A comparison of different paging mechanisms for mobile IP

Hung Tuan Do · Yoshikuni Onozato

Abstract This paper proposes two Individual paging schemes, then presents a comparative analysis on the signaling cost functions of Mobile IP (MIP) with different paging protocols and paging schemes and investigates constructing optimal paging areas using discrete system model as a mobility model. In wireless mobile Internet, mobile hosts often visit foreign networks that might be far away from their home networks and the occurrences of their inter-domain movement are relatively rare. In this scenario, our analytical results show that paging, particularly individual paging, can significantly improve the total signaling cost of MIP. We show that Domain paging can bring about considerable cost saving compared to FA (Foreign Agent) paging. Our results also demonstrate the significant advantages of Individual Paging over Static Aggregate Paging. The results show that specifying the optimal paging area size is critical in saving signaling cost of MIP with paging support.

Keywords Mobile IP · Paging protocol · Paging scheme · Paging area · Signaling cost

1. Introduction

At present, MIP is the current standard protocol for the mobility management at IP layer. Unfortunately, Mobile IP (MIP) was first designed without consideration of the performance efficiency and QoS warranty. As a result, many efforts have been made to improve and extend Mobile IP. An effort to enhance the performance of MIP is Route Optimization Protocol (IETF RO) [7], which is introduced to solve the problem of triangular routing. Route Optimization is already integrated into MIPv6. Generally, localization is a popular approach to improve the performance of MIP. One typical example of this approach is MIP-RR (Mobile IP with Regional Registration) [9] or Hierarchical MIP (HMIP) [10], where localization of location updates is applied. We believe that, in addition to localization approach of location updates, paging is an important approach to improve the performance of MIP [1–3].

In wireless mobile networks, paging is a process to determine the exact location of a specific Mobile Terminal (MT) in PCSs or a Mobile Host (MH) in Mobile IP that is in standby state. Paging service is popularly deployed in wireless WAN for two major benefits [1, 3]: to reduce location update cost and to save power consumption of mobile terminals (MT).

With paging support, an idle MH performs location update less frequently (at each change of paging area as a set of subnets) than it does in the base MIP (at each change of subnet). Thus, the application of paging service introduces two main benefits to MIP: to reduce location update cost and to save power consumption of MHs. The paging mechanism operating at IP layer to enhance the efficiency of MIP by achieving these benefits is termed IP paging. Adversely, paging procedures also generate additional signaling overhead that is paging cost itself and the latency in locating an MH for packet delivery. There exists a tradeoff between paging cost and registration cost with respect to PA size. With a bigger paging area (PA) size, an MH tends to update its location less frequently, thus the location update cost is reduced, but the cost of paging over the PA certainly increases and vice versa. Therefore, it is desirable to figure out the optimal PA size that minimizes the total signaling cost.

H. T. Do (✉) · Y. Onozato
Department of Computer Science, Gunma University, Kiryu, Gunma 376-8515, Japan
e-mail: {hung, onozato}@nztl.cs.gunma-u.ac.jp