Reducing Real-Time Traffic Packet loss in Mobile IPv6 using Two-Tier Buffer

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Abstract

Packet loss in mobile IPv6 is a huge problem during mobile node handover, especially for real-time packets. When the mobile node moves from one subnet to another, it cannot receive packets that the correspondent node sent to it. This unreachable problem remains until the mobile node gets new address and sends its binding updates to inform the correspondent node about its new address. In real-time traffic this situation will be a huge setback. In this paper we propose a new technique tries to reduce packet loss in MIPv6, by setting a two-tier buffer on the correspondent node, in order to retain the sent packets.

I. Introduction

The increase of mobile computing devices and wireless networking products over the past decades has necessitated the support for host mobility on the Internet. In Internet environments, when a host moves and attaches itself to another network, it needs to obtain a new IP address. With this change of IP address, all existing connections to the mobile host terminate, as the IP routing mechanisms cannot deliver the data to the correct end-point. Mobile IPv4 [1] overcomes this by introducing a level of indirection at the network (IP) layer. It deploys a home agent that intercepts packets from the correspondent host and redirects these packets by tunneling them to the mobile node via a foreign agent in the visiting network. This approach ensures correspondent host transparency and only requires the mobile node to update its location to the home agent when changing between networks. However, initializing this indirection requires a timely home network registration process and an address resolution procedure. In addition, some short comings also accompany MIPv4 such as triangle routing, latency time and packet loss.

Mobile IPv6 has some features that could overcome MIPv4 shortcomings and better supporting for real-time traffic between the correspondent node and the mobile node [2]. Handoff for a mobile node causes packet loss. This problem will be huge during real-time sessions between the mobile node (MN) and the correspondent node (CN). Several solutions have been proposed to overcome this problem in MIPv6, such as Fast Handover (FMIPv6), Hierarchical (HMIPv6), and their extensions, which each of them tries to reduce the number of packet loss as much as possible.

In this paper we try to reduce real-time traffic packet loss in MIPv6 by setting a two tier buffer on the correspondent node in order to retain real-time packets during mobile node handoff procedure. The buffered packets will be retransmitted to the mobile nodes once the binding updates have been received by the corresponding node.

The rest of the report is organized as follows. Section II gives an overview of the MIPv6, FMIPv6, and HMIPv6, as well as related work on their performances. Section III describes our proposed scheme. Finally, section IV concludes the paper.
II. BACKGROUND AND RELATED WORK

A. Mobile IPv6 (MIPv6)

Mobile IPv6 allows a Mobile node to move from one link to another without changing the mobile node's "home address" as shown in Figure 1. Packets may be routed to the mobile node using this address regardless of the mobile node's current point of attachment to the Internet. The mobile node may also continue to communicate with other nodes (stationary or mobile) after moving to a new link. The movement of a mobile node away from its home link is thus transparent to transport and higher-layer protocols and applications. The Mobile IPv6 protocol is just as suitable for mobility across homogeneous media as for mobility across heterogeneous media. For example, Mobile IPv6 facilitates node movement from one Ethernet segment to another as well as it facilitates node movement from an Ethernet segment to a wireless LAN cell, with the mobile node's IP address remaining unchanged in spite of such movement[2].

Figure 1: MIPv6 Scenario

B. Fast Handovers for Mobile IPv6

These protocol enhancements are intended to minimize the time during which the mobile node is unable to send or receive IPv6 packets (i.e., the handover latency). The aim of this protocol is to enable the mobile node to configure a new care-of-address before it moves to a new access router in a way that can use this new care-of-address immediately at connection with new access router. The areas of preparation are new care-of-address configuration, Duplicate Addressing avoidance and Neighbor Discovery [3].

C. Hierarchical Mobile IPv6

The proposed HMIPv6 is improving the shortages of the MIPv6, namely the slow handoff process and all Binding Updates message-traversing through the network backbone. In order to keep local movement management within the responsibility of the current network provider, a new MIPv6 node called Mobility Anchor Point (MAP) is introduced. The MAP can be located at any level in a hierarchical network of routers, including the Access Router (AR) [4]. AR is the MN’s default router and it aggregates the outbound traffic of the MN.

In HMIPv6 a mobile node is assigned with two care-of addresses, instead of one in MIPv6. The addresses are called Regional Care-of-Address (RCoA) and On-Link Care-of-Address (LCoA). MN obtains the RCoA from the visited network and it is an address on the MAP’s subnet. The LCoA is the same as the CoA in the MIPv6 i.e. it is based on prefix advertised by AR [5].

D. Related work

In [6] the author assumes the forwarded packets from Previous Access Router (PAR) may arrive at New Access Route (NAR) before the MN is able to attach to it. These packets will be lost unless they are buffered by the NAR. Similarly, if the MN attaches to NAR and then sends a Fast Binding Update (FBU) message, packets arriving at PAR will be lost unless they are buffered. It provides an option to indicate request for buffering at the NAR in the Handover Initiate (HI) message. When the PAR does request this feature, it should also provide its own support for buffering. The problem here is generating triangle routing through the PAR, the NAR and the CN.

In [7], the authors proposed an enhanced buffer management scheme for Fast handover. The proposed scheme has two parts. First, while the original Fast Handover protocol only buffers packets in the New Access Router (NAR), they use buffers in both the Previous Access Router (PAR) and the NAR during a handoff process. This helps improve the total buffer utilization in the network. Second, they define three types of services in the handoff process so that packets can be treated differently based on their traffic characteristics. Buffering packets will reduce packet loss. In the other hand real-time packets takes high
capacity from router memory, over that if the number of mobile nodes those attached to the router increased. The overhead on the router will affect its efficiency.

Reference [8], presents new two-path hop handoff technique, that assume the correspondent node has the option of using two different RSVP paths to reach the mobile node. The first path is called the mobile path, which is a direct RSVP path to any new location of the MN. Since the mobile path does not depend on forwarded packets from the HA, it is the more efficient and preferred path to use. However, while the MN is moving to a new location, incoming packets may be lost or may arrive out of order. Therefore, this technique uses the home path, i.e., from the CN to the HA to the MN, to ensure uniform and ordered forwarding of incoming packets, and to reduce packet loss.

Reference [9], propose Tunnel Buffering (TB) that is an interoperable enhancement to Mobile IPv6 to reduce packet loss during movement, and to avoid retransmission when movement is complete. TB does this by ‘holding’ the packets which are to be send over a MobileIPv6 or HMIPv6 tunnel until movement is complete. Tunnel Buffering (TB) considers the situation where a MN anticipates that it is about to move, but does not know where it is about to move. In this case, the MN can send a special Local Binding Update (L)BU requesting that its traffic to be buffered until it has determined its new link Care of Address CoA and can send another (L)BU.

III. The Proposed Architecture

In the proposed architecture, the CN has two tier buffers to retain the forwarded real-time traffic packet as shown in Figure 2. The first buffer used to retain a copy of the sent packets to the MN. However, while the MN is moving to a new location, incoming packets may be lost or may arrive out of order. Therefore, we periodically use the first buffer on the CN to retain the packets that already sent before MN handoff procedure starts, as illustrated in Figure 3. When the MN attached to a new location and sending binding updates (BU) to the correspondent node, the CN will send the first buffer contents to the Mobile node. The contents of this buffer cleared after MN receives them and substituted by new packets that the CN wants to send to the MN and so on until the real-time session finish between the two nodes. The size of the buffer depends on the amount of packets that need to be sent. This approach will reduce packet loss during the MN handoff procedure and will reduce overhead on the routers those used to buffer real-time packets for MNs.

It is possible the MN moves again while the CN sending the buffered packets. This could make the forwarded packet unable to reach the MN. To avoid this problem, duplication for the first buffer contents into second tier of the buffer has been proposed as shown in Figure 4. The aim of this buffer is to retain the packets for the first buffer until the CN be sure that the MN got the packets that were retained in the first buffer. Once the MN received the packets, the second buffer will be cleared as illustrated in Figure 5.
In this paper, a new packet loss reducing technique was introduced for real-time traffic in Mobile IP version 6 networks. The buffering concept is proposed to retain packets sent by the CN to the MN. The new technique anticipated to reduce packet loss in MIPv6 handoff by retaining real-time packets inside the two-tier buffer on the CN. Retransmission of the lost packets will be done after MN sends its BU to the correspondent node. The proposed architecture also is capable to reduce the overhead on the router, which traditionally used to buffer real-time packets for MNs.

References:


