

Chapter 13

Network Layer Mobility Management Schemes for IP– Based Mobile Networks: A Survey

Paramesh C. Upadhyay

Sant Longowal Institute of Engineering & Technology, India

Sudarshan Tiwari

Motilal Nehru National Institute of Technology, India

ABSTRACT

Mobility is a natural phenomenon in cellular networks. The worldwide popularity of mobile communications and Internet has necessitated the merger of the two fast growing technologies to get their fullest advantages. The Internet protocol (IP) was designed for static hosts only. Therefore, in order to add mobility in Internet, the Internet protocol needs to be redefined. This paper is intended to present an overview of various mobility management schemes, available in literature, for IP-based mobile networks.

INTRODUCTION

Mobility is a natural phenomenon in cellular networks. Several research efforts have already been made to devise efficient mobility management schemes for cellular networks. These schemes employ two operations to keep track of mobile users. One is the location update (LU), which is

performed by a user to inform its current location to the network. Second operation is called paging. Paging is a search operation which a network uses to locate the mobile for call delivery. Both, either no update or no paging incurs heavy signaling burden on the network. The signaling cost can be reduced by reducing the update frequency in the network (Vincent & Victor, 2001).

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In cellular networks, several cells are grouped together to constitute a location area (LA). The concept of LAs allows the user to send their LU messages to the network only when they have entered a new LA, thereby reducing the update frequency. However, this increases the paging cost, as the network will search all the cells in an LA to locate the mobile user. Therefore, there should be a trade off between the update and paging costs so as to achieve optimum signaling cost in the network (Yugang, 2003).

There is wide consensus among the researchers that 'all-IP' will become a norm for next generation mobile networks (Fabio, 2002; Hong-Yon, 2003; Josef, 2004; Newman, 2004; Ramjee 2000; Zahariadis, 2002). However, Internet protocol was developed for providing services to fixed hosts only. The IP addresses in the Internet are primarily used to identify a particular stationary host, and to find a route between the endpoints. In order to add mobility in Internet, a mobile host requires a stable IP address for being identified by the stationary hosts, also called correspondent hosts, in the Internet. If the IP address is stable, then the routing path for datagrams to the mobile host is also stable. This means no mobility. Therefore, the Internet protocol needs to be re-defined in this context. Mobile IP has addressed this issue by assigning two IP addresses to the mobile hosts when they move from one point of attachment to the other. It is generally agreed that in order to scale to a large number of mobile terminals, the mobility problem is divided into two complementary parts: mobility over a large area (macro-mobility) and mobility over a small area (micro-mobility). This is due to the fact that 69% of user's mobility is local rather than the global (Theodoros, 2002). Accordingly, mobility management schemes for IP based mobile networks can be broadly classified into two categories: macro-mobility management schemes and micro-mobility management schemes. Macro-mobility management schemes provide freedom for users to move globally, whereas micro-mobility management schemes

handle the local mobility of users. Thus, while designing the mobility management schemes, it is essential to deal local and global mobility management schemes differently, though they co-exist to form a complete mobility management scheme. The Figure 1 shows the distinction between macro-mobility and micro-mobility.

This paper is structured as follows: the first provides the research survey of macro-mobility management schemes; the state-of-art in the field of micro-mobility protocols is then presented, and finally, conclusions are given.

MACRO-MOBILITY MANAGEMENT SCHEMES

Two macro-mobility management schemes have been reported in the literature. One is Mobile IP (MIP) (Perkins, 1997), and the other is Session Initiation Protocol (SIP) (Handley, 1999). MIP is a network layer mobility protocol, whereas SIP provides an application layer solution for global mobility. SIP is beyond the scope of this paper, and only network layer mobility protocols are considered in the present work.

Mobile IP

MIP, an IETF standard, has laid the foundation stone for IP mobility. It incorporates three additional entities in existing IP network: mobile host, home agent (HA), and foreign agent (FA). The two mobility agents, HA and FA, are used to handle the movement of the mobile hosts in the network. For a mobile host, its HA is fixed whereas the FA changes during its movement from one subnet to another. Therefore, each MH is assigned two addresses, namely a permanent address or home address which is assigned by the HA, and a temporary address or care-of-address (CoA) which is assigned by its visiting FA. Whenever a mobile host moves to a new FA, it obtains a new CoA from the current FA advertisement

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