Chapter 8.5
Next Generation Cellular Network Planning:
Transmission Issues and Proposals

Spiros Louvros
COSMOTE S.A., Greece

Athanassios C. Iossifides
COSMOTE S.A., Greece

ABSTRACT

In this chapter, a multi-layer ATM architecture is proposed for the interconnection of current and future mobile communications nodes. Consisting of different ATM node types with respect to switching capability, the proposed architecture is adapted to current 2G and evolving 3G systems as well as future 4G wireless systems, as a common and shared backbone transmission network interconnecting core and access nodes between each other and Internet or PLMN/PSTN. Moreover, facing the huge expansion of transmission interconnection network that will support current and future generation mobile communications, a modification of the standard ATM cell structure is introduced in order to efficiently support user mobility functional procedures. The proposed ATM architecture is integrated over a suitable, with respect to region and capacity, physical inter-face, consisting of SDH or SONET for wide area topologies, wireless links for outdoor areas and LED-POF combination for indoor areas. Being an interesting alternative over copper or traditional fiber, POF characteristics and performance issues are analyzed.

INTRODUCTION

Chapter Overview

3G and 4G mobile communication systems should provide the subscribers flexibility to multimedia services, including voice, constant or variable data rates and video, in conjunction with increased quality of service, high bandwidth reservation, and increased bit rate transmission. The proposed network plan, in the wireless part of next generation mobile networks, consists of a

multi-layer architecture of macro, micro, and pico cells. Cell planning is adapted to the topographical background (hilly, mountainous, flat terrain) and the population-demographic basis (urban, suburban, agricultural areas).

In this chapter, a multi-layer ATM architecture is proposed for the interconnection of radio APs (e.g. Base Stations in 2G, Node B's in 3G glossary, Access Points in WLAN glossary) to the access network controller (e.g. BSC in 2G, RNC in 3G) and the core network. This architecture consists of different types of ATM nodes/switches regarding their capacity and switching capability with respect to the area and traffic load that they will serve. Existing ATM networks are designed to support wire-line users with fixed locations. Consequently, current ATM protocol does not support mobility functionalities like *location registration* and *handover* that are required to support users' mobility; these procedures are fully supported and directed by higher layers. Location registration is required to locate a user prior to information exchange (switching on/off mobile equipment, moving to different locations within the network, etc.). Handover is a function that supports mobility during information exchange, allowing users to move beyond the coverage area of a single cell without disturbing their communication. Since different radio access technologies may be supported by the proposed ATM networking topology and ATM nodes are going to be extended in number (together with the extension of subscribers and services), it is desirable to engage some portion of the aforementioned procedures to the ATM protocol in order to ensure their proper functionality. Thus, a slight modification of the ATM cell is proposed in order to accommodate new information fields supporting the aforementioned mobility procedures in the standard ATM cell structure. Additionally, modifications of the cell structure are introduced for wireless ATM access from and towards the end user.

The physical layer is mainly over wire or optical fiber and ATM switches may be embed-ded in the Node B's and RNC (BSC)'s, avoiding the crucial problem of designing new interconnection network and thus minimizing the cost. However, in crowded areas, like city centers or indoor business-shopping centers, the number of cells is extremely increased. In order to achieve the desired level of quality of service and bit rate, the cost for wired or optical fiber infrastructure is prohibitively augmented. A more convenient way is to differentiate the physical layer according to specific geographical data. Thus, while keeping optical fibers for long distance interconnections, a wireless physical layer can be used for outdoor short distance interconnections. On the other hand, regarding indoor interconnections, a new, cheap and reliable optical fiber network is investigated and proposed. Semiconductor lasers have been proved to be the most promising devices in nowadays-optical communication networks. Light emitting diodes (LED) are their counterparts, providing moderate efficiency in bandwidth and lower bit rates compared to semiconductor lasers. Considering though the cost efficiency in integrated multi-optical networks (UMTS, B-ISDN in-building internet links, etc.), LEDs consist a strong candidate for indoor backbone. Moreover, the use of Plastic Optical Fibers (POF) in recent years, mainly for short distance optical networks, increased the interest in LED as a transmission device. An optical network designed for short distance in-building optical links, using LED as transmitter, POF as the transmission medium, is proposed.

Chapter Outline

This chapter proposes new transmission solutions for the interconnections of the separate parts of next generation mobile and wireless cellular networks. It is separated into different sections in order to explain in a more convenient way all the necessary technical and planning issues.

In the first section, the technical background information of mobile cellular networks and their

Related Content

Semantic Composition of Web Portal Components

Jens Jahnke, Yury Bychkov, David Dahlemand Luay Kawasme (2008). *End-User Computing: Concepts, Methodologies, Tools, and Applications (pp. 658-677).*

www.irma-international.org/chapter/semantic-composition-web-portal-components/18214

An Adaptive Feedback Framework to Support Reflection, Guiding and Tutoring

Evangelia Gouli, Agoritsa Gogoulou, Kyparisia A. Papanikolaouand Maria Grigoriadou (2008). *End-User Computing: Concepts, Methodologies, Tools, and Applications (pp. 525-543).*

www.irma-international.org/chapter/adaptive-feedback-framework-support-reflection/18206

High School Introductory Programming on Raspberry Pi Made from Scratch

Andy Luseand Bryan Hammer (2017). *International Journal of People-Oriented Programming (pp. 33-45).*

www.irma-international.org/article/high-school-introductory-programming-on-raspberry-pi-made-from-scratch/197774

A Decision Support System for Prescriptive Academic Advising

Louis A. Le Blanc, Conway T. Rucksand W. Scott Murray (2002). *Advanced Topics in End User Computing, Volume 1 (pp. 263-284).*

www.irma-international.org/chapter/decision-support-system-prescriptive-academic/4436

Capturing and Comprehending the Behavioral/Dynamical Interactions within an ERP Implementation

James R. Burns, Don G. Jungand James J. Hoffman (2011). *Organizational and End-User Interactions: New Explorations (pp. 189-212).*

www.irma-international.org/chapter/capturing-comprehending-behavioral-dynamical-interactions/53091