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4th Joint **IFIP Wireless and Mobile Networking Conference** is sponsored by **IFIP TC6** and technically co-sponsored by **IEEE Communications Society**.

Wireless and mobile networks, applications and services are rapidly growing areas that have attracted significant attention due to their potential impacts on the quality of life in many domains (health, emergency services, disaster recovery, commerce, shopping, TV, games...). To enable wireless and mobile computing, the integration of technologies from different fields -application and service design, distributed computing, networking, communications, and signal processing- is required.

Members of the international wireless and mobile networks research community have for many years split their conference activity among a number of IFIP-sponsored events, including **PWC (Personal Wireless Communications)** – since 1996, **MWCN (Mobile and Wireless Communication Networks)** – since 1998, and **WSAN (Wireless Sensor and Actor Networks)** – since 2007. In 2008, PWC and MWCN steering committees joined forces to establish **WMNC (joint IFIP Wireless and Mobile Networking Conference)**

IMPORTANT DATES

Regular paper submission deadline: ~~May 31, 2011~~ July 10, 2011 *(new)*

WIP paper submission deadline: ~~June 15, 2011~~ July 10, 2011 *(new)*

Author notification: September 15, 2011

Manuscript due date: September 30, 2011

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I1: Wireless Networks

Chair: Zoubir Mammeri

Room : Concorde (11:00-12:30)

NEW MEASURES FOR MULTICAST GAIN AND THEIR APPLICATION TO IPTV DELIVERY IN WIMAX BASED ACCESS NETWORKS

Alireza Abdollahpouri (University of Hamburg); Bernd E. Wolfinger (University of Hamburg)

ADAC: ADAPTIVE COVERAGE COORDINATION SCHEME IN FEMTOCELL NETWORKS

Fadoua Mhiri (TIME Université); Kaouthar Sethom (Sup'Com, Tunis); Ridha Bouallegue (Sup'Com, Tunis); Guy Pujolle (University of Pierre et Marie Curie)

DISTRIBUTED HANDOVER CONTROL IN LOCALIZED MOBILE LISP NETWORKS

Moneeb Gohar (Kyungpook National University); Seok Joo Koh (Kyungpook National University)

ON INDOOR WIFI SIGNAL STATISTICAL PROPERTIES

Yacine Mezali (INRIA); Jacquet Philippe (INRIA)

Distributed Handover Control in Localized Mobile LISP Networks

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Abstract—**The Locator Identifier Separation Protocol (LISP) has been made as an identifier-locator separation scheme for scalable Internet routing. The identifier-locator separation is also helpful for mobility support. The issue of mobility is a serious challenge in LISP. However, the existing LISP-based handover schemes tend to induce larger handover latency and packet loss. To overcome this problem, we propose a network-based distributed handover control scheme, named LISP-DHC. In the proposed LISP-DHC scheme every access router has the functionality of LISP tunnel router. From numerical results, it is shown that the proposed scheme can give better performance than the existing LISP-based schemes in terms of handover latency.**

Keywords-component; LISP, Mobility, Handover Control, Analysis

I. INTRODUCTION

With wide popularity of smart phones and various mobile/wireless access networks, the number of mobile Internet users has been rapidly increasing. It is reported that the number of mobile Internet users will be 1.6 billions in around 2014 and thus exceed the number of desktop users [1]. This mobile trend has caused a rapid growth of BGP routing table, as known as the routing scalability problem [2, 3].

To solve this problem the Locator Identifier Separation Protocol (LISP) has recently been made in IETF [4], which splits the current IP address space into endpoint identifier (EID) and routing locator (RLOC). An EID is not changed, which is used by end host to send and receive data packets. During communication between hosts, an Ingress Tunnel Router (ITR) prepends a new LISP header to the data packet of a source host, and an Egress TR (ETR) strips the LISP header prior to final delivery to the destination host.

One of the critical issues on LISP is how to manage the EID-RLOC mapping system. Several proposals have so far been proposed, such as LISP-MS [5], LISP-ALT [6], LISP-NERD [7], LISP-DHT [8], and LISP-CONS [9]. On the other hand, we note that all of these mapping schemes commonly make an assumption that EIDs can be aggregated within an edge network. However, the EID aggregation may not be achieved in mobile networks, since every mobile host will have its own distinctive and different EID from the other hosts in the same mobile network, as pointed out in [10].

To address the LISP mobility control, the host-based schemes were proposed [11, 12], in which each mobile host implements the TR functionality. In addition, the works in [13] proposed the network-based schemes, in which a border router (BR) implements the TR functionality. The work in [14] also proposed a network-based scheme in which the Global Mobility Anchor Tunnel Point (GMATP) implements the TR functionality. However, we note that all of the existing LISP mobility schemes are based on a centralized approach by using the LISP Map Server (MS) as a mobility anchor for mobile hosts. However, such a centralized scheme tends to induce larger handover delay and packet loss. In the host-based scheme Mobile Node (MN) acts as a TR and obtains a new Local Locator (LLOC) from the network, while in network-based scheme the border router acts as a TR.

In this paper, we propose a network-based distributed mobility control scheme for localized mobile LISP networks. The proposed distributed handover control scheme can be used to effectively provide the mobility support in wireless/mobile LISP networks, compared to the existing centralized control schemes.

The rest of this paper is organized as follows. In Section II, we review existing centralized schemes for LISP handover control. In Section III, we describe the proposed distributed mobility control scheme. Section IV analyzes and compares the existing and proposed schemes in terms of handover latency. Section V concludes this paper.

II. RELATED WORKS

The existing schemes for LISP mobility control can be divided into host-based scheme and network-based schemes. To support the LISP mobility, the work in [11] proposed a host-based control scheme, in which it is assumed that a MN implements the light-weight TR functionality and it will act as ITR and/or ETR in mobile networks. In this architecture, a MS is used as an anchor point for MNs. That is, a MN will maintain the map cache and directly communicate with MS. However, this scheme is still subject to the triangle routing problem.

The work in [12] proposed an enhanced scheme for the host-based mobility control, which is denoted by LISP-MN in this paper. In this scheme, the main idea is the same with that in

[11]. However, it deploys a local mapping system (LMS) in the edge networks to solve the triangle routing problem.

On the other hand, the work in [13] proposed a network-based LISP mobility control, denoted by Seamless Mobility Support (SMOS) scheme. The main feature of LISP-SMOS is that the EID of MN represents a 128-bit identifier such as Host Identity Protocol (HIP) [14], rather than IP address. Each host uses an IP address of AR as its LLOC for network-based mobility control. The Border Router (BR) of a domain implements the TR functionality and it has its LMS to contain the EID-LLOC mapping information for MNs in the domain.

The work in [15] proposed a network-based LISP mobility control, denoted by LISP-PMIP scheme in this paper. The main feature of LISP-PMIP is that the Global Mobility Anchor Tunnel Point (GMATP) and Local Mobility Anchor Tunnel Point (LMATP) are introduced. GMATP has the functionality of TR, and also performs management of home EIDs and mobility-related signaling for foreign EIDs. In addition, it maintains bidirectional tunneling with LMATP to provide local mobility. A LMATP is responsible for detecting mobile node.

To describe the existing mobility schemes, we will first consider a generalized network model for LISP mobility control, as shown in Fig. 1. In the figure, there are a variety of fixed and mobile LISP networks. In the mobility perspective, we can consider the two types of mobility: 1) micro-mobility within the same mobile LISP network, and 2) macro-mobility across different domains.

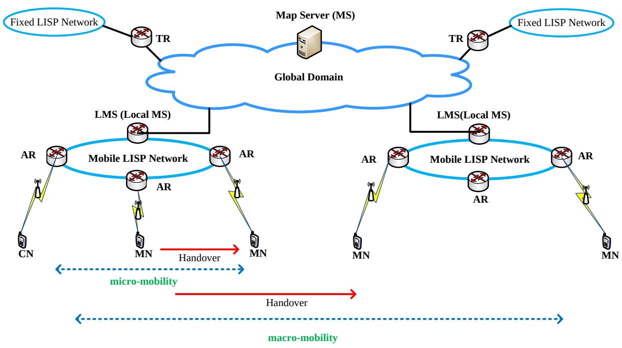

Figure 1. Generalized network model for LISP mobility control

In this paper, we will focus on only the micro-mobility control within a local mobile LISP domain, rather than the macro-mobility control across different mobile domains. For simplicity, we assume that both Correspondent Node (CN) and MN are located within the same mobile domain (i.e., both are mobile hosts), and also we will assume that MN moves from one AR to another AR within the same domain, as illustrated in Fig. 2.

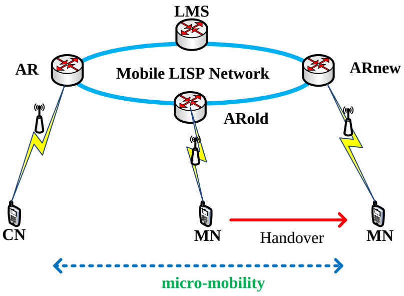

Figure 2. Localized mobility control in LISP

Fig. 3 shows the handover operation of LISP-MN [12]. It is assumed that MN moves from ARold to ARnew region during data transmission with CN. Before handover, MN/TR with EID2:LLOC2 is communicating to CN with EID1:LLOC1. By handover to new AR region, the network attachment to new AR is performed. MN/TR shall configure a new LLOC3 address using DHCP or address auto-configuration scheme. Then, Map Register and Map Register Reply are exchanged between MN and LMS for binding update. After that, the Map Request/Reply messages are exchanged between CN and MN to update the modified LLOC3.

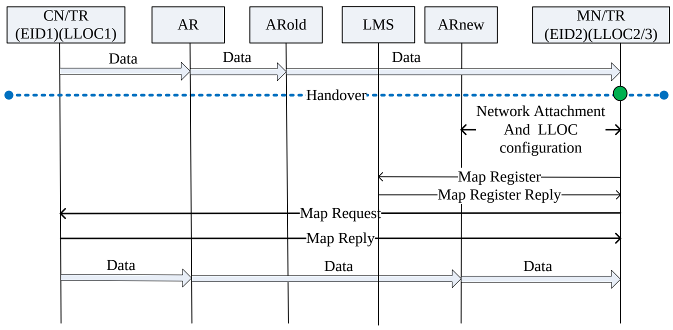

Figure 3. Handover Control in LISP-MN

Fig. 4 shows the handover operation of LISP-SMOS [13]. It is assumed that MN moves from ARold to ARnew region during data transmission with CN. Before handover, MN with EID2:LLOC2 is communicating to CN with EID1:LLOC1. By handover to new AR region, the network attachment is performed to new AR. LLOC3 of ARnew is used and MN does not need to configure the new LLOC. After that, the Map register and Map register reply messages are exchanged between AR and MN and also between AR and BR to update the modified LLOC3. After updating the local database, the BR broadcasts the Map update message in the domain.

Fig. 5 shows the handover operation of LISP-PMIP [15]. It is assumed that MN moves from LMATPold to LMATPnew region during data transmission with CN. Before handover, MN with EID2:LLOC2 is communicating to CN with EID1:LLOC1. By handover to new LMATP region, the network attachment is performed to new LMATP. LLOC3 of LMATPnew is used and MN does not need to configure the new LLOC. After that, the PBU and PBA messages are exchanged between LMATP and GMATP.

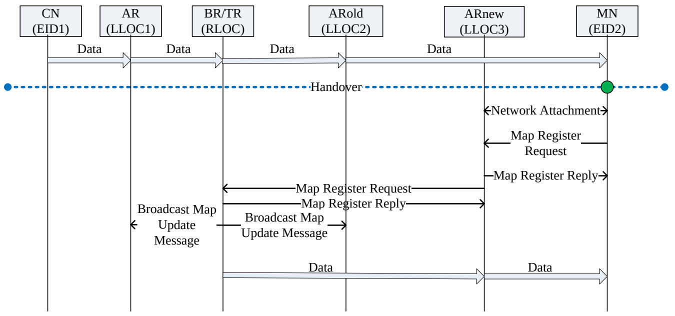

Figure 4. Handover Control in LISP-SMOS

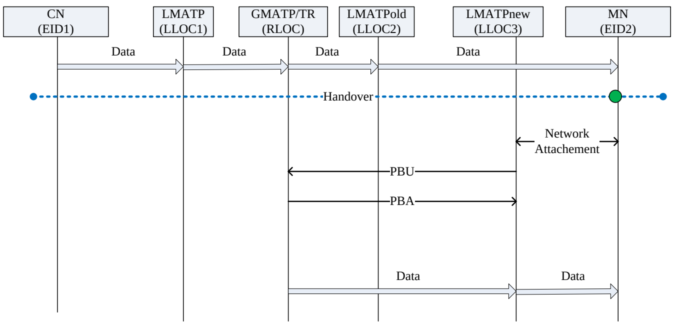

Figure 5. Handover Control in LISP-PMIP

III. Proposed Distributed Mobility Control

In this section, we describe the proposed distributed mobility control scheme: LISP-DHC.

A. *Overview*

In the proposed network-based mobility control model, each AR implements the TR functionality, and it will maintain an EID-LLOC Cache (ELC) for remote hosts. This ELC is used by TR to deliver data packets to remote hosts in the mobile network. This ELC is updated after Map request and Map reply messages are exchanged between ARs in the proposed scheme after handover of MN from old AR to new AR.

Table 1 gives an overview of existing centralized schemes and proposed distributed scheme.

Table 1. Overview of Candidate Mobility Control Schemes

Schemes	Architecture	TR Location
LISP-MN	Centralized (host-based)	MN
LISP-SMOS	Centralized (network-based)	BR
LISP-PMIP	Centralized(network-based)	GMATP
LISP-DHC	Distributed (network-based)	AR

LISP-MN is a centralized host-based scheme, in which MN has the functionality of TR. LISP-SMOS is a centralized network-based scheme in which BR has the functionality of TR. LISP-PMIP is also a centralized network-based scheme in which GMATP has the functionality of TR. While LISP-DHC is a distributed network-based scheme, in which AR has the functionality of TR.

B. *Handover Operation of LISP-DHC*

The handover control is used to provide service continuity for on-going sessions, especially in mobile environment. We note that some existing/future services require high-level handover performance (i.e. low packet loss/latency) and some additional considerations should be given to support seamless handover. In this context, LISP-DHC assumes the use of link-layer information such as Link-Up (LU), which is defined in the IEEE 802.21 MIH [16].

The handover latency is defined as the time interval from the time that MN loses L2 connection with old AR until the time that MN receives the first data packet from new AR.

We first consider the following handover scenario in which MN is communicating with CN, and it is moving from ARold to ARnew. During this process, it is assumed that the ARnew will get an LU trigger from the networks.

Fig. 6 shows the handover operation of LISP-DHC. We assume that CN and MN (in ARold) are communicating before handover. ARnew of MN performs network attachment with the newly attached MN, and the ARnew will update its ELC cache table for MN. After that, ARnew will exchange Map Request and Map Reply messages with ARold for handover control. The Map Reply message shall include the mapping information of EID1:LLOC1 for MN (EID2), which is recorded in the ELC of ARold. After exchanging of Map request and Map Reply messages between the ARold and ARnew, the bidirectional tunneling is established for data forwarding between ARold and ARnew. After establishing tunnel, ARold will forwards the data packets to ARnew, and then ARnew will forward data packets to MN.

Now, the ARnew of MN sends the Map Request message to the AR of CN for route optimization. On reception of the Map Request message, AR of CN will update its ELC table from EID2:LLOC2 to EID2:LLOC3. Then, AR of CN will send the Map Reply message to the ARnew of MN. On reception of the Map Reply message, the ARnew updates its ELC table by creating the EID1:LLOC1 entry.

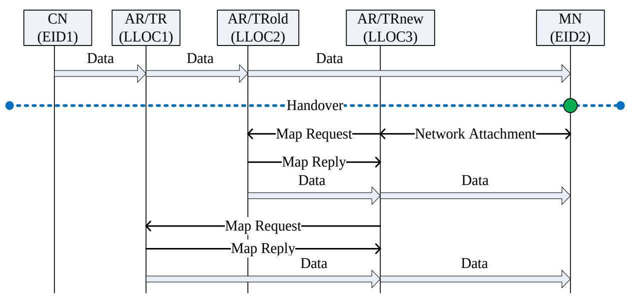

Figure 6. Handover Control in LISP-DHC

IV. Performance Analysis

In order to evaluate the performance of proposed LISP-DHC scheme and existing schemes LISP-MN, LISP-SMOS and LISP-PMIP, we analyze the handover latency during handover.

A. Analysis Model

We consider a network environment with a single domain. The whole domain is served by a single BR/GMATP/LMS and each subnet is served by a single AR/LMATP as shown in Fig. 7.

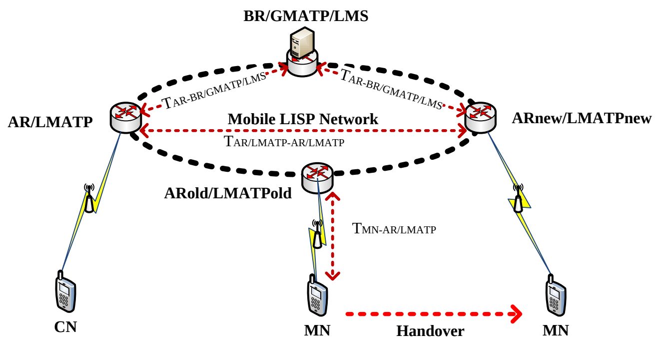

Figure 7. Network Model

In the figure, the link between MN and AR are wireless links and the links between AR/LMATP and BR/GMATP/LMS, and AR/LMATP and AR/LMATP are wired links.

For analysis, we define the following notations in Table 2.

Table 2. Parameters used for cost analysis

Parameters	Description
S_c	Size of control packets
S_d	Size of data packets
B_w	Wired bandwidth
B_{wl}	Wireless bandwidth
L_w	Wired link delay
L_{wl}	Wireless link delay
$H_{a\text{-}b}$	Hop count between node a and b in the network
P_k	Routing lookup and Processing delay at node k
T_{AC}	Address configuration delay
T_{MD}	Movement detection delay
T_{L2}	Link switching delay

Let t(s) denote the transmission delay of a message of size *s* sent from ‘x’ to ‘y’ via the ‘wireless’ link. Then, t(s) can be expressed as follows:

- For control packets: $t(s) = [(S_c/B_{wl}) + L_{wl}]$
- For data packets: $t(s) = [(S_d/B_{wl}) + L_{wl}]$

Let $t(s, H_{x\text{-}y})$ denote the transmission delay of a message of size s sent from ‘x’ to ‘y’ via ‘wired’ link. $H_{x\text{-}y}$ denotes the number of wired link hops between node x and node y. Then, $t(s, H_{x\text{-}y})$ can be expressed as

- For control packets: $t(s, H_{x\text{-}y}) = H_{x\text{-}y} \times [(S_c/B_w) + L_w] + (H_{x\text{-}y}+1)\times P_k$
- For data packets: $t(s, H_{x\text{-}y}) = H_{x\text{-}y} \times [(S_d/B_w) + L_w] + (H_{x\text{-}y}+1)\times P_k$

B. Cost Analysis

In the analysis, we consider the handover latency (HOL) for the existing and proposed schemes.

1) LISP-MN

The HOL of LISP-MN can be composed of link switching delay (T_{L2}), Movement Detection Delay (T_{MD}), Address Configuration Delay (T_{AC}), Map Register and Map Register Reply messages are exchanged between MN and LMS ($2T_{MN\text{-}LMS}(S_c)$), Map Request and Map Reply messages between MN and CN ($2T_{MN\text{-}CN}(S_c)$), delay of data between CN and AR ($T_{CN\text{-}AR}(S_d)$), delay of data between AR and ARnew ($T_{AR\text{-}AR}(S_d)$), and delay of data between ARnew and MN ($T_{AR\text{-}MN}(S_d)$).

Then, we can derive the handover latency of LISP-MN as follows.

$$HOL_{LISP\text{-}MN}=T_{L2}+T_{MD}+T_{AC}+2T_{MN\text{-}LMS}(S_c)+2T_{MN\text{-}CN}(S_c) +T_{CN\text{-}AR}(S_d)+T_{AR\text{-}AR}(S_d)+T_{AR\text{-}MN}(S_d)$$

$$= T_{L2}+T_{MD}+T_{AC}+2\times [(S_c/B_{wl}) +L_{wl}] +2\times [H_{AR\text{-}LMS}\times ((S_c/B_w) +L_w) + (H_{AR\text{-}LMS}+1) \times P_k] +2\times [((S_c/B_{wl}) +L_{wl})+ \{H_{AR\text{-}AR}\times ((S_c/B_w) +L_w) +(H_{AR\text{-}AR}+1)\times P_k\}+((S_c/B_{wl})+L_{wl})]+((S_d/B_{wl}) +L_{wl}) +\{H_{AR\text{-}AR}\times ((S_d/B_w)+L_w)+(H_{AR\text{-}AR}+1)\times P_k \} + ((S_d/B_{wl})+L_{wl}) \quad (1)$$

2) LISP-SMOS

The HOL of LISP-SMOS can be composed of link switching delay (T_{L2}), Movement Detection Delay (T_{MD}), Map Register Request and Map Register Reply messages between MN and ARnew ($2T_{MN\text{-}AR}(S_c)$), Map Register Request and Map Register Reply messages between ARnew and BR ($2T_{AR\text{-}BR}(S_c)$), delay of update message broadcasted to all ARs in the domain from BR ($T_{AR\text{-}BR}(S_c) \times N_{AR}$), delay of data between ARnew and BR ($T_{AR\text{-}BR}(S_d)$), and delay of data between ARnew and MN ($T_{AR\text{-}MN}(S_d)$).

Then, we can derive the handover latency of LISP-SMOS as follows.

$$HOL_{LISP\text{-}SMOS}=T_{L2}+T_{MD}+2T_{MN\text{-}AR}(S_c) +2T_{AR\text{-}BR}(S_c) +T_{AR\text{-}BR}(S_c)\times N_{AR} +T_{AR\text{-}BR}(S_d) +T_{AR\text{-}MN}(S_d)$$

$$= T_{L2}+T_{MD}+2\times[(S_c/B_{wl}) +L_{wl}] +2\times[H_{AR\text{-}BR}\times ((S_c/B_w) +L_w) + (H_{AR\text{-}BR}+1)\times P_k] +[H_{AR\text{-}BR}\times ((S_c/B_w) +L_w) + (H_{AR\text{-}BR}+1)\times P_k] \times N_{AR} +[H_{AR\text{-}BR}\times ((S_d/B_w) +L_w) + (H_{AR\text{-}BR}+1)\times P_k]+((S_d/B_{wl})+L_{wl}) \quad (2)$$

3) *LISP-PMIP*

The HOL of LISP-PMIP can be composed of link switching delay (T_{L2}), Movement Detection Delay (T_{MD}), PBU and PBA messages between LMATPnew and GMATP ($2T_{LMATP\text{-}GMATP}(S_c)$), delay of data between LMATPnew and GMATP ($T_{LMATP\text{-}GMATP}(S_d)$), and delay of data between LMATPnew and MN ($T_{LMATP\text{-}MN}(S_d)$).

Then, we can derive the handover latency of LISP-PMIP as follows.

$$HOL_{LISP\text{-}PMIP}=T_{L2}+T_{MD}+2T_{LMATP\text{-}GMATP}(S_c)+T_{LMATP\text{-}GMATP}(S_d)+T_{LMATP\text{-}MN}(S_d)$$

$$= T_{L2}+T_{MD} \times 2\times[H_{LMATP\text{-}GMATP}\times((S_c/B_w)+L_w)+(H_{LMATP\text{-}GMATP}+1)\times P_k]+[H_{LMATP\text{-}GMATP}\times((S_d/B_w)+L_w)+(H_{LMATP\text{-}GMATP}+1)\times P_k]+((S_d/B_{wl})+L_{wl}) \quad (3)$$

4) *LISP-DHC*

The HOL of LISP-DHC can be composed of link switching delay (T_{L2}), Movement Detection Delay (T_{MD}), Map Request and Map Reply messages between ARold and ARnew ($2T_{AR\text{-}AR}(S_c)$), delay of data between ARold and ARnew ($T_{AR\text{-}AR}(S_d)$), and delay of data between ARnew and MN ($T_{AR\text{-}MN}(S_d)$).

Then, we can derive the handover latency of LISP-DHC as follows.

$$HOL_{LISP\text{-}DHC}=T_{L2}+T_{MD}+2T_{AR\text{-}AR}(S_c)+T_{AR\text{-}AR}(S_d)+T_{AR\text{-}MN}(S_d)$$

$$= T_{L2}+T_{MD}+2\times[H_{AR\text{-}AR}\times((S_c/B_w)+L_w)+(H_{AR\text{-}AR}+1)\times P_k]+[H_{AR\text{-}AR}\times((S_d/B_w)+L_w)+(H_{AR\text{-}AR}+1)\times P_k]+((S_d/B_{wl})+L_{wl}) \quad (4)$$

C. *Numerical Results*

Based on the analytical equations for handover latency given so far, we compare the performance of the existing and proposed schemes. For the numerical analysis, we configure the default parameter values as those described in Table 3, by referring to [17]. In addition, we define Υ as the ratio of $H_{AR\text{-}AR}$ over $H_{AR\text{-}BR/GMATP/LMS}$ ($= H_{AR\text{-}AR}/H_{AR\text{-}BR/GMATP/LMS}$).

TABLE 3. DEFAULT PARAMETER VALUES

Parameters	Values
T_{MD}	10 ms
T_{L2}	50 ms
B_{wl}	11 Mbps
B_w	100 Mbps
L_{wl}	10 ms
L_w	2 ms
S_c	50 bytes
S_d	1024 bytes
$H_{AR\text{-}AR}$	$\sqrt{N_{AR}}$
$H_{AR/LMATP\text{-}BR/GMATP/LMS}$	20
N_{AR}	30
T_{AC}	150 ms
P_k	0.1 ms

The handover latency is depicted in Fig. 8 as a function of the link switching delay. We observe that the handover latency increases proportionally to the link switching delay for all the schemes. It is noted that the proposed scheme (LISP-DHC) outperforms existing schemes (LISP-MN, LISP-SMOS and LISP-PMIP), and they are more efficient when the link switching delay increases. The gap of handover latency among proposed scheme and existing schemes gets larger, as augmentation of link switching delay.

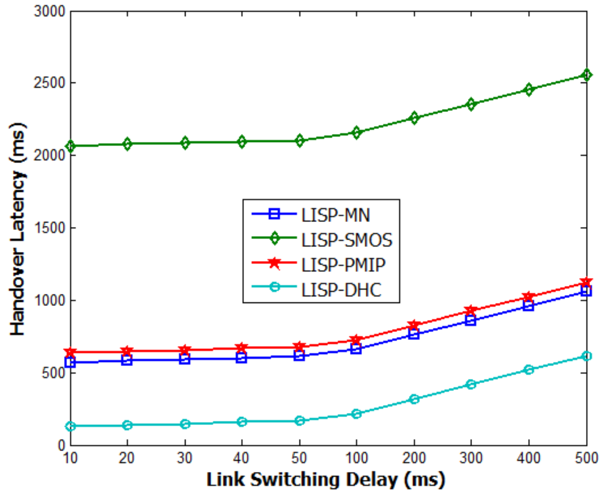

Figure 8. Impact of link switching delay on handover latency

In Fig. 9, we can see that the handover latency increases proportionally with the wireless link delay. We observe that the existing schemes (LISP-MN, LISP-SMOS and LISP-PMIP) have worse performance than the proposed LISP-DHC scheme. In the figure we can see that LISP-PMIP gives better performance than LISP-MN, when wireless link delay increases. In the all candidate schemes, the proposed scheme (LISP-DHC) performs better than the existing schemes.

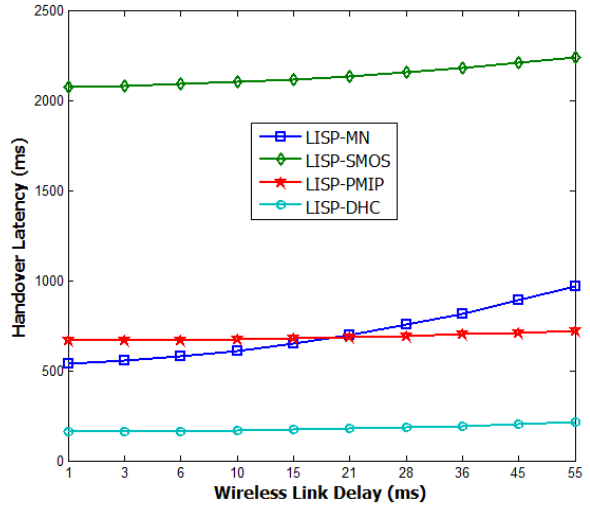

Figure 9. Impact of wireless link delay on handover latency

Fig. 10 shows the handover latency of each candidate scheme for different hop count delay between ARs of CN and MN ($\Upsilon = H_{AR\text{-}AR}/H_{AR/LMATP\text{-}BR/GMATP/LMS}$), which will depend on the relative distance between ARs of CN and MN in the network. In the figure we can see that the host-based LISP-MN and the proposed network-based LISP-DHC scheme slightly depend on Υ. This is because the optimized data path depends on Υ. On the other hand, the network-based LISP-SMOS and LISP-PMIP schemes do not depend on Υ, since MN sends the data packet directly to BR and GMATP, and then BR and GMATP will forward the data packet to AR of MN. From the figure, we can see that LISP-DHC gives the best performance among all the candidate schemes.

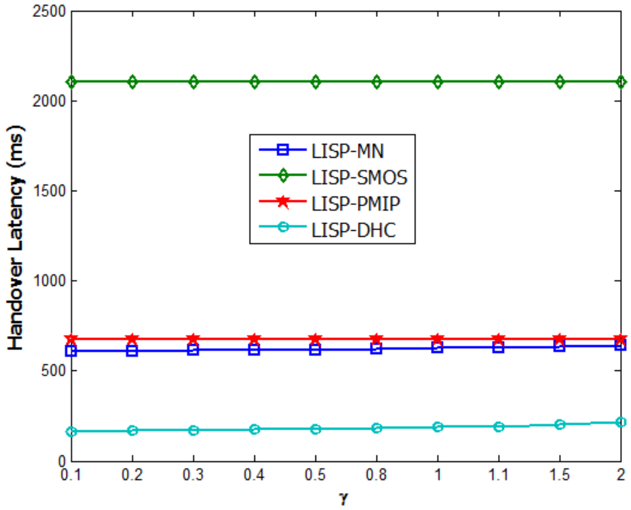

Figure 10. Impact of the hop count ratio of H_{AR-AR} over $H_{AR/LMATP-BR/GMATP/LMS}$

Fig. 11 shows the handover latency for different T_{AC}. In the figure, we can see that the three network-based LISP-SMOS, LISP-PMIP and LISP-DHC schemes are not affected by T_{AC}. On the other hand, LISP-MN is affected by T_{AC}. This is because MN shall configure a new LLOC address in the LISP-MN. From the figure, we can see that LISP-DHC gives the best performance among all the candidate schemes.

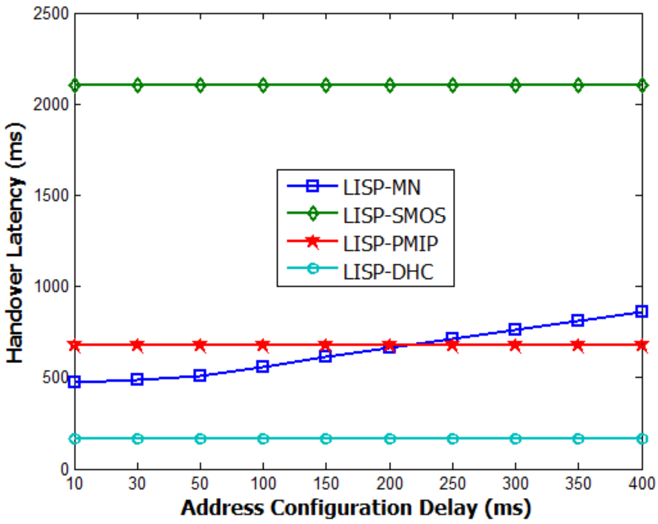

Figure 11. Impact of T_{AC} on handover latency

Fig. 12 shows the handover latency of each candidate scheme for different movement detection delay (T_{MD}). From the figure, it is shown that the existing host-based LISP-MN and proposed network-based LISP-DHC give much lower handover latency than LISP-SMOS and LISP-PMIP. This is mainly because the two network-based LISP-SMOS and LISP-PMIP schemes used centralized node for control and data packets. We can also see that LISP-DHC provides better performance than LISP-MN. This benefit comes from that LISP-DHC uses an optimized data path between CN and MN. From the figure, we can see that LISP-DHC gives the best performance among all the candidate schemes.

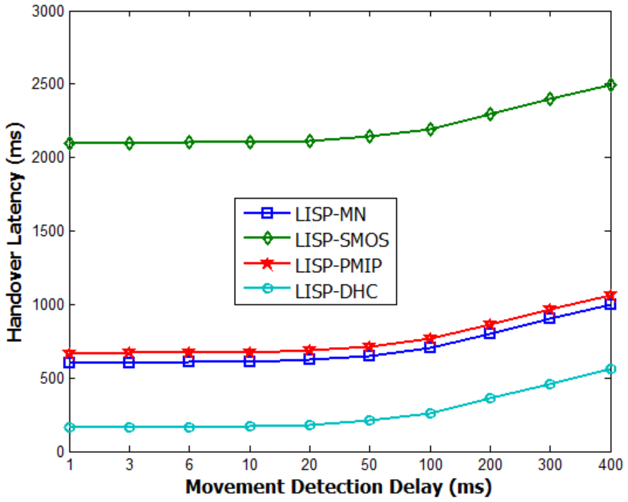

Figure 12. Impact of T_{MD} on handover latency

Fig. 13 compares the handover latency of candidate schemes for different hop counts between AR or LMATP and BR or G-MATP ($H_{AR/LMATP-BR/GMATP/LMS}$). In the figure we can see that $H_{AR/LMATP-BR/GMATP/LMS}$ gives a significant impact on handover latency for the LISP-MN, LISP-SMOS and LISP-PMIP schemes. This is because LISP-SMOS and LISP-PMIP use a centralized node for control and data packets. On the other hand, LISP-MN uses a centralized node for only control packets. However, LISP-DHC do not depend on $H_{AR/LMATP-BR/GMATP/LMS}$. From the figure, it is shown that LISP-DHC gives the best performance among all the candidate schemes.

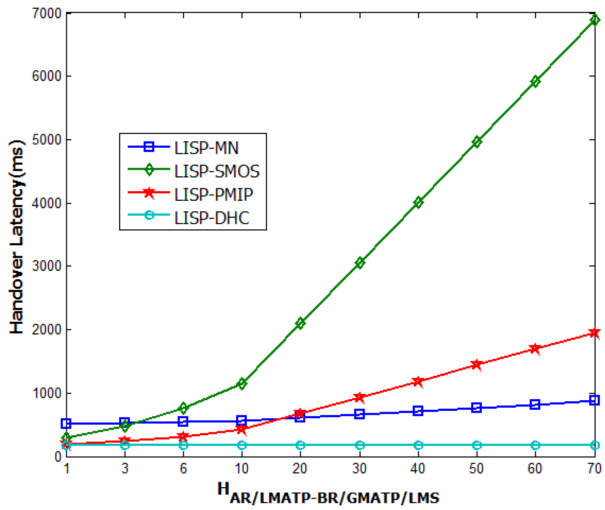

Figure 13. Impact of $H_{AR/LMATP-BR/GMATP/LMS}$ Delay on handover latency

V. Conclusion

In this paper, we proposed a network-based distributed mobility control scheme in mobile LISP network, named LISP-DHC. In LISP-DHC, every AR has the functionality of TR. For handover support, Map request and Map reply messages are exchanged between ARnew and ARold. After that, the tunnel is established for data forwarding from ARold to ARnew. Then, LLOC update operation should be performed between TR of CN and TR of MN so as to provide the route optimization.

By numerical analysis, the proposed scheme is compared with the existing centralized schemes, LISP-MN, LISP-SMOS, and LISP-PMIP, in terms of the handover latency. From the numerical results, we can see that the proposed LISP-DHC scheme is better than the existing schemes. This implies that the distributed mobility control is preferred to the centralized mobility control.

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