Improving Message Delay, Handoff latency and Binding Update in High level Nested Network Mobility

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Abstract
Recently, wireless devices have been used significantly due to the continuous and enormous Services that they provide. One of the major challenges that faces is how to achieve high network performance. The Internet Engineering Task Force (IETF) has developed Mobile IP, which allows Mobile node to be connected while it is moving as well as functioning in foreign mobile network zone using its original IP address. IETF also in order to manage mobility of an entire network as single unit, they developed NEMO Basic Support Protocol (NEMO BS), which allows Mobile Router to move and change their point of attachment. When a Mobile Router connected to other mobile router on foreign mobile network, it makes a hierarchical structure known as Nested Mobile Network. When the level of nesting becomes high, problems of tunneling overhead are increased, which will produce high message delay. This paper proposed a novel scheme to improve massage delay and handoff latency and binding update in case of high level of nesting.

Keywords:
Mobile Network, Mobile Router, Nested Mobile Network, Performance

I. INTRODUCTION

The Mobility Support has been designed for the purpose of achieving a permanent and continuing access to the Internet while the wireless devices are roaming and changing their points of attachment. This Supports are classified into:

- Host Mobility

The Host Mobility Support is a mechanism that maintains session continuity between mobile node and their Correspondent Node whereas the mobile host changes the point of attachment [1]. It can be realized by using one of the following techniques:

- MIPv6

A MIPv6 protocol allows mobile node retaining its home address after moving to another network. Then the packets are routed to the MN using home address instead of using the MN's current point of attachment to the Internet [2].

- Hierarchical Mobile IPv6 (HMIPv6)

A HMIPv6 is an extension of the MIPv6, which designed to minimize signaling overhead between the mobile node with its correspondent nodes, and its home agent when the MNs are roaming locally [2].

- Proxy Mobile Ipv6 (PMIPv6)

A PMIPv6 contains of the network entities that are responsible for controlling mobility signals in the MIPv6, and therefore provides the network based mobility management service. [3].

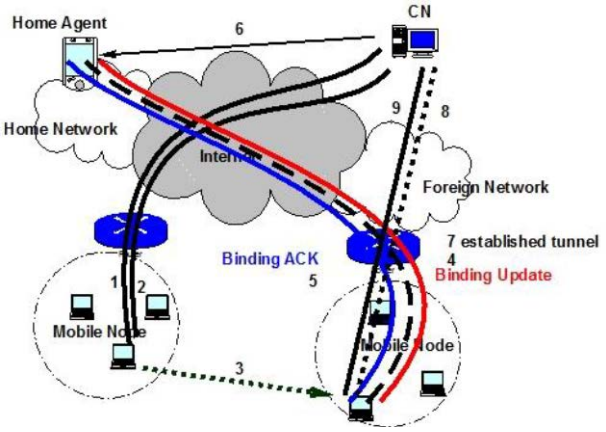

Figure 1. Basic operation of Mipv6

II. NETWORK MOBILITY

Network mobility supports the protocol which introduces the concept of network mobility based on Mipv6 standard [4]. It aimed to ensure permanent continuity for mobile network (routers, nodes) and to support network mobility management. Fig. 2 shows basic mechanism for network mobility which consist for mobile nodes connecting to the mobile router. The mobile router provides internet access to its local network. When the mobile router departs its local network and engages with the foreign network, it obtains new address known as care of address (CoA), and then the mobile router sends BU to the Home Agent to inform its new address in foreign network. The home agent after receiving binding update the message, it automatically sends an acknowledgment to the mobile router to notify the status of connection. Then a bi-directional tunneling between mobile router and the Home Agent has been established. Then all the traffic is done via this tunnel. The key advantages of this mechanism is to minimize the

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signaling cost by avoiding extra registration operation and hidden mobility of the mobile router from mobile node as well as CN. In spite of these advantages, there is still an existence of some substantial problems such as tunneling overhead, handoff latency and high signaling cost particularly in the case of nested network mobility.

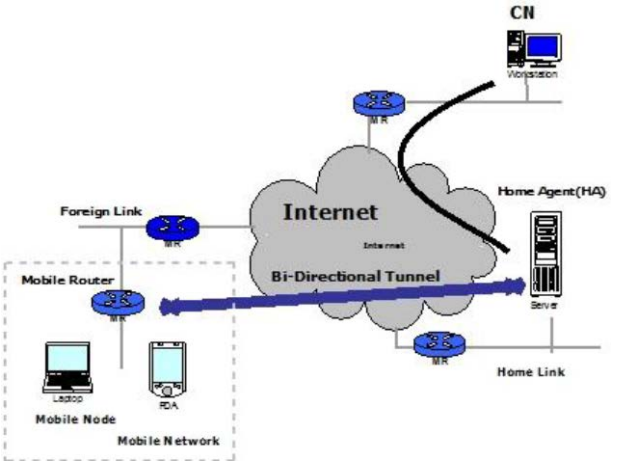

Figure 2. Network Mobility

III. NESTED NETWORK MOBILITY

The nested NEMO is topology that occurs when the mobile router attached to other mobile router in other mobile network and so on. This hierarchy of mobile routers increased the complexity of route because a bidirectional tunnel will be formed at each level of nesting. A bidirectional tunnel is (IP-in-IP) tunnel between mobile router and its Home Agent; this additional IP header will increase the size of the message at each level which consequently increases tunneling overhead, handoff latency and signaling cost leading to bad performance. Fig. 3 illustrates the nested NEMO after three mobile routers moves to foreign link, when the CN sends message to Mn3, then the message will pass through all the levels of the tunnels and traverses via the following route :

CN->MN3HA->MN2HA->MN1HA->MR1->MR2->MR3->MN3

This path results in multiple encapsulations and high delay during packet forwarding. Furthermore, the message will pass through all the Home Agents before reaching its destination [5]. Moreover, whenever there are multilevel of nesting the performance problem becomes seriously complicated. Hence, more research efforts are required.

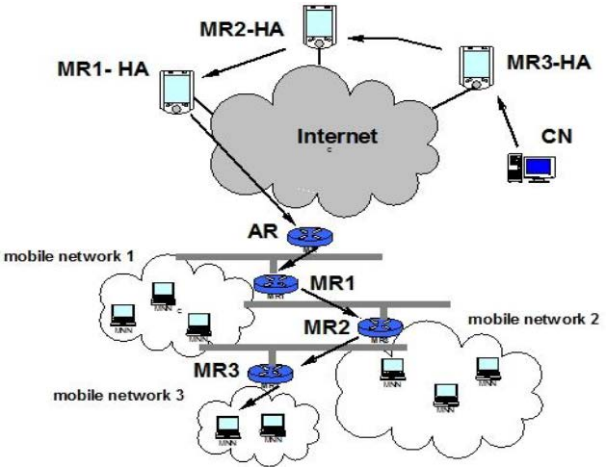

Figure 3. Nested Network Mobility

IV. RELATED WORK

This section shows different techniques that have been proposed to tackle the nested mobile network problems. Even though a number of previous studies have endeavored to resolve these problems, there is still a means for enhancement. Some of these techniques are briefly discussed below:

In [6] "a new route optimization scenario based on nested mobile network is proposed ". This approach used hierarchal structure with binding update tree (BUT), and configured two care of address: (i)- Regional care of address (RcoA) which is based on the mobile node prefix of the TLMR. (ii)- Local care of address (LcoA) which is based on the mobile prefix of it is access router [7]. Although this scheme has reduced packet overhead, handoff latency, packet transmission delay and enhanced the routing. However, additional research efforts are badly needed to complement the previous findings contributions in high level of nesting. Also it is clearly observed that the obtained result from this study giving a better indication compared to the NEMO. But, what is obviously observed is that the packets delay is increasing with an increase of the level of nesting.

In [7] the author proposed an "efficient route optimization scheme for nested network mobility" which used two care of addresses for each mobile router as well as two types of entries in the mobile routers caches [7]. This scheme completely removed the tunneling on the nested Nemo in a single step and transmitted only one BU message. However, this scheme has introduced high signaling cost at each level of nesting because of the operation of the two addresses and the two types of entries. Therefore, this scheme is not suitable for multiple level of nesting.

The author in [8] presented "a novel route optimization scheme (HRS) based on local management architecture that combined nested NEMO and HMIPv6".

This scheme had eliminated the bi-directional tunneling by setting up one-way tunnel between (TLMR) and Home Agent [8]. Moreover, it had reduced registration overhead because it is based on hierarchal local management architecture [8]. Whenever the domain under the MAP becomes high the efficiency of the scheme significantly decreased, problems of BU storm are appeared and leads to high hand-off latency. Although this approach they show a little improvement than the previous studies standard benchmarks, but the issue of performance efficiency is still persisting in the high level of nesting.

The author in [9] proposed "an (HRO), a routing optimization scheme based on hierarchical MIPv6" .In this scheme a MAP was introduced and deployed to manage the mobile network in its domain. Most registration messages are kept in MAP domain, and the packets in MAP domain are forwarded along the optimized routing path [9]. Although this scheme avoided encapsulation between intermediate Mobile Router along the transmission path and reduced registration overhead. However, similar to consequences of the HRS scheme it increases handoff latency and registration overhead whenever the number of nesting becomes higher.

In [10] A DRO scheme for nested mobile Networks has been proposed. The scheme based on domain-based network architecture which adapts ad hoc routing techniques to reduce handoff latency, prevent the out-of sequences packet delivery as well as the minimization of packet transmission delay. Although the result of this technique is better compared to the other techniques, however the handoff latency is still increasing in the case of multiple nesting.

TABLE I. APPROACHES COMPARATIVE TABLE

Approach	**Comparative Table Discussion**	
	on low Level of nesting	***On high level of nesting***
In [6]	• Reduced packet overhead. • Reduced messaging cost • Reduced handoff latency	• Increases over all Delay
In [7]	• Reduced packet overhead. • Reduced messaging cost • Reduced handoff latency	• High processing overhead
In [8]	• Reduced Tunneling overhead • Reduced registration cost	• Increases handoff latency • Increases massaging cost
In [9]	• Avoid encapsulation • Reduced registration cost	• Increases handoff latency • Increases registration cost
In [10]	• Reduced packet overhead. • Reduced messaging cost • Reduced handoff latency	• Increases registration cost • Increases massaging cost

V. THE FRAMEWORK ARCHETICTURE

The proposed scheme using Hierarchal Mobile IPv6 (HMIPv6) with novel architecture which divides the domain under MAP into multiple sub domains depending on the level of nesting. So this technique will reduces the transmission cost and decrease the nested tunnels and also will enhances Intra domain routing perfectly behind Improving Message Delay and enhances Handoff latency and Binding Update. This scheme is simple to implement as it requires only slight change in the implementation of mobile routers and mobile nodes, no change is requires on home agents, correspondent node or any other network components.

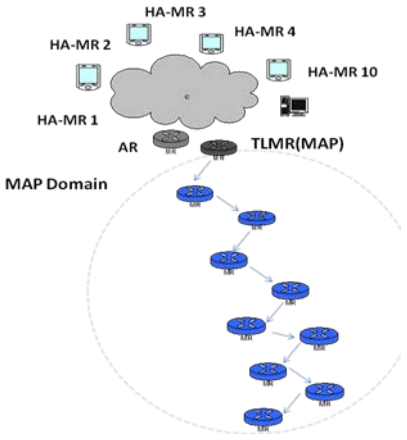

Figure 4. HIPV6 archetidture

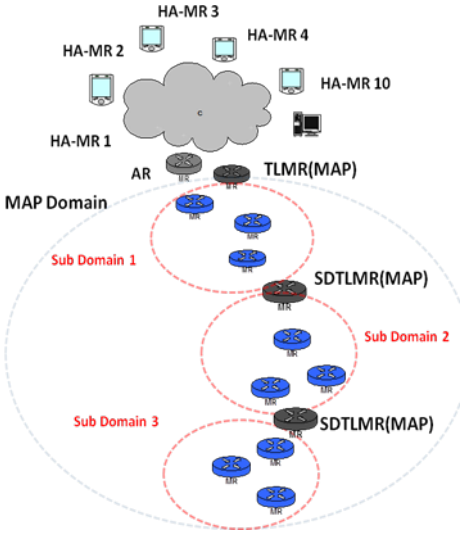

Figure 5. Proposed scheme archeticture

VI. CONCLUSION

This paper produced a novel architecture using Hierarchal Mobile IPv6 (HMIPv6) which expected to overcome the problems that will be faced in case of high level nested network mobility , some of the approaches are introduced to resolve the nested NEMO problems. However, the examined approaches in this study appeared to provide only partial solution for low level of nesting. Therefore, The analysis of this paper emphasizes that all the current schemes suffer from the increase of handoff latency and packet transmission delay particularly in the case of multiple nesting. So additional efforts will be

needed to enhances performance when there are multiple network mobility connected together

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