A Novel Scheme of Binding Update No Sense Drop BCE in LMA

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Abstract
The frequent changes of Mobile Node (MN) location is going to increase rapidly as everything is a mobile presently. In order to achieve seamless mobility, mobility managements are considered as very important. The mobile IPv6 (MIPv6) is proposed and standardized by IETF. It is introduced to improve the host mobility management. But, it faces different problems when mobile nodes move between different network infrastructures. To overcome these issues, proxy mobile IPv6 PMIPv6 is introduced. PMIPv6 is a network based mobility management intended to improve handover delay by functioning mobility managements on behalf of mobile node. However, PMIPv6 added additional cost to the network by implementing mobile access gateway and bi-directional tunnel. Hence, network mobility NEMO standardized as extension to MIPV6 to support session continuity to the Internet services on behalf of mobile network nodes. But, still there are some issues such as packet loss and handover delay during the registration of MNNs and handoff of NEMO. The research in this area is very active, trying to solve these problems by integration of different mobility management's schemes. In this paper, we investigate different integrations of mobility management's schemes. This paper proposed a Binding Update No Sense Drop BCE in LMA BUNSD-LMA schema. The BUNSD-LMA aims to find possible solution to allow MNNs that are roaming in a PMIPv6 domain to perform seamless mobility whiles maintaining their session continuity through mobile router. In this scheme, we integrate PMIPv6 with NEMO BS and extend an existing binding update message format to register the prefix of MNNs in advance with short time. In addition to this, we considering the concept of investigated proposed schemas to enhance our solution.

Keywords
NEMO, PMIPv6, BUNSD, MR, ;LMA

I. INTRODUCTION

With the increase of wireless network technology IP faces many short comes to support network addresses. For this, the network engineer extends the existing protocol with a new feature that has been gained from previous ones. New protocols have been improved called IPv6 to solve networks addressing shortcomings. Besides this, the previous ones face some issues for mobility management. Due to this, the researcher extends the existing protocol to mobile Internet protocol version six (MIPv6). This protocol is used to support the mobile node movement in IPv6 networks. It allows mobile nodes (MNs) users to continue their network connection to previous networks whiles they move between different IP networks. The MIPv6 is a mobility management protocol, in future all-IP mobile systems are expected to have wide deployment. With the rapid increase in wireless network technology, MIPv6 becomes very important to researchers in order to develop powerful mobile devices running mobile applications to get access to multimedia and data services over broadband wireless connections based on IPv6, to reduce the cost of IPv6 network [1].

The advantage of Mobile IPv6 is that even though the mobile node changes domains and addresses during handover session, the existing connections through which the mobile node is communicate can be maintained. To do this, connections to MNs has configured with a specific address that is always assigned to the MN interface generated from its link layer address, and through which the mobile node is always reachable [4]. Mobile IPv6 faces some limitations in packet loss and latency during handoff operations and binding of its new address. For this, mobility management protocol standardized to support movements of mobile network nodes MNNs as one unit. The IETF group calls that" network mobility basic support protocol" NEMO BSP [3]. Mobility management is to continue services to MNNs while mobile router MR changes its point of attachments in different networks. One of the important issues of mobility management scheme is the hands-off management. Hand-off is how to keep services continue without interruption. When the MR changes its point of attachment to another network (Visited network), the MR needs to update its home agent HA with a new location. The MR acquires Care-of-Address CoA from visited network and sends binding update message to its HA. While the MR configure the CoA, it initiates a bi- directional tunnel between HA and MR, this tunnel is used to sends packets between MNNs and correspondent node CNs. These messages decrease the performance of NEMO BSP. However, NEMO BSP has some limitations such as handover delay and low power consummation compared to network mobility management schemes [4, 5, 6, 7, 9]. In this paper, we focus on evaluating different integrations of mobility managements with NEMO. Then we proposed BUNSD-LMA scheme, to solve the problem of packet loss and handover delay, by integration of PMIPv6 with NEMO

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BS, using pre-registration of HNP in advance with short time update in binding update extension message format.

II. MOBILITY MANAGEMENTS

In the following, we highlight mobility management schemes that classified into two types. The host mobility and network mobility management.

A. Host mobility Managements

Host mobility management: is the method in which the mobility of every mobile node is managed independently.

However, the host mobility is not sufficient for true mobility due to handoff latency and exchange of messages between MN and home agent (HA). In addition to this, host mobility enhanced in different schemes to improve the performance of MNs by mean of localized mobility domain (LMD), in which the home agent is closer to MN to get faster signal exchange [1].

PMIPv6 extends the signaling of MIPv6 and introduces new elements known as Local Mobility Anchor (LMA) and Mobile Access Gateway (MAG). The LMA behaves like the HA in MIPv6 domain and it introduces other capabilities required for Network-based mobility management [2].

B. Network Mobility NEMO

Network mobility NEMO is an extension of MIPv6 protocol and it was supported by IETF standard [3]. The NEMO changes its point of attachment to network infrastructure as a vehicle or train using one mobile router MR as one unit. The NEMO consists of local and fixed mobile nodes L/FMN such as cameras, sensors and as well as visiting mobile nodes VMN such as customers with PDAs, smart phone and laptop so as to use their local services to connect to the Internet. The mobile router takes the advantage of handover to mobile network nodes MNNs as one unit. The HA that resides in the home mobile network negotiates the mobile network prefix MNP for MR. This is done by using binding update BA. The last mobile network prefix generated from its home network is sent back by binding acknowledgement BA to the MR. in this time, the MR configures its permanent HoA, and MNNs gets their IPv6 addresses from the advertised MNP. While the VMNs configure it as CoAs because, its home agents are outside the mobile home network see Fig. 1.

When the MR finishes the configuration of HoA, it configures a bi-directional tunnel between HA and MR. This tunnel is used to forward all packets sent between MNN and correspondent node CNs.

III. PROPOSED BINDING UPDATE NO SENSE DROP BCE IN

LMA (BUNSD-LMA)

In this section, we describe the network topology of the proposed BUNSD-LMA scheme and its elements. Then, we explain the scenario of how to solve the problem of packet loss and handover delay. The proposed scheme deals with the network layer to achieve seamless mobility because it provides transparency to the upper layers. Hence, no changes required to the upper layer existing protocol. It uses PMIPv6 to register MNNs on behalf of MMNs, to decrease handover latency. Then, we use a pre-registration of MNP in advance with short time update in binding update extensions massage format, to reduce MNNs registration time as a group. Fig. 2 shows more details.

NEMO BS changes its point of attachment to network infrastructure using one mobile router (MR). The NEMO consists of LMN and FMN (cameras, sensors) and visiting mobile nodes VMN (customers with PDAs, smart phone and laptop) to use their local services to connect to the Internet.

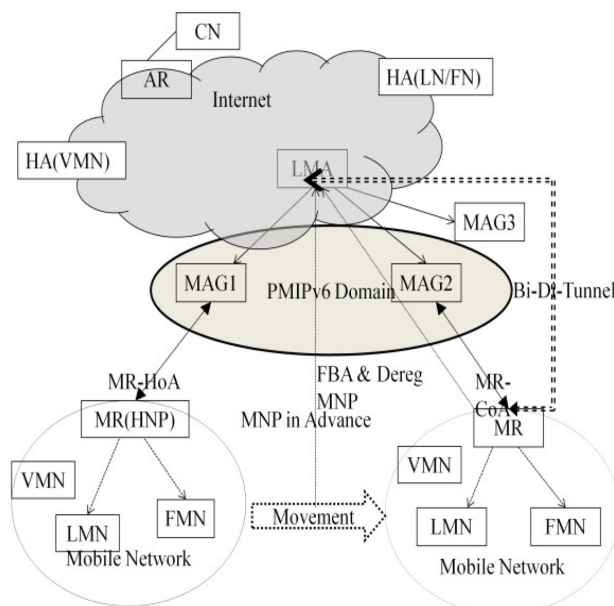

Figure 1. Proposed BUNSD-LMA Architecture.

The mobile router is responsible for triggering the handover on behalf of MNNs as one unit. In addition to, generate the mobile network prefix MNP from the home agent (HA) that resides in the home mobile network. This process is done by using binding update BU and Binding Acknowledgement BA. The last mobile network prefix generated from its home network sent back by binding acknowledgement BA to the MR. This time the MR configures its permanent HoA, and MNNs get their IPv6 addresses from the advertised MNP. However, the VMNs configure it as CoAs because its home agents outside the mobile home network [3].

A. EXTENDED BINDING UPDATE MESSAGE FORMAT

Extended binding update used to register MNNs location in one message. Because, all MNNs have the same mobile network prefix MNP under MR of NEMO. However, we include new extended binding update messages format option, to indicate mobile network prefix. The HA (LMA) binds the MNP with MNNs care of addresses and the CoA of MR and in its binding cache entry BCE. Then if HA intercept packet form any CNs its search binding cache entry for IP address that match bonded MNP prefix. The correspondent Nodes can receive the same binding update from HA by using multicast group of IPv6 protocol.

							OPType	**OPLen**
A	**H**	**R**	**D**	**G**	**R S V E D**	**Prefix Len**	**Sequence No**	
Live time								

Figure 2. BUNSD–LMA Binding Update Message Format.

a. Flag G: When set to 1 it indicates that the MR needs to register its CoA and MNP in sub-option with HA. In this case the life time must be short.
b. HA Operation: While HA intercepts any packets distend to or from MNNs, the HA must verify the HA-BCE, if flag G=1 it must update the binding path life time and delete the flag G.

B. HOME AGENT OF BUNSD-LMA OPERATION

The home agent of BUNSD-LMA is LMA. The LMA is Local Mobility Anchor point in the proposed scheme uses the function capabilities of LMA in PMIPv6 [6]. It maintains a collection of network path for MNNs moved within integrated network mobility domain INMD and location managements. INMD is consisting of PMIPv6 domain and NEMO BS. The MNNs addresses are bonded in the LMA Binding Cache Entry BCE. Hence, all MNNs have the same mobile network prefix of MNP. The MNNs are registers with one BU in BCE of LMA. When LMA receive BU for MAG, it register this prefix with short time and set flag G=1. While LMA intercept any message sent to MNN from any CNs or sent to CN form any MNNs. At this time LMA check its cache and search for flag G. If flag G=1 it update the prefix lifetime to valid time which defined by domain network and delete flag G. Otherwise, it's sent the message to the last destination as normal operation as forwarding.

C. MOBILE ACCESS GATEWAY OPERATION MAG

The MAG performs the mobility-related signaling on behalf of the Mobile Router attached to its access links. The MAG is usually the first-hop access router for the Mobile Router in the BUNSD-LMA Management infrastructure. It is taking the responsibility of tracking the movements of the Mobile Router in the PMIPv6 domain. Hence, A PMIPv6
Domain has multiple MAGs. In BUND-LMA scheme, the MAG performs the handover of MR and the registrations of MNNs in the first time for MNNs NEMO BS standard operation. In this time the MNNs prefixes registers with D=1 flag in its Binding Cache list BCL for proxy domain registration. However, in the second movement the MAG uses BUNSD-LMA scheme to register the MNNs. In addition to this, the MAG is responsible to delegate the mobile network prefix to every attachment of mobile router.

D. MOBILE ROUTER OPERATION

In BUNSD-LMA scheme the Mobile Router operation is operate as a host, a router [10], and a Mobile Node [11]. However, Mobile router in BUNSD-LMA acts as a Mobile Node into two scenarios:-
First as a Mobile Host: In this case, the Home Agent of BUNSD-LMA does not maintain any prefix information related to the Mobile Host's Home Address but, does maintaining a binding cache entry associated to the Mobile Host's Home Address.
Second as a Mobile Router: in this case, in addition to maintain the binding cache entry related to the Mobile Router Home Address of BUNSD-LMA, the Home Agent maintaining forwards information related to prefixes assign to the Mobile Network. Besides every mobile router must delegates MNP prefix to MNNs in the equivalent way if MAG detect attachments of MN in proxy domain. The difference between the two modes is representing by the Flag (R) value of the Mobile Router.

E. SENDING BINDING UPDATES

A Binding Updates sent by Mobile Router to its Home Agent (LMA) for first registration, as described in [1]. However, in BUNSD-LMA we extended the binding update message for fast registration of group of mobile network Nodes as mentioned in (A). Extended binding Update is send by MAG to LMA on behalf of MR. In this time LMA must to create binding cache entry for all MNNs included in the MNP in BU message option. Then it must enable forwarding for correspondent mobile network prefix.

F. BINDING ACKNOWLEDGEMENTS

In response to the Binding Updates which sent by the MAG in behalf of Mobile Router, it can receives Binding Acknowledgements same as in [3]. While in BUNSD-LMA the Binding Acknowledgement can be received after any successfully interception of any messages, send to or form MNNs.

G. ESTABLISHMENT OF BI-DIRECTIONAL TUNNEL

For the implementation of the bi-directional of BUNSD-LMA it MUST be met the following operations:

1) The Home Agent of the BUNSD-LMA scheme can tunnel packets sent for the Mobile Network prefix to the MR's current location, by mean of Care-of-Address.
2) The Home Agent of the BUNSD-LMA scheme can receive packets tunneled by the MR with the source of address of the outer IPv6 header that set to the MR CoA.

IV. OPERATION OF THE PROPOSED ARCHITECTURE

In this section, we describe the operation of BUNSD- LMA. BU and BA message format are extended with the MNP option as shown in fig. 2 in order to register a mobile network prefix of MNNs to the home agent of mobile network (HA=LMA) in BUNSD-LMA. While MAG1 in PMIPv6 domain senses movement of MR to MAG2, this event is detected by sending router solicitation (RS) containing the MNP of MNNs. MNP is delegated to supports MNNs (FMN, LMN, and VMN). The MAG1 check its authorization to use BUNSD-LMA mobility management services. Then MAG1 exchanges signaling with HA on behalf of MR. The BUNSD-LMA authorizes the MR and responses by a router advertisement containing the new MAG2 prefix. This prefix is forwarded to MR by MAG1. Then MR configures the CoA address from HNP and tunnel set up between MAG2 and LMA. While NEMO changes its point of attachment, every MNN sends BU and receive BA through the established tunnel between the LMA and MAG2. The PMIPv6 domain registers the MNNs of NEMO based on HNP obtained from LMA. However, all mobile nodes in the movement of NEMO are assigned HNP as MNP delegated by the mobile router (MR).

1) The MR decides to attach to MAG2.
This phase detected by receiving router solicitation (pre-movements) or MR solicit the MAG2 for movement's uses router solicitation (RS). MR receives high signal strength form MAG2. In this time MAG1 detects the movement of MR1 to MAG2 and performs deregistration process at LMA for the MR1. Then MAG waits for the registration of MR1 through MAG2.
2) L2 handover process is performed for MR1 and the n MR1 will be attached to MAG2.
3) The authentication will be performed using MAG2 for the MR1.
4) Upon detecting the attachment to the access link, the MAG1 assigns the MR to a group Proxy domain and the group identifier (G=1) is assigned by including it in the mobile node group identifier option in the PBU message. The MAG1 send PBU message to LMA for registering MNN.
5) After accepting the PBU message from MAG, the LMA creates a binding cache Entry and assigns to a group G1. Then LMA send proxy-binding acknowledgement PBA back to the MAG1. Forward to the MR.
6) Upon receiving the PBA, the MAG1 also updates the binding cache entry for the mobility session by using G1. Now both MAG and LMA are aware of the group identifiers for the INMD.
7) The MR configures its care of address and forwards the MNP to MNN.
8) Bi-directional tunnel is create between the LMA and MAG and between MAG and MR
9) After this, MNNs can send and receive from anyCNs.

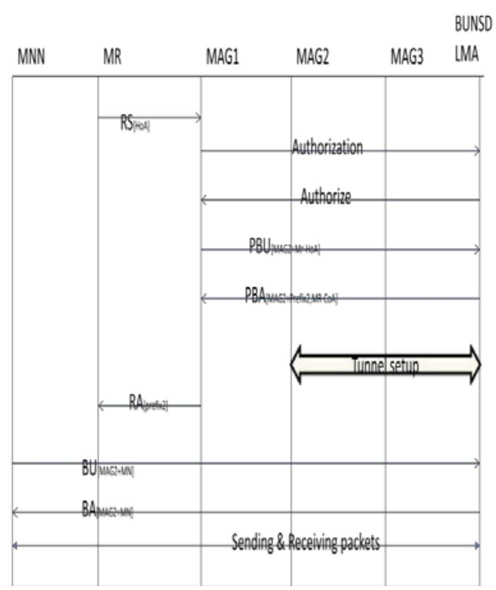

Figure 3. Flowchart BUNSD-LMA

However, When the MR initiates the handover to MAG3. The MAG2 sends PBU to LMA with HNP flag to pre-register MNNs bonded with MAG2 and MNP=HNP to be bonded with MAG3 in LMA in advance. In this case the HNPrifx life time must be short. Then if LMA (HA) intercepts any packet delivered to MNNs, the LMA must update the BCE of LMA with valid lifetime and send fast deregistration message FPA to MAG2. Then MAG2 delete same MNP bonded in it is cache. Otherwise, the bonded MNP prefix in LMA cache must be dropped, see fig. 3. However, in the second movement to MAG3, all MNNs are registered with one PBU and PBA to LMA to register mobile network nodes locations. This leads to degrease the total packet loss and enhance seamless mobility of MNNs compared to [9]. Hence, the binding update extent the message format option flag and set to 1. This leads to less bandwidth consummation and low latency. In addition, the handover of the MR takes two signals to join MAG3. The complete scenario of MR movement and registration of MNNs is shown in fig. 4.

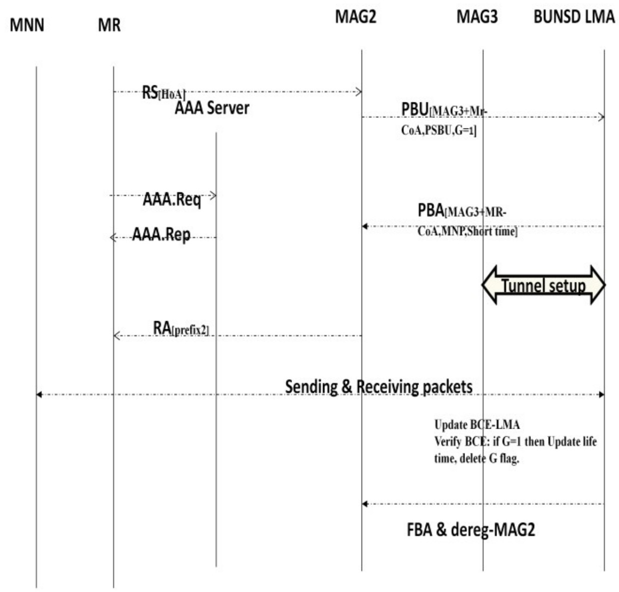

Figure 4. Proposed BUNSD-LMA Messages flow

MR will be uses the extended binding update process to exchange the group identifier for the MNP such as G=1. Here, the MR is also assigned to the same MAG's group binding update flag G and LMA's extended binding update message format. Now MAG and LMA are also aware of MR message group identifier.

1) The MR decides to attach to NMAG. This phase detected by receiving router solicitation (pre-movements) or solicitation (RS). MR receives high signal strength form NMAG. In this time MAG detects the movement of MR to NMAG and performs deregistration process at LMA for the MR. Then MAG waits for the registration of MR through NMAG.
2) L2 handover process is performed for MR and the MR will be attached to NMAG.
3) The authentication will be performed using MAG for the MR.
4) Now MR will be participated in the extended binding update process to exchange the group identifiers such as G=1. Here, the MR is assigned to a MAG's extended binding update group identifier with flag G=1 and LMA's extended binding update group identifier D=1(Proxy domain). Now at this point MAG treats MR as group G for MNP registration. Whereas LMA treats the MR as domain registration D=1. Now both the entities can perform the extended binding operations on a group of mobility sessions identified by the respective extended binding update group identifier.
5) The MAG sends a EPBU message for short lifetime of all the mobile Network Nodes identified by the group identifier G. Upon accepting the PBU, the LMA will update the lifetimes of MNP prefix, and MR in the binding cache entries.
6) Upon LMA intercepts any message from any part of the group G. the LMA verify BCE for flag G=1. Then update MNN lifetime, and sends a binding acknowledge message to MAG with fast BA. Upon accepting FBA message, the MAG deletes MNN for its cache.

MR solicit the NMAG for movement's uses router The BUNSD-LMA, which shown in figure.3.5 flowchart is implementing route decision operations for the proposed scheme described into these steps:

1) The route decision operation of proposed BUNSD-LMA scheme is start by the mobile router movements to foreign network.
2) The MR perform authentication with BUNSD-LMA Domain or INMD. If the authentication fails its stop movement in proxy domain, otherwise, then check proxy domain applicability.
3) If MR is registered in BUNSD-LMA proxy domain then, MAG perform the registrations for MNNs using extended binding update message with flag G=1. In this time it call fast registration.
4) If MR is not registered in BUNSD-LMA proxy domain then, MAG perform the registrations for MNNs using first time proxy domain registration with flag D=1.
5) After successfully registration for MNP prefix with flag G=1. The LMA update MNNs lifetime to short.
6) Upon intercepting, any message for the network LMA updates the lifetime and sends FBA to MNN through NMAG.

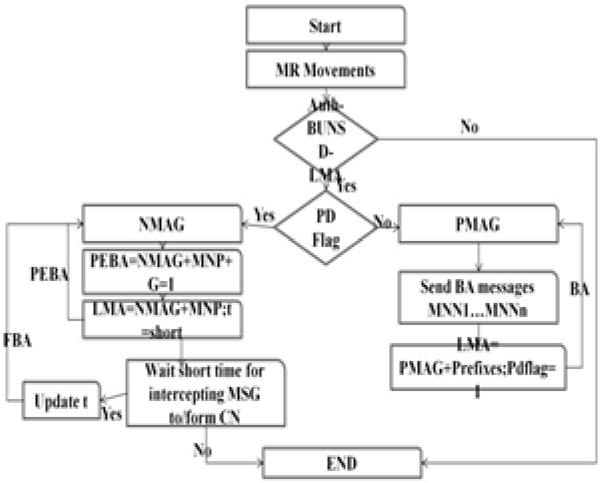

Figure 5. Flowchart BUNSD-LMA

PMIPv6.

REG-G : Check Flag G. IF
the Flag G=1 THEN
Update LMA BCE
Send PBA to
MAG ENDIF
Configure Tunnel End Point.
Packets intercepted:
IF Packet intercepted to MNN
THEN Update MNN valid time.
Send FBA with G dereg to MAG.
Delete Flag G.
ENDI
F
ENDCASE
}

V. CONCLUSION

In this paper, we proposed a BUNSD-LMA scheme to solve the problems of packet loss and handover delay of MNNs. The proposed solution based on PMIPv6 to perform signaling for handover on behalf of MR. Then we extended Pre-registration mechanism of MNP (HNP) in advance with short time. However, the result shows that the MR takes two signals for handover function and two binding update message to register mobile network nodes locations. This leads to degrease the total packet loss and enhance seamless mobility of MNNs compared to [9] and NEMO BS standard.

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