Fast Handoffs With GPS Routing For Mobile IP

Mustafa Ergen, Sinem Coleri, Baris Dundar, Anuj Puri, Pravin Varaiya
{ergen,csinem,dundar,anuj.varaiya}@eecs.berkeley.edu
University of California, Berkeley
Berkeley, CA 94720

Abstract

Mobile IP is designed to support uninterrupted connectivity of mobile computers as they roam from place to place. We propose a fast intra-domain and inter-domain handoff scheme using the location of routers through GPS (Global Positioning System) to meet the delay and packet loss requirements of real-time services. The scheme achieves an intelligent and dynamic neighborhood discovery and avoids the use of multicast addresses in intra-domain handoff. In addition, it decreases the registration time and distributes home agent data base dynamically in inter-domain handoff depending on how far from the home agent mobile host is. Simulation results for an interactive voice communication and implementation environment are presented.

Keywords — Mobile IP, Fast Handoff, GPS, Mobility Management, QoS in Wireless

1 Introduction

The Internet has attachment points at the edges that connect wireless mobile users to the Internet. The primary aim of Mobile IP is to adapt IP to achieve a robust communication between users who change their attachment points.

A major problem in Mobile IP arises in providing real-time services while achieving certain QoS requirements. To establish communication efficiently while roaming and minimize handover disruption, there must be good geographical coverage. This problem is only solved by the cellular architecture. We adapt this cellular idea to Mobile IP.

The high bandwidth required for real-time services is only be solved through smaller cells. However, small wireless cells cause frequent handoffs. Frequent handoffs require frequent location updates, which increases latency and loss in the re-routing of packets in handoffs. Therefore, even if the wireless sources improve in the future, high quality of service cannot be achieved without eliminating the detrimental impact of the handoffs.

Our system achieves fast handoffs by using both hierarchical structure of the network proposed by IETF and GPS (Global Positioning System) devices in the routers. The network is thought to be composed of administrative or geographical domains. Each domain has a hierarchical tree of foreign agents with a domain foreign agent at the top. Using a GPS device, each router knows its own position. A special advertisement-messaging scheme informs other routers in the domain of its position. Routers use this position information to send the packets directed to one foreign agent to adjacent foreign agents as well. In addition, we use the position information of domain foreign agents to decide whether to send a registration request to home agent or to the previous domain foreign agent of the mobile host. This brings local home agent functionality to domain foreign agents if a mobile host does not go geographically away from this domain compared to its distance from the home agent.

Our objectives are to achieve performance equivalent to that obtained by non-mobile protocols, scalability and security. The first goal, achieving the performance as non-mobile protocols, requires efficient fast handoffs when the user moving from one cell to another since the user should not understand that he is roaming from cell to cell. The second goal, scalability, is necessary in order to avoid the bottleneck of the MH location database as the number of MHs increases. The third goal, security, is necessary in order to prevent the redirection of packets to malicious eavesdroppers.