

Chapter 1.9

Network Mobility

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ABSTRACT

Network mobility (NEMO) management is concerned about the mobility management of an entire wireless mobile network to provide uninterrupted network connectivity to many mobile devices moving together in the mobile network. This is particularly important for ubiquitous computing, which commonly means anytime, anywhere computing and communication. Most of the 3G and entire 4G and beyond wireless communication technology is all-IP. This growing use of IP devices in portable applications has created the demand for mobility support for entire networks of IP devices. NEMO solves this problem by extending Mobile IP. Devices on a mobile network are unaware of their network's mobility; however, they are provided with uninterrupted Internet access even when the network changes its attachment point to the Internet. The main objective of NEMO is to provide continuous, optimal, and secure Internet access to all nodes and even recursively nested mobile sub-nets inside a moving network. Internet Engineering Task Force (IETF) is engaged in standardizing NEMO Basic Support protocol that ensures uninterrupted connectivity to nodes within a mobile network via a mobile router. This protocol extends the mechanisms utilized in the host mobility management protocol Mobile IPv6. There are few open problems remain to be addressed in NEMO. In this chapter, we discuss about NEMO basic support protocols, its features, and other related issues.

INTRODUCTION

IP appears to be the base technology of future networks to provide all kind of services through different access technologies, both fixed and mobile. Nevertheless, IP was not designed for taking into account mobility of users and terminals, and in fact, IP does not support it, neither in IPv4 nor in IPv6. The IETF has defined some IP layer protocols that enable terminal mobility in IPv4 (Perkins, 2002) and IPv6 (Johnson et al., 2004) networks. Nevertheless, these protocols do not support the movement of a complete network that moves as a whole by changing its point of attachment to the fixed or ad hoc infrastructure, which results in NEMO. To allow NEMO in practice, several protocols and methods were designed and evaluated. NEMO Basic Support (Devarapalli et al., 2005) is the most widespread network mobility protocol located in the IP layer, which inherits the benefits of Mobile IPv6 while staying away from the problems of the main approach such as protocol overhead and inefficient routing. This protocol ensures uninterrupted connectivity to nodes within a mobile network via a mobile router. This protocol extends the mechanisms utilized in the host mobility management in order to allow multi-homing and nested mobile networking (Ng et al., 2007). There are two important requirements must be met in network mobility service provisioning. For instance, a mobile user inside a bus moving within the coverage of its wireless Internet service operator may subscribe a VoIP service. He or she would like to be able to access the service by initiating and receiving calls while the bus moves. This global Internet reachability and ubiquity turns out to be the basic requirement of network mobility. Similar to Mobile IP and Mobile IPv6, it requires that the mobile user can always be reached by some unique identifier anywhere the bus roams. Another important requirement is that the communication quality, especially for VoIP like sessions must not be affected by handovers when the vehicle moves from one coverage area

of a base station (BS) to another. Hence, the speed of QoS re-negotiation on the new route and fast and reliable packet redirection from old to the new path during handover becomes critical to assure no disruption and performance degradation of the ongoing services. In other words, this requires resources necessary to sustain the service quality of all ongoing communication instances be reserved in time at the new route to ensure a successful QoS handover, not just network connectivity establishment. NEMO basic support protocol is still in developing phase by IETF. There are some shortcomings, which need to be addressed. It has the side effect of increasing packet delivery overheads due to pinball routing and multi-layer encapsulation of data packets. Moreover, the protocol does not address the large handover latency that causes a large number of packet losses and, consequently, communication service interruption of all the mobile nodes belonging to the mobile network. Therefore, it can be observed that, there exist several issues regarding this evolving protocol, which are mostly open research problems, though some attempts were made to address these issues.

It can also be observed that NEMO should work properly with the security protocols in order for the protocol to actually be accepted. Some of the information that must be addressed includes authentication of the user, authorization of information to be sent or received, and also confidentiality of the data that is being sent and received. The mobile network basically had the same requirements as a normal network. The hosts have to be confirmed and identified before any information will be sent. In addition, all NEMO support messages that are transmitted in a network will have to have ample amount of security that needs to be pre-determined.

There are numerous applications and use cases of NEMO. We are particularly interested in on-board communication networks, where a number of users inside a vehicle use internet or other cellular infrastructure through a common mobile

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