A Proposal for Enhancing the Mobility Management in the Future 3GPP Architectures

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ABSTRACT

The management of the mobility between radio networks composed of heterogeneous radio technologies, called inter-access mobility management, provides the capability to tie together heterogeneous radio networks into an integrated network. The 3GPP architectures with well-designed inter-access mobility management capabilities are a part of the solution to cope with the growth of the mobile data traffic. This paper reviews the 3GPP architectures to highlight those with these capabilities. In order to evaluate if the mobility management is well-designed into these architectures, the authors describe the phases making up the management of the mobility and design an evaluation grid to assess the integration of these phases into the highlighted architectures. Since the assessment shows the existence of loopholes in the design of the inter-access mobility management, this paper proposes to enhance the 3GPP architectures by implementing a method called Hierarchical and Distributed Handover.

Keywords: 3GPP Architectures, Handover Decision, Handover Execution, Handover Information Gathering, Handover Management Chain, HDHO, Session Continuity

INTRODUCTION

Seamless mobility, i.e. a set of solutions that provide uninterrupted session continuity, has been performed thanks to the development of cellular technologies and was dedicated to voice services. Once addicted to this seamless mobility, mobile users ask for mobility for their data services also. In Europe, 3rd Generation Partnership Project (3GPP) mobile networks are used to transmit voice and data over long distances. The arrival of new radio technologies, such as Wi-Fi or WiMAX, enhances the radio coverage, thus should potentially satisfy the increasing demand of mobility for data services. But in order to offer a seamless mobility for data services across heterogeneous radio technologies, for example between Universal Mobile Telecommunications System (UMTS) and Wireless Local Area Network (WLAN), a
network operator has to deploy an architecture that ties together heterogeneous radio networks into an integrated network. This architecture should allow network operators to cope with the exponential growth of the mobile data traffic by offloading data traffic from their overburdened 3GPP mobile networks to unloaded radio networks without noticeable impact on the Quality of Service (QoS).

Because we consider that 3GPP architectures with well-designed inter-access mobility management capabilities are a part of the solution to cope with the growth of the mobile data traffic mainly fuelled by flat rate subscriptions, smartphones and new uses such as social communities, we want to identify these architectures and evaluate if the management of the mobility is well-designed within these ones.

Our paper is organized as follows. In the first section we describe the phases making up the management of the mobility. This description will help us to assess the accuracy of the design of the mobility management within the 3GPP architectures. In the second section we survey the related works in the inter-access mobility management domain. In the third section, we identify the 3GPP architectures implementing inter-access mobility management functions. In the fourth section, we examine if the mobility management is well-designed within the identified architectures. Since our assessment shows the existence of loopholes in the design of the inter-access mobility management, in the fifth section, we propose to introduce a new method, called Hierarchical and Distributed Handover, into the future 3GPP architectures for enhancing their mobility management. Finally, the conclusion offers insights into our future work.

**DESCRIPTION OF THE PHASES MAKING UP THE MOBILITY MANAGEMENT**

By carefully analysing the management of the mobility, we can split the mobility management into three phases, namely handover information gathering, handover decision and handover execution. The handover information gathering phase gathers information (link monitoring, new incoming call...) and triggers the handover decision phase based on criteria. The handover decision phase selects one or more target network(s) taking into account user’s preferences, operator’s policies, and so on, and then triggers the handover execution phase. The handover execution phase asks the User Equipment (UE) to connect to the selected network(s). This phase encompasses a preparation phase (context transfer, QoS renegotiation, authentication ...) before the execution phase itself consisting of a UE network interface attachment to the new network, a terminal location update, a data forwarding and a resource release on the previous network. Together, the three phases define a handover management chain as shown in Figure 1. These phases may be carried out separately by various entities comprising User Equipments and network nodes.

A question arises: which entity should manage the mobility of a user? His User Equipment? One or several network nodes? Zdarsky and Schmitt (2004) proposed to shift the mobility management to the users. But if the viewpoint of the operator managing the networks differs from the viewpoint of a user, a conflict might appear between a user and the operator because the operator might want to choose a different target network from that chosen by a user. The

![Figure 1. The handover management chain](image-url)
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