Chapter 4

Resource Management of Mixed Unicast and Multicast Services Over LTE

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ABSTRACT

In recent years, mobile operators are observing a growing demand of multicast services over radio cellular networks. In this scenario, multicasting is the technology exploited to serve a group of users who simultaneously request the same data content. Since multicast applications are expected to be massively exchanged over the forthcoming fifth generation (5G) systems, the third-generation partnership project (3GPP) defined the multimedia broadcast multicast service (MBMS) standard. MBMS supports multicast services over long-term evolution (LTE), and the 4G wireless technology provides high quality services in mobile environments. Nevertheless, several issues related to the management of MBMS services together with more traditional unicast services are still open. The aim of this chapter is to analyze the main challenges in supporting heterogeneous traffic over LTE with particular attention to resource management, considered as the key aspect for an effective provisioning of mobile multimedia services over cellular networks.

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INTRODUCTION

The increase in the content availability and the growing number of available devices with enhanced media capabilities (i.e., smartphones and tablets) enabled a tremendous growth in the demand of advanced services over mobile radio systems. Among those, multicast services are expected to be massively transmitted over Fifth Generation (5G) wireless systems and allow groups of users to simultaneously access services with high Quality of Service (QoS) (such as Mobile TV, news forecast, video calls, video conferencing, Internet video streaming). Since multicasting is considered as one of the main value-added services for 5G systems, standardization bodies and network providers are currently working to suitably support multicast services over Long Term Evolution (LTE), the most promising wireless technology that will lead the growth of mobile broadband services in the next years (Third Generation Partnership Project, 2012). With this aim, the Third Generation Partnership Project (3GPP) standardized the Multimedia Broadcast Multicast Service (MBMS). This standard, which defines all networks enhancements necessary to support the transmission of multicast services over LTE, introduces the Point-to-Multipoint (PtM) transmission mode and covers different functionalities related to the management of multicast services (e.g., service announcement, joining and leaving procedures, session setup and re-configuration). An example of PtM transmission mode is shown in Figure 1, where the main differences between PtM and the traditional unicast transmission mode, i.e., Point-to-Point (PtP), are highlighted. In particular, PtM simultaneously serves all users interested to a given multicast service through a shared channel, with the aim to improve the system capacity and “theoretically” serve an unlimited number of users per group (Lecompte & Gabin, 2012).

Although MBMS improves the capabilities of LTE in supporting multicast services, the main challenge in multicast environments is related to the Radio Resource Management (RRM), which includes all functionalities necessary to manage the radio resources available in the cellular system (Richard, Dadlani & Kim, 2013). In particular, the RRM is in charge of performing link adaptation procedures, i.e., the selection of the transmission parameters, such as the Modulation and Coding Scheme (MCS), for multicast content delivery according to the channel conditions experienced by the User Equipments (UEs). Indeed, in a multicast scenario, link adaptation must be accomplished on a per-group basis, i.e., by taking into account the channel state information of all terminals interested to a given multicast service.

Figure 1. A comparison of multicast service delivery through Point-to-Point (PtP) and Point-to-Multipoint (PtM) transmission modes
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