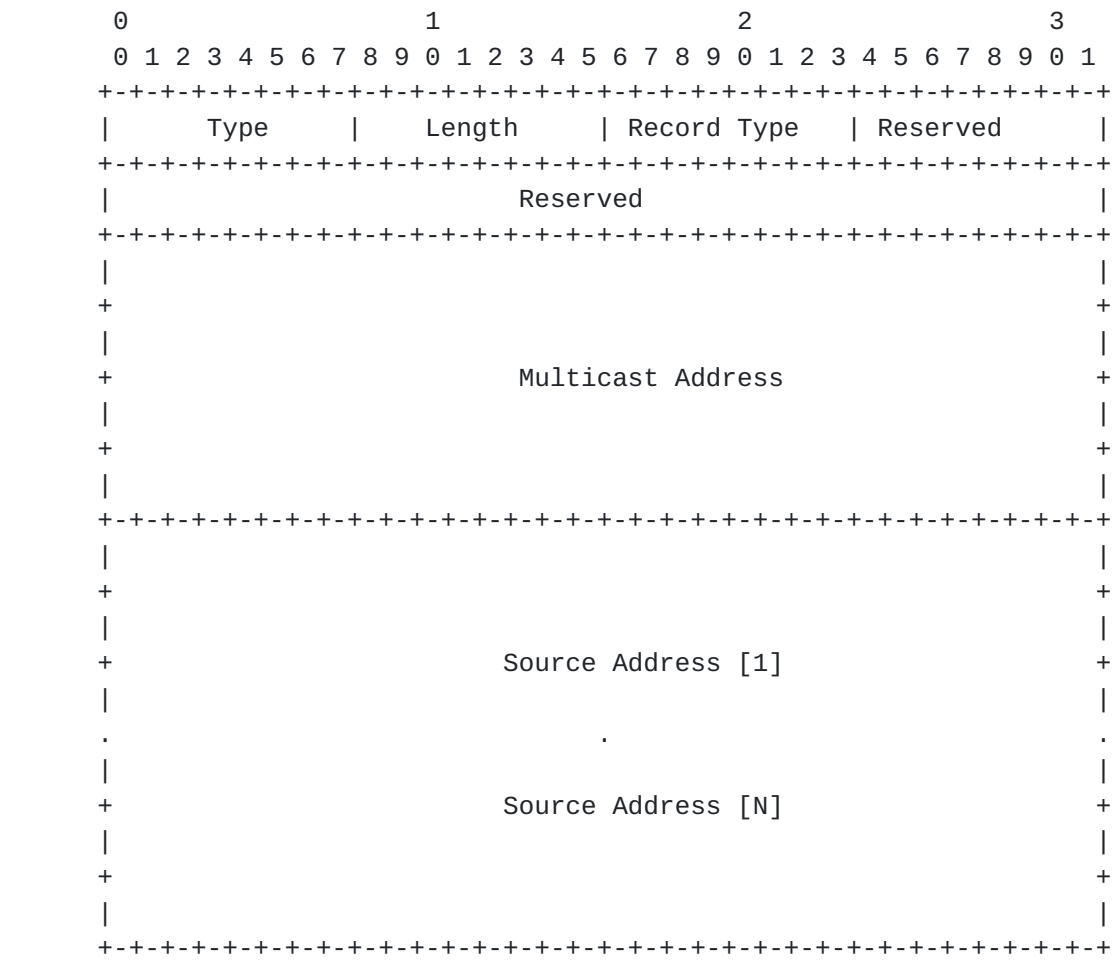

Figure 3: Multicast Group Information Option

Type: TBD

Length: The size of this option in 8 octets. The option is variable

Reserved: MUST be set to zero

Record Type: refer to section 5.2.5 in [MLDv2].

Multicast Address: the multicast group address

Source Address: a vector of N unicast addresses of the senders of this multicast group.

6. Security Considerations

This memo is based on FMIPv6, and no additional messages are defined. No additional threats are introduced. For a more analysis, see

related section. [FMIPv6]

7. Conclusions

We presented a simple extension to FMIPv6 to transfer local multicast traffic of an MN from PAR to NAR during handover. We also defined a new option to be used in FMIPv6 messages.

8. References

8.1. Normative References

[FMIPv6] Ed., R., "Fast Handovers for Mobile IPv6", RFC 4068, July 2005, <ftp://ftp.isi.edu/in-notes/rfc4068>.

[MIP] Johnson, D., Perkins, C., and J. Arkko, "Mobility Support in IPv6", RFC 3775, June 2004, <ftp://ftp.isi.edu/in-notes/rfc3775>.

[MLDv2] Vida, R. and L. Costa, "Multicast Listener Discovery Version 2 (MLDv2) for IPv6", RFC 3810, June 2004, <ftp://ftp.isi.edu/in-notes/rfc3810>.

[PIM-SM] Fenner, B., Handley, M., Holbrook, H., and I. Kouvelas, "Protocol Independent Multicast - Sparse Mode (PIM-SM): Protocol Specification (Revised)", RFC 4601, August 2006, <ftp://ftp.isi.edu/in-notes/rfc4601>.

[STANDARDS] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", RFC 2119, March 1997, <ftp://ftp.isi.edu/in-notes/rfc2119>.

8.2. Informative References

[MULTICASTPS] Schmidt, Thomas C. and Matthias. Waehlisch, "Multicast Mobility in MIPv6: Problem Statement", March 2007, <draft-schmidt-mobopts-mmcastv6-ps-02.txt>.

[RFC4067] Loughney, J., Nakhjiri, M., Perkins, C., and R. Koodli, "Context Transfer Protocol (CXTP)", July 2005, <ftp://ftp.isi.edu/in-notes/rfc4067>.

Authors' Addresses

Frank Xia
Huawei USA
1700 Alma Dr. Suite 100
Plano, TX 75075

Phone: +1 972-509-5599
Email: xiayangsong@huawei.com

Behcet Sarikaya
Huawei USA
1700 Alma Dr. Suite 100
Plano, TX 75075

Phone: +1 972-509-5599
Email: bsarikaya@huawei.com

Full Copyright Statement

Intellectual Property

Acknowledgment

Funding for the RFC Editor function is provided by the IETF Administrative Support Activity (IASA).