Chapter X
Mobile Telecom System Architectures—IMS an Evolution Path Towards IP Convergence

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ABSTRACT

This chapter deals with the description of the various applied Mobile System Architectures, showing the evolution path towards the IP Convergence issue, with the introduction of the IP Multimedia Subsystem. It contains the most important networks entities of the different Mobile Networks Systems and their integration to the IMS. Being the core of the Fixed-Mobile Converge, IMS' operation, functionality and interoperability with the other Telecom platforms are analyzed. Furthermore, aiming in a cost effective high QoS solution, typical performance evaluation strategies of the network manufacturers are described. Its scope is to give an overview of the existing architectures, their network components, their characteristics and their differences, while also show how nearly all traditional Telecom networks can be converged, with the use of the IMS, to an all-IP network, where various applications can be accessed by heterogeneous network platforms.

INTRODUCTION

Across the years, man's need to communicate with each other has resulted to the development of many heterogeneous telecom systems and network architectures. The beginning has been done with the implementation of basic analogue fixed networks, which across the years became digital and more complex, also with the addition of new IP based technologies like VoIP and xDSL.

However, the increasing need for mobility deployed the mobile cellular telephone systems. With the GSM standard of 2nd Generation, only voice based services could be offered to the clients. But soon, the increasing

necessity for new data services, which required a broader bandwidth and data transmission rate overcoming the emerged problems and restrictions, has resulted to the research, development and introduction of new modulation and channel management techniques, as well as new improved systems and network architectures.

Therefore, with the introduction of the 2G+ (or 2.5 Generation), a packet data oriented technology, called General Packet Radio Service (GPRS), has been integrated as an overlay architecture to the existing circuit switched one of the GSM. New Core Network entities, like Serving GPRS Support Node (SGSN) and Gateway GPRS Support Node (GGSN), have been introduced, as well as new data radio transmission techniques like HSCSD (High Speed Circuit Switched Data) and EDGE/EGPRS (Enhanced Data rates for GSM evolution).

The introduction of 3rd Generation, based on the UMTS 3GPP release 99 standard, has considerably increased the offered data transmission rate and was then able to offer new exciting data demanding services like streaming video, supporting QoS R99 attributes. Also here new modulation and protocol improvement techniques like High-Speed Packet Access (HSPA) are being developed. The UMTS standard introduced new entities at its UMTS Terrestrial Radio Access Network (UTRAN), like the Node B and the Radio Network Controller (RNC).

A UMTS network comprises integrated elements for both Circuit and Packet Switched area, interworking with existing mobile networks, while also supporting high bit rate with negotiated QoS. In UMTS release 4, the transport bearer and bearer control in the CS core network are separated and ATM (AAL2) or IP can be used as data transport bearer also in the CS domain.

In UMTS release 5, improved modulation techniques like High Speed Downlink Packet Access (HSDPA) are adopted, while the IP Multimedia Subsystem (IMS), based on the Session Initiation Protocol (SIP), is introduced aiming in unifying heterogeneous fixed and wireless networking platforms. The IP Convergence issue that arises, has been developed to the idea of the Fixed Mobile Convergence (FMC)

IMS—A STANDARDIZED NEXT GENERATION NETWORK ARCHITECTURE FOR FIXED/MOBILE CONVERGENCE

Mobile Telecom System Architectures—The IP Convergence Issue

Initial Generation Concept of the Cellular Telecom Systems

Initially radio communication was based on simple single cell analogue systems. After the early 80ties introduction to mass market, digital systems were soon adopted. It is not only the architectural technology but also the transmitted information and data rate that characterize the different generations. To be more precisely, the widely applied and used generations till the present time can be summarized in the following:

- **1st Generation (1G):** Transmission of analogue Information
- **2nd Generation (2G):** Analogue systems give their place to digital ones and Transmission of digital Information is adopted.
  - Implementation based on the GSM Standard aiming mainly on voice services.
- **2nd+ Generation (2G+):** Implementation based on combined Voice and Packet Technology. Introduction of the GPRS.
  - IN Intelligent Networks Services and Data Services with higher Transmission Rate.
- **3rd Generation (3G):** Based on the UMTS Standard.
  - Applications for simultaneously Voice, Picture, Video and Data Transmission

Evolution of the Data Transmission Techniques

As aforementioned, the need for higher Transmission Rate has played a significant role to the evolution of Radio Communications through the years. One issue that arose was the high costs of the technical equipment and therefore the need to re-use the existing one also in new architectures. In order that to be achieved successfully but also smoothly, new modulation and transmission techniques were developed such as: