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# RSVP Extensions over Mobile IPv6 Based on Branch Routers

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## Abstract

Wireless communications services are growing rapidly, so it is desired to guarantee quality of service (QoS) for nomadic users. Currently, Mobile IPv6 (MIPv6) is one of the most important protocols for next generation mobile Internet. Resource reSerVation Protocol (RSVP) is known as a proper protocol for reserving network resources to support QoS requirements. However, because RSVP was originally designed for stationary networks, it is not aware of the mobility of mobile nodes (MNs) and causes some degree of service disruptions during handoffs. To overcome mobility impact on RSVP, this paper proposes a concept of branch router, which is the lowest common router between the active reserved path and the pre-reserved path, and then charged with preserving a resource reservation in advance. It can minimize the service disruption caused by re-routing the data path during handoff, and reduce the path message overhead for establishing pre-reservation.

## I. Introduction

Recently, wireless communication services are widely used, and the number of mobile node is increased very quickly. To keep mobile devices seamlessly communicating in the Internet, Mobile IP (MIP) is essentially proposed to support the mobility function and manage mobile node (MN) location. The new MIP version Mobile IPv6 (MIPv6) [1] provides some advanced features, such as large address space, route optimization and security. It is the trend of next generation mobile Internet.

In wireless network, real-time applications, such as Internet telephone and video on demand, are run on mobile terminals usually impose bandwidth and certain quality of service (QoS) requirements. Internet Engineering Task Force (IETF) has proposed two different QoS models: Integrated Service (IntServ) [2] and Differentiated Service (DiffServ) [3] to guarantee the QoS. Some applications, such as real-time audio and video streaming, should make explicit resource reservation by IntServ model.

Resource reSerVation Protocol (RSVP) [4] is a receiver-initiated signaling protocol support for IntServ network to deal with end-to-end unidirectional flows. It allows Internet applications to reserve resources in the path from sender to receivers before they start transmit data. However, because RSVP was originally designed for stationary networks, it is not aware of the mobility of mobile nodes (MNs) and causes some degree of service disruptions during handoffs.

In order to reduce the service disruption with re-establish the guaranteed service path, mobile user need to make resource reservation in advance at locations, where it will visit during the lifetime of the connections. The original RSVP is insufficient to achieve this. In this paper, we propose a concept of branch router, which is the lowest common router between the active reserved path and the pre-reserved path, to establish passive reservation in advance between the branch router and the neighbor proxy agent. It has been integrated to MIPv6 protocol in order to minimize the service disruption, and improve the resource utilization.

The rest of this paper is organized as follows. Some backgrounds are introduced for the MIPv6 as well as RSVP protocol and some problems with them are defined in section II. The proposed scheme is described in detail in the section III. Finally, section IV presents the concluding remarks on our work.

## II. Background and related works

### A. Mobile IPv6 and RSVP overview

MIPv6 is a new version protocol that allows a MN to roam from one subnet to another seamlessly. Here, MN has two addresses: a current Care-of Address (CoA) and a Home Address (HoA). If the MN remains in its home subnet, it communicates like a normal host with HoA. If the MN moves into another subnet, it acquires a CoA in the new subnet, and registers it with its home agent and correspondent nodes (CNs). So the CNs can send the packets directly to the MN by using the MN's CoA.

RSVP provides a receiver-initiated resource reservation. It includes two important types of messages: Path and Resv. The Path message carries SENDER_TSPEC which describes the traffic characteristics of the flow generated by the sender. The Resv message contains a FLOWSPEC object, which consists of two set of numeric parameters: an RSPEC that defines the desired QoS and a TSPEC that describes the traffic characteristics of the data flow. Sender sends a Path message associated with a specific data flow to receiver, all RSVP-capable routers on the path intercept it and set up soft path states for the data flow. The path state includes the previous hop (PHOP) of the flow and its traffic characteristics. After received Path message, the receiver responds with a Resv message which contains desired QoS parameters. The Resv message traverses the reverse path back to the sender. If the required resources on links are all available, the soft reservation state is established in each router. Otherwise, the ResvErr message is generated and sent back to the receiver.

### B. RSVP in mobile network environment

Since RSVP was actually designed for wired networks, some issues will be arisen when it is used to provide QoS over a mobile network. The resource reservation path should be dynamically adapted along with the MN movements, that is, it must be re-established whenever MN changes its access point with an active flow. This re-establish method is obviously slow, inefficient, and bandwidth consuming. The MN may suffer temporary disruption of service before the new reservation is re-established, and any duplicated reservation may be preserved until resources on the old path are explicitly released or time out. This duplication of resource possibly causes to block new sessions in high mobility environments, and would lead to lower average resource utilization levels for the same cost.

Until now, there are some works have been done to deal with those issues of RSVP in mobile network environment. In [5], MRSVP was proposed to add some extensions for mobility support and advance reservation. It employs the MSPEC to indicate multiple locations where an MN may possibly visit during the service time, and introduces proxy agents to make