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GPS ASSISTED HANDOFF IN OVERLAPPING IPv6 WLAN WITH MULTIPLE CoA

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ABSTRACT

With the evolution of wireless networks and the unique features of mobile IPv6 it has become possible to utilize network services at remote location. However the handoff issues due to mobility can lead to serious delays. In this paper we present a unique approach for handoff when mobile node moves into a foreign network. We have utilized GPS (Global Positioning System) for gathering location information and multiple care of addresses handoff assistance.

Keywords: *Care of Address, Global Positioning System, Handoff, Mobile IPv6*

INTRODUCTION

Nowadays, wireless network access is becoming increasingly popular since wireless communication offers interesting advantages: it allows movements during communications and networks at a fair rate among users[1]. By default, MIPv6 provides location update for mobility management for mobile node[2]. Yet, it has been recognized for some time that the default Mobile IPv6 algorithm for moving a Mobile Node's point of attachment from one subnet to another can result in packet drops which introduce user-perceptible artefacts for real time traffic[3]. To overcome handoff shortcoming in the default MIPv6, many algorithms have been proposed[4,5,6,7].

However, the use of Global Positioning System and multiple Care of Addresses (CoA) for handoff management has remained limited. Some research has focused on GPS assisted handoff schemes[8]. Since range of access point (AP) is limited, for a mobile node to continue using the network services multiple handoff will result when the mobile node enters the coverage area of a new AP.

In this paper we present a novel handoff approach utilizing GPS and multiple CoA[9].

HANDOFF IN MOBILE IPv6 802.11

The standard handover process in Mobile IPv6 is illustrated in Figure 1. When MN moves to a foreign network, it must inform its home network about this movement and must autoconfigure a new CoA in order to avoid losing any during an ongoing conversation with CN. However, this new CoA must be registered with the home agent (HA), which allows HA to tunnel packets to MN until CN receives a binding update from MN. When ever MN moves outside its home network, it informs HA by sending a binding update (refer to figure 1) to HA (1). HA replies back with a binding acknowledgement (2). Since CN knows MN's home address, it forwards packets destined for MN to HA which tunnels them to MN (3). MN then sends a binding update to CN (4).

MULTIPLE CARE OF ADDRESS REGISTRATION

The multiple care of address registration allows a mobile node (MN) to register multiple CoA with one home agent. The registration is done in bulk or individually, all the CoA are registered through a single binding update (BU) message. The MN uniquely identifies each CoA by assigning a Binding Unique Identification Number (BID) to each of the CoA and recording it in BU list. The MN then registers its care of addresses by sending a Binding Update with a Binding Unique Identifier sub-option[9]. Once the home agent receives the BU message, it verifies the request and stores it in its binding cache.

When a mobile node wants to send a binding update to the corresponding node, it follows the same process as that for registration with home agent. The calculation of authenticator by using BID and other sub-options is specified in[2].

PROPOSED HANDOFF MODEL

In the proposed handoff model we are presenting a unique approach that only provides a fast handoff, but also deals with the delay associated with Duplicate Address Detection (DAD). The terminologies which will be used in this model are defined below along with some assumptions:

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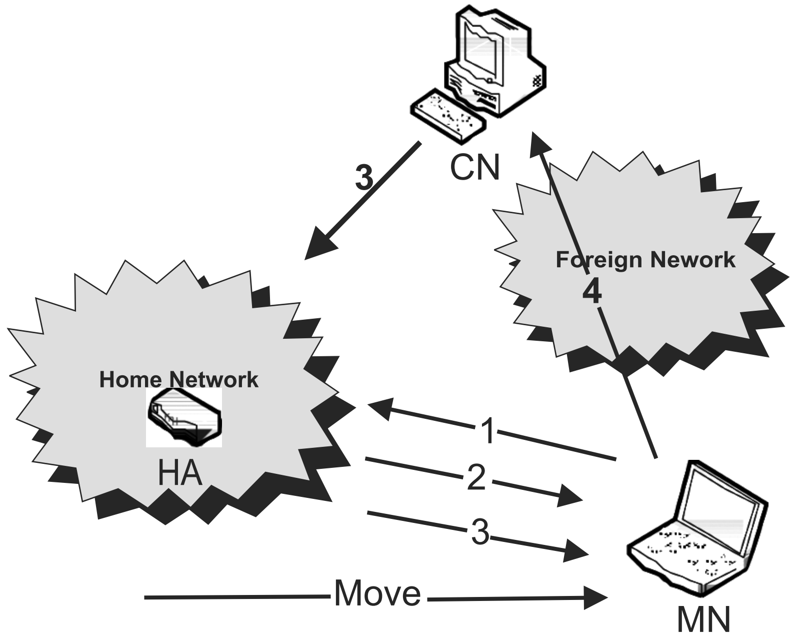

Figure 1: Handover in Standard Mobile IPv6

Mobile Node (MN): It is the mobile terminal which needs to maintain a connection with the internet while on the move. These terminals are equipped with GPS (Global Positioning System) receivers and hence are aware of their location.

Home Network: It is the initial network of the MN from where the MN first shows its presence on the internet.

Foreign Network: It is the network other then the MN's home network in which the MN moves into.

Handoff Agent: It is an agent that assists an MN during transition from one network to another network. It is also equipped with GPS receiver.

Corresponding Node (CN): It is a node trying to communicate with the MN.

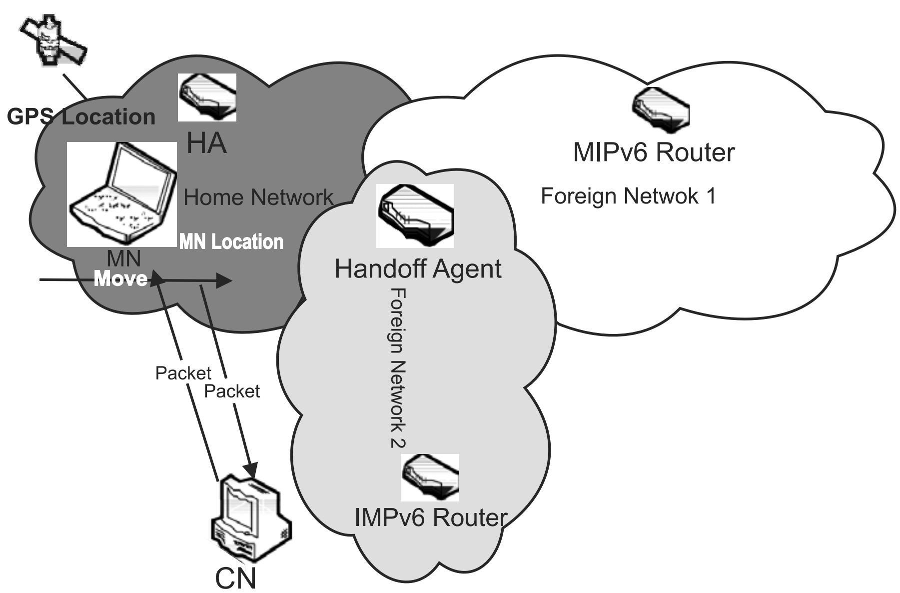

Figure 2: MN updates location information to handoff agent

Agent Discovery: The MN must realize if it is in its home network or in a foreign network. In case of being in a foreign network, the MN will have to obtain a CoA through autoconfiguration.

Consider a scenario where an MN is located in its home network and is initially stationary. In the home network, the MN only has its home address. When a CN wants to send a packet to the MN, it relays the packet to the home agent and home agent forwards the packet to MN. MN then sends a binding update to CN so that MN and CN can form an optimized route. When MN starts moving within its home network it still maintains communication with CN as MN still maintains its home address.

During movement, the MN sends its location update to the handoff agent. The handoff agent resides in the overlapping region of home network and foreign network. The handoff agent maintains a location table for all the nodes present in either of the two overlapping areas. Location table contains the home address of MN, its current location (an update is sent by MN to handoff agent whenever the location is changed) and heading (which handoff agent can deduce itself since it know its own location and that of the MN).

When the handoff agent senses that the MN is moving towards the foreign network, it sends an autoconfig_request to the MN. In autoconfig_request the handoff agent asks MN to autoconfigure an address for maintaining connectivity in the foreign network. The autoconfig_request reply contains home address of MN as well as the new autoconfigured address (multiple CoA). This allows handoff agent to keep track of who sent which autoconfig_reply. The handoff agent broadcasts the new address in the foreign network to detect a duplicate address. If no duplicate is detected, the handoff agent sends “success” message to MN. In case of a duplicate, handoff agent sends back a “duplicate” which indicates MN to choose another Care of Address (CoA) address.

For multiple overlapping networks, MN initially sends multiple CoA to handoff agent for detecting potential duplicate addresses (Figure 3). Once MN and handoff agent are a certain threshold distance away, handoff agent calculates which foreign network MN is heading for. This is done by examining the “heading” field in the GPS comma separated message string received by the GPS receiver, this information is given in degrees. Once MN is near the overlapping area, handoff agent informs MN which CoA (out of the multiple CoA) to perform binding update for. MN then proceeds by sending a binding update to HA as well as to CN (Figure 4). HA responds by sending a binding acknowledgement. During network formation, the handoff agent sends a test message to the

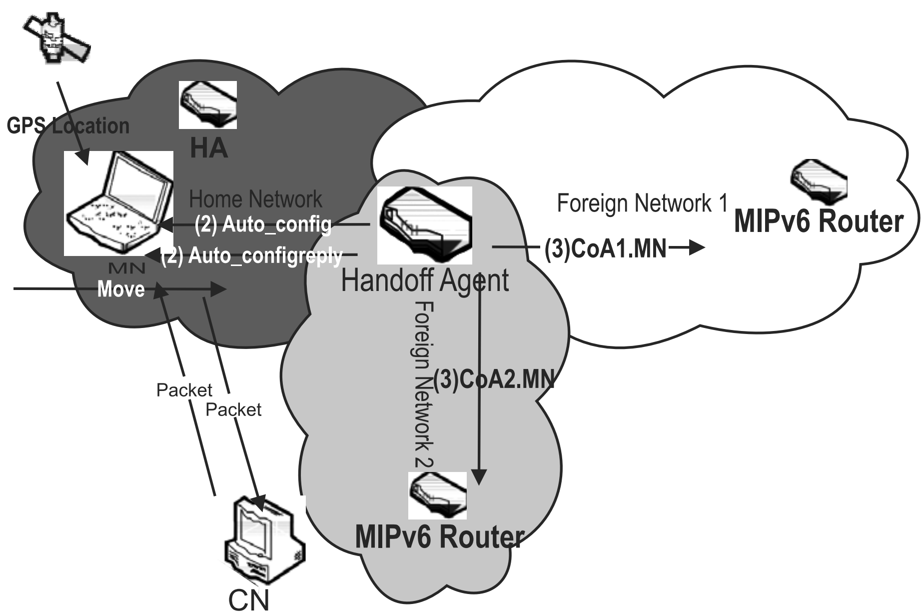

Figure 3: CoA addresses duplicate detection

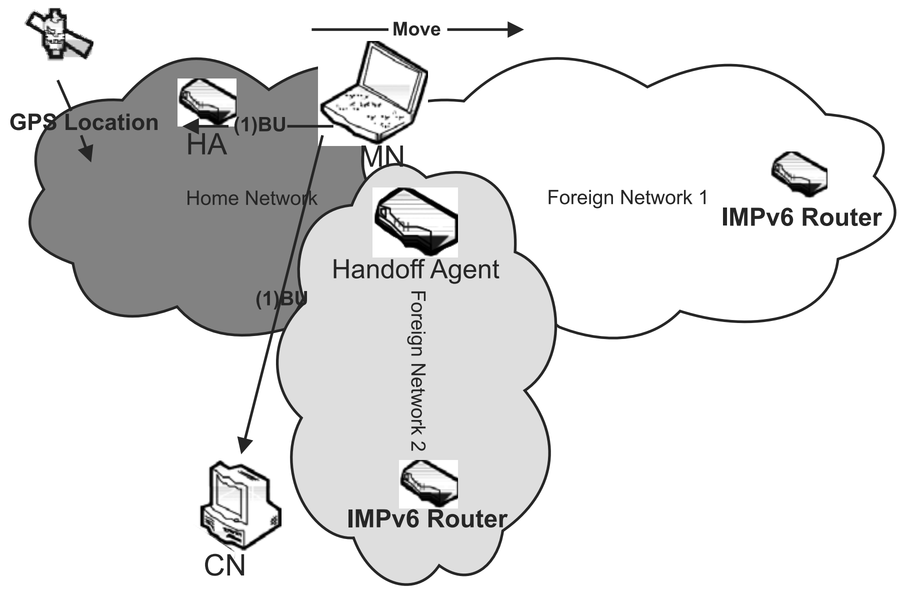

Figure 4: Binding Update

neighbouring Mobile IPv6 routers. The mobile IPv6 routers reply by sending a test reply. This process helps handoff agent to estimate how much time will the binding update and binding acknowledge message take when send by MN nearing overlap area.

The threshold distance depends on distance between MN and handoff agent and the speed at which MN is travelling. It helps handoff agent in calculating how soon MN will reach the overlapping area.

Distance between MN and handoff agent can be calculated using Haversine Formula which takes into consideration the spherical nature of earth. Use of Haversine Formula has also been supported in other published literature[8].

R = radius of earth

$\Delta lat = lat2 - lat1$

$\Delta long = long2 - long1$

$a = \sin^2(\Delta lat/2) + \cos(lat1).\cos(lat2).\sin^2(\Delta long/2)$

$c = 2.a.\tan2(\text{sqrt } a, \text{sqrt } (1-a))$

$d = R.c$

During MN's transitions from home network to foreign network, it never losses communication with CN and no packets are lost as there are no delays introduced by DAD and handoff.

ALGORITHM

In this section Figure 7 represents the overall proposed algorithm. The modified binding update (BU) to accommodate for multiple care of addresses is presented in[9] and can be utilized for the proposed algorithm.

Home address	**Latitude, Longitude**	
	Speed	Heading

Figure 5: Location update message sent by MN to handoff agent.

	Type	**Length**
Binding ID (BID)	Status	
IPv6 Care of Address		

Figure 6: Binding Update with Binding ID (BID)[9]

CONCLUSION

The proposed algorithm presents a unique solution for managing seamless mobility of MN. We have introduced a handoff agent for handoff assistance. The true performance of the proposed algorithm will be judged while compared with similar algorithms. The next stage of the research involves simulating the proposed solution.

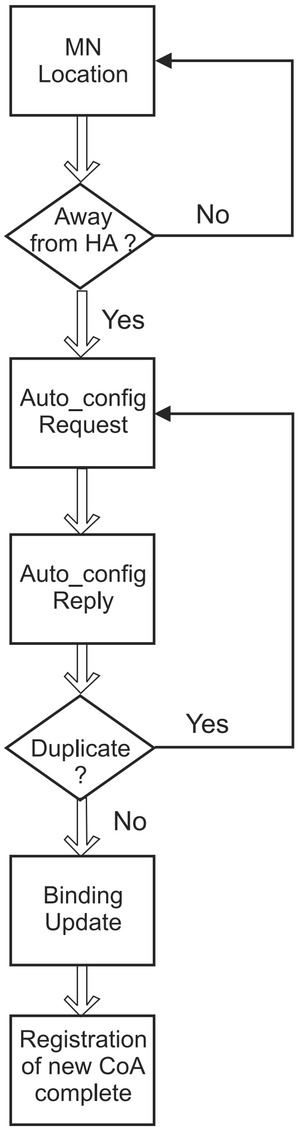

Figure 7: Algorithm flow charge

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