A Scenario for Enhanced Network-based Localized Mobility Management

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Abstract— Everytime a node moves out of its area, the connection to the node encounters a handover which may cause much latency. NetLMM(Network based Localized Mobility Management) supports the mobility management for such nodes and improves handover latency using MIH(Media Independent Handover) function. In this paper, we add some messages to NetLMM procedure to improve handover latency and analyze its effects through a scenario based approach

Index Terms— Netlmm, handover, mobility

I. INTRODUCTION

The chances to choose among various access technologies have been continuously expanded thanks to the development of various wireline/wireless communication networks and access technologies. Moreover, users require such services that can mutually cooperate with each other without disconnection when they use various access technologies.

To cope with this communication environment, IEEE 802.21 Working Group(WG) was organized to establish the standard for heterogeneous handovers. The standard from IEEE 802.21 WG will support for cooperating with various broadband access systems. IEEE 802.21 WG is currently establishing the standard for improving the quality of user's experience, i.e., Media Independent Handover Function. (MIHF). The MIHF supports handovers among networks of IEEE 802.3, any type of 802 series and 3GPP, 3GPP2.

In the environment of Mobile IPv/v6, a Mobile Node (MN) needs to register its Home Agent (HA) /Correspond Agent (CA) whenever it changes its location. This may cause more delays and packet losses, which might not be permitted for real time applications. To solve this problem, the Internet Engineering Task Force (IETF) organized WGs such as Mobility for IP: Performance, Signaling and Handoff Optimization (MIPSHOP), Network Mobility (NEMO), Network-based Localized Mobility (NetLMM) etc. MIPSHOP Working Group published two mobility supports protocols as extensions of MIPv6: Hierarchical Mobile IPv6 (HMIPv6) and Fast Handovers for Mobile IPv6 (FMIPv6) to improve mobility supports based on MIPv6[11][12]. The IETF NetLMM (Network-based Localized Mobility Management) WG has launched standardization for network-based mobility management in a localized domain. Accordingly, the IETF chartered the NETLMM working group (WG) to develop a mechanism for network-based localized mobility support of IPv6 nodes. As it is network based, the MN is not required to include new mechanisms in its IP stack, or to change its IP address when it attaches to a new access router. To date, the WG has not adopted any of the individual submission as WG draft. However, two of these individual submissions[4][5].

In this paper, introduced are previously mentioned protocols. Also proposed is a scenario reducing the handover delay by enhancing some primitives of MIH.

II. Related works

A. Preemptive operations for fast handover

The handover procedure can be accelerated by preemptively performing some operations of the network or higher layer handover schemes before a link-layer handover is initiated. Preemptive operations may reduce the handover latency required for the allocation of a new Location ID, an authentication and an authorization, as well as the handover signaling between UE(User Equipment) and HCFs(Handover Control Function). There are two preemptive operations for the fast, host-based and network-based handover.

1) Host-based preemptive operations.

In order to move to another network for satisfying the UE's needs, the UE is required to send the handover request to the Access HCF in advance. In this case, the UE is recommended to send the handover request. On receiving the request, the A-HCF sends the ACK to the UE and the subscribing information to the Central HCF (C-HCF), and this C-HCF performs the same procedure to move the subscribing information to the next, A-HCF in the visited network. After this process, the A-HCF in the visited network knows the UE's handover beforehand and treat it in the fast time. Fig. 1 denotes

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this procedure.

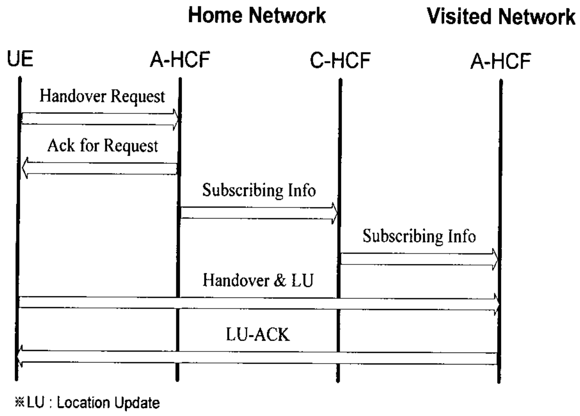

Fig. 1 Host-based Preemptive Operations

2) Network-based preemptive operations

In case of an UE on the edge of the boundary of the Access Network, when it has more chances to move to another network, the A-HCF needs to confirm the location of this UE whether this is on the edge of its Access Network or not. If so, it sends subscribing information to the nearby the A-HCF or C-HCF in advance. When the UE moves to another network, the A-HCF in the visited network already has the subscribing information of this UE. Through this passage of subscribing information to the nearby A-HCF(or C-HCF), the UE which moves to another network has no needs to function to request handover in advance. Fig. 2 denotes this procedure.

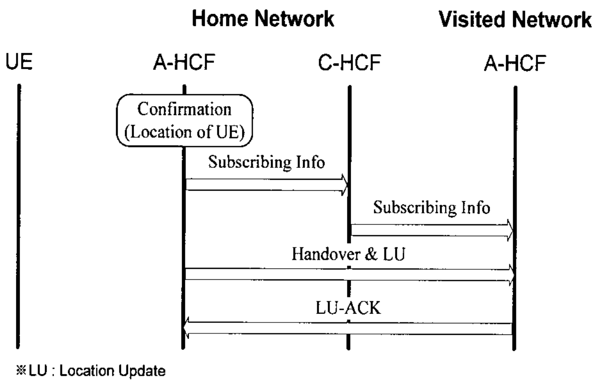

Fig. 2 Network-based Preemptive Operations

B. NetLMM

The Internet Engineering Task Force (IETF) already standardized several host-based mobility management protocols. Recently, a localized mobility management protocol has been suggested. And the IETF establishes the NETLMM working group (WG) to develop a mechanism for the network-based localized mobility support of the IPv6 nodes. Because of its network based nature, the MN is not required to have additional mechanisms.[1]

There are some issues or components for NetLMM as follows:

Network-based Localized Mobility Management Domain (NETLMM domain): An administrative domain spanning geographically contiguous link layer networks served by access routers acting as MAGs.

Mobile Node Identifier (MN ID): An authenticated identifier of the MN used by the NETLMM protocol to identify a MN and index its NETLMM state.

Mobility Access Gateway (MAG): The Mobile Node's default router which sends and receives NETLMM mobility signaling on behalf of the MN.

Local Mobility Anchor (LMA): A router located in the network-based localized mobility domain handling information exchanged between that domain and the Internet.[1]

Fig. 3 shows the operation of NetLMM. The weak point of this protocol is that periodical RA(Router Advertisement) messages may cause some delays which are not suitable for real time packets, especially at the instance of handover.

When the MN finds its aMAG, the aMAG sends the Location Registration message including the MN ID to the LMA. Then, the LMA sends back the Ack Message including the LMA ID. The LMA has known the existence of the MN. Everytime the MN which receives the RA performs Duplicate Address Detection (DAD) and sends the results to the aMAG. The aMAG sends local information to the LMA. When the MN moves to the bMAG, the bMAG also sends RA message to the MN. The MN performs DAD again and sends its local information to the bMAG. Repeatedly, the bMAG sends the Local Registration message to the LMA.

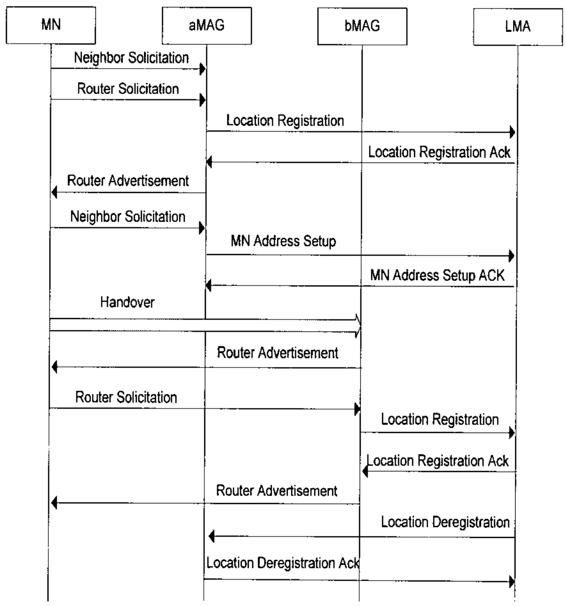

Fig. 3 NetLMM Operation

C. Media Independent Handover

The MIH is the standard for supporting seamless handovers between heterogeneous networks, which have been processed at IEEE 802.21. The MIH may exist on either layer 2 or layer 3. When the MIH locates between Medium Access Control (MAC) layer and IP layer, it charges the role of addressing the information from up to down, down to up. If the MIH is located above layer 3, the IETF MIPSHOP supports for it. The MIH supports MNs which have multiple wireless interfaces can automatically choose a type of the best quality network without users' intentions. And the MIH offers Event, Command, and Information services to make a flexible handover.

Fig. 4 shows these three kinds of services and the relations between the MIH and other layers[7].

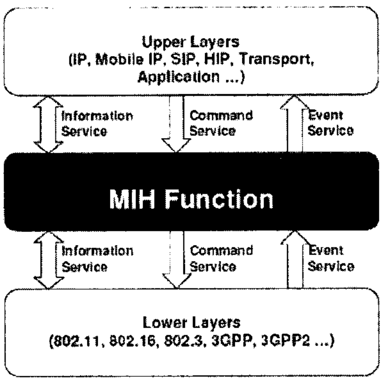

Fig. 4 MIH Important service

III. Proposed scenario

Use either SI (MKS) or CGS as primary units. (SI units are strongly encouraged.)

Table 1 and 2 show some primitives required for the propsed scenario. The MIH primitive is used for improving the problem due to the handover latency[7]. There is a MN which tries to move to the bMAG. The MIH_Scan measures the signal strength. When the signal strength becomes less than the threshold, the MN issues Link_Going_Down event. Then, the handover processing starts. The bMAG can be notified a MN is coming to its boundary by the MIH_Handover_Prepare event. When the MN issues MIH_Handover_Commit, the MN goes to the bMAG. At this time, the bMAG starts buffering the packets for ongoing MNs. As the MN arrives at the bMAG, the MN can get the data from the bMAG. Fig. 5 shows the proposed scenario.

Table 1 Link Events

Link Event type	Link Event Name	Description
State Change	Link_up	L2 connection is established and link is available for use
State Change	Link_Down	L2 connection is broken and link is not available for use
Predictive	Link_Going_Down	Link conditions are degrading connection loss is imminent

Table 2 MIH Commands

MIH Command	Remote Direction	Comments
MIH_Scan	Network -> Client	Scan a link
MIH_Handover_P epare	Network -> Client	This command is sent by current MIHF entity to target MIHF entity to allow for resource query and handover preparation.
MIH_Handover_I nitiate	Client -> Network	Network initiates handover and sends a list of suggested networks and associated Points of Attachment
MIH_Handover_ Commit	Client -> Network	In this case the client commits to do the handover and sends it's choice of selected network and associated PoA.
MIH_Handover Complete	Client -> Network	In this case the client commits to do the handover and sends it's choice of selected network and associated PoA.

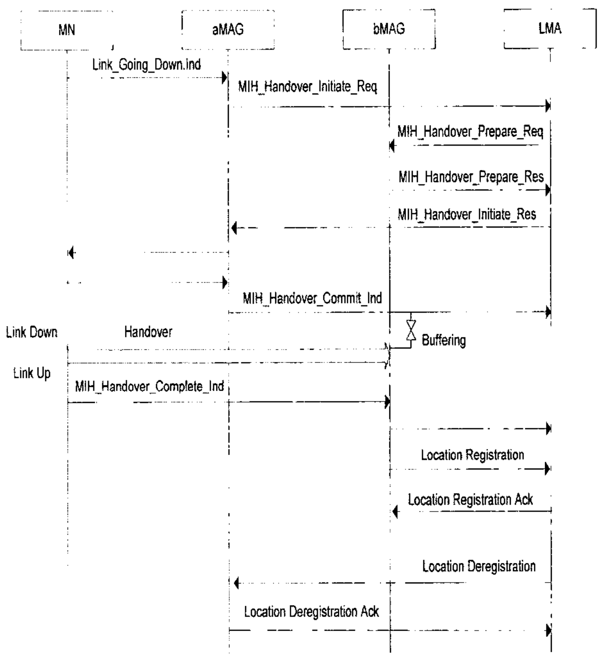

Fig. 5 Proposed scenario

IV. Conclusion and Future works

A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

REFERENCES

[1] Julien Laganier, Matthias Flege, Alf Zugenmaier, Anand Prasad, "Traveling without Moving 802.11 Access Points backed by Secure NETLMM", IEEE, 2007

[2] Stefan Aust, Nikolaus A. Fikouras, Michael Sessinghaus "HIERARCHICAL MOBILE IP NS-2 EXTENSIONS FOR MOBILE AD HOC NETWORKS", University of Bremen, 2004
[3] Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, "Electron spectroscopy studies on magneto-optical media and plastic substrate interfaces(Translation Journals style)," IEEE Transl. J. Magn.Jpn., vol.
[4] H. Levkowetz, G. Giaretta, K. Leung, M. Liebsch, P. Roberts,K. Nishida, H. Yokota, and M. Parthasarathy, The Network-based Localized Mobility Management (NETLMM) Protocol, IETF Internet Draft draft-giaretta-netlmm-dt-protocol-02.txt, October 2006.
[5] S. Gundavelli, K. Leung, V. Devarapalli, K. Chowdhury, and B. Patil, Proxy Mobile IPv6, IETF Internet Draft draft-sgundave-mip6-
[6] http://www.ieee802.org/21
[7] IEEE 802.21/D04.00, "Draft IEEE Standard for Local and Metropolitan Area Networks: Media Independent Handover Services" , February, 2007
[8] T. Narten, E. Nordmark and W. Simpson, "Neighbor Discovery for IP Version 6," IETF RFC 2461, Dec 1998.
[9] Yoon-Young An and Kang-Won Lee, "Enhanced Fast Handover Mechanism Using MIH Services in MIPv6," WWIC 2006. pp. 120-131, 2006.
[10] D. Johnson, C. Perkins and J. Arkko, "Mobility Support in IPv6," IETF RFC 3775, Jun 2004.
[11] Seonggeun Ryu, Younghwan Lim, Seongjin Ahn, and Youngsong Mun, "Enhanced Fast Handover for Mobile IPv6 Based on IEEE 802.11 Network", Lecture Notes in Computer Science, 2005
[12] H. Soliman, C. Castelluccia, K. El Malki, and L. Bellier, "Hierarchical Mobile IPv6 Mobility Management (HMIPv6)", RFC 4140, August 2005. R. Koodli, Ed., "Fast Handovers for Mobile IPv6", RFC 4068, July 2005.

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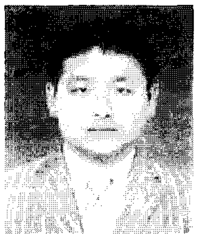

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