HMAT을 사용한 Mobile IPv6의 QoS 보장 구조

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A QoS Support Architecture in Mobile IPv6 using HMAT

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ABSTRACT

In Integrated Services Internet the Resource Reservation Protocol (RSVP) provides a signaling mechanism for end to end QoS. In this paper, we propose a novel scheme using a Hierarchical Mobile Agents Tree (HMAT) based on the definition of new option called QoS Object Option (QOO) in order to improve the efficiency during handoff in Integrated Services Internet. Mobile agents are required to manage QOO, resource reservation and other mobility related tasks on behalf of mobile hosts. This scheme is based on Mobile IPv6.

1 Introduction

The mobile IPv4 [1] and mobile IPv6 [2] are introduced by the Internet Engineering Task Force (IETF) . Resource Reservation Protocol (RSVP) [3] [4] is a resource reservation setup protocol designed for a wired network, provides resource reservation signaling support and has been facing a great challenge due to the mobile hosts. Provision of end-to-end QoS in wireless networks is more complex [5] than in wired networks because of the user mobility.

In this paper, we will propose a novel scheme using the Hierarchical Mobile Agents Tree (HMAT) based on the definition of new option called QoS Object Option (QOO) to improve the efficiency. Mobile agents of HMAT manage QOO, resource reservation and some tasks related with mobility on behalf of mobile hosts.

In section 2, we provide related works, and in section 3, we describe our scheme to provide a new QoS mobility support in the Internet. Finally, we present our conclusions and future work in section 4.

2 Related Works

Recently there have been some works [6-12] about RSVP support in mobile and wireless networks focusing on the handoff management problem. In [6], [7] and [9] there is a challenge, how to predict the Mobile node's movement behavior so that pre-reservation may be done only in necessary cells. If prediction is not available, resource pre-reservation may have to be performed in all neighboring cells, which wastes resource. In [8], the proposal results in triangle routing problem, and the pre-provisioned RSVP tunnels are not flexible and efficient. In [10], a Flow Transparent Mobile IP and RSVP integration scheme is proposed. However, it is difficult to choose a proper router as the Nearest Common Router. In [11], when the mobile node is receiver in access network, the Binding Acknowledgment has to be used so that the proposal is not efficient, and has more data packet delay. In [12], the handoff message has to be used for access network, thus the flexibility is not better.

3. Proposed Scheme

In this section we propose a framework to get more efficient use of scarce wireless bandwidth and minimize the QoS signaling delay, the data packet delay and losses and possible service degradation during handoff in mobile environment.

3.1 QoS Object Option (QOO)

This option is included in the hop-by-hop extension header of

certain packets carrying Binding Update message in Mobile IPv6. The composition of a QOO is shown in Figure 1 by using TLV format. A QoS Object is an extension of RSVP QoS.

In QOO, the QoS Requirement describes the QoS requirement of the MN's packet stream, the fields Max Delay and Delay Jitter specify the delay that packet stream can tolerate, the fields Average Data Rate, Burstiness, Peak Data Rate, Minimum Policed Unit and Maximum Packet Size describe the volume and nature of traffic, the field Packet Classification Parameters provide values for parameters in packet headers.

<table>
<tr><td></td><td>0</td><td>0</td><td>1</td><td colspan="2">Opt type 5bit</td><td>Opt Data Len 8bit</td></tr>
<tr><td>Reserved</td><td colspan="4">Object Length 8bit</td><td>QoS requirement 8bit</td></tr>
<tr><td colspan="3">Max Delay (ms) 16bit</td><td colspan="4">Delay Jitter (ms) 16bit</td></tr>
<tr><td colspan="7">Average Data Rate 32bit</td></tr>
<tr><td colspan="7">Burstiness : Token Bucket Size 32bit</td></tr>
<tr><td colspan="7">Peak Data Rate 32bit</td></tr>
<tr><td colspan="7">Minimum Policed Unit 32 bit</td></tr>
<tr><td colspan="7">Maximum Packet Size 32 bit</td></tr>
<tr><td colspan="7">Values of Packet Classification Parameters</td></tr>
</table>

Figure 1 : Composition of a QoS Object

3.2 Hierarchical Mobile Agents Tree (HMAT)

As mobile devices are being made ever smaller and more convenient, the moving host may cross small cells very often, resulting in frequent handoffs. Then the QoS signaling delay, the data packet delay will increase and packet losses, possible service degradation may occur.

Our hierarchical mobile agents tree is aimed at alleviating this problem. HMAT contains mobile agents of several levels, and can be chosen and configured in any way as the network administrator deems appropriate.

3.3 Mobile Agent

A mobile agent is an entity that manages QOO, resource reservations and other mobility related works. Mobile agents in a HMAT can be divided into two kinds. First kind is the mobile agent in a domain and the first level of the HMAT, similar to home agents in Mobile IPv6, manages QOO for QoS support, processes the mobile related RSVP messages and maintains the mobile soft state for mobile hosts, is organized into a hierarchy to handle local movements of Mobile hosts within the domain. And the second kind is the mobile agent in higher levels of the HMAT can manage QOO for QoS support, merge path message and reservation message. This kind of mobile agent will be a point where merging causes no resulting state change when the Path or Resv refresh message establish path or reservation state respectively along the new route after a handoff takes place. The first kind of mobile agent's function includes the second kind of mobile agent's function.

3.4 QoS Support in HMAT

When the Mobile Node (MN) is sender, the Correspondent Node (CN) is receiver, after a handoff, the MN sends a Binding Update with QOO to CN along HMAT, in the first level mobile agent, this agent examines QOO and immediately performs the resource reservation, sends the new path message to CN with the same source flow identity as the one before handoff, and also sends the Binding Update with QOO to the CN. Then the path message can be merged at some mobile agent that has already a path state in HMAT for that flow which is created before. This will make RSVP to have a Local Repair for sender route. Therefore the mobile agent sends a Resv message associated with the flow along the new path in HMAT to the MN upstream at once, also sends the Binding Update with QOO to the CN downstream. And the flow path reserved resources previously from the mobile agent to the CN can be reused.

When the MN is receiver and a handoff occurs, the MN sends a Binding Update with QOO upstream along HMAT to some mobile agent that has already the path state for the flow which is created before. This mobile agent examines QOO and immediately performs the resource reservation, sends the new path message to the MN downstream and at the same time sends the Binding Update with QOO upstream to the CN. When the MN receives the new path message, it sends a Resv message associated with the flow along this path in HMAT to the mobile agent. And the flow path reserved resources previously from the mobile agent to the CN can be reused. Figure 2 shows this scenario.

Our scheme provides seamless handoff QoS provision. It is sure that the RSVP messages traverse shorter than the Binding

Update and Binding Acknowledgment, because the RSVP messages traverse between some mobile agent of HMAT and the MN in a part of the route where the Binding Update and Binding Acknowledgment have to traverse between the CN and MN. Therefore the RSVP renegotiation can be finished before the CN is updated with MN's new care-of address, especially when there are congested links within the path between the CN and the mobile agent of HMAT. Thus resources have been set up before CN starts to send or receive packets with MN's new location. In other words, all packets subsequently between MN's new location and the CN will be offered QoS as desired and no any extra handoff delay may occur due to handoff.

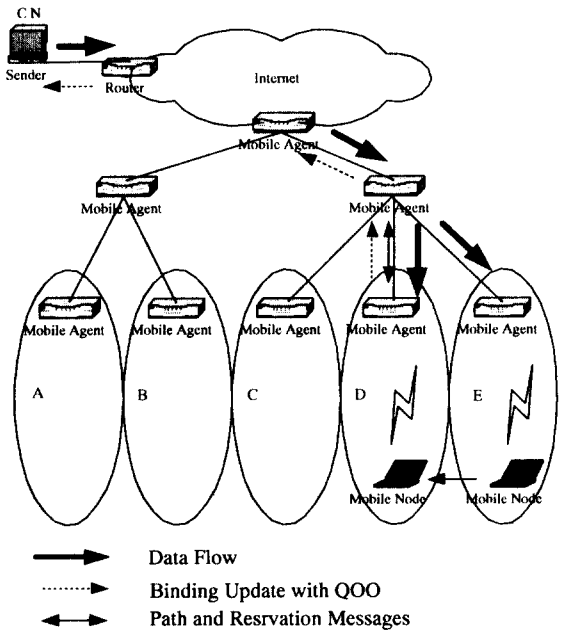

Figure 2 : MN is Receiver in HMAT Model

4 Conclusions and Future Work

In this paper, a novel framework for QoS support in Mobile IPv6 in Integrated Services Internet has been proposed. When a mobile host moves to a new location, the RSVP will be made a Local Repair only between the mobile host and some mobile agent of HMAT in a part of the route where the Binding Update and Binding Acknowledgment are traversed between the MN and the CN. Therefore, this scheme improves the efficiency by using HMAT based on QOO in MIPv6.

In the future, we will keep on researching to give more efficient QoS support in Core Network based on the Mobile IPv6 and QOO.

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