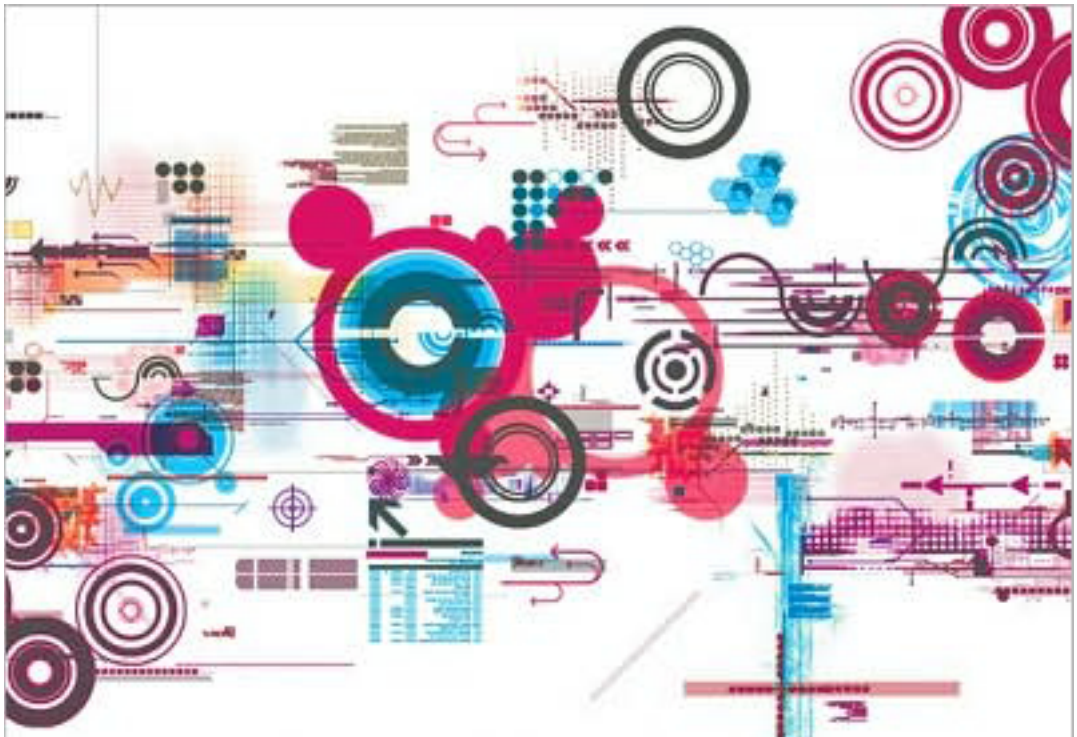

EVOLVED PACKET SYSTEM (EPS)

The LTE and SAE Evolution of 3G UMTS

Pierre Lescuyer | Thierry Lucidarme

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Contents

Preface

With more than two billion customers, there is no doubt that 2G GSM and 3G UMTS cellular technologies are a worldwide success, adopted by most countries and network operators. The 3G UMTS technology has significantly evolved since the first declination. The first release of the standard, published in 1999, was mostly oriented towards dedicated channel allocation, and circuit-switched service support. Later on, the standard evolved to high-speed packet radio interface for downlink transmission (HSDPA for High Speed Downlink Packet Access) and uplink transmission HSUPA as a clear orientation towards IMS (IP Multimedia Subsystem) and IP-based services.

EPS (Evolved Packet System) represents the very latest evolution of the UMTS standard. EPS is also known by other acronyms related to technical study items being worked on at 3GPP standard committees: **LTE** (Long Term Evolution), which is dedicated to the evolution of the radio interface, and **SAE** (System Architecture Evolution), which focuses on Core Network architecture evolution.

Although still a 3G-related standard, EPS proposes a significant improvement step, with a brand new radio interface and an evolved architecture for both the Access and the Core Network parts. The two major disruptions brought by EPS are:

- **Improved performances** – characterized by a spectrum efficiency which is twice as large as HSDPA/HSUPA.
- **A packet-only system** – resulting in a unified and simplified architecture.

EPS is specified as part of the 3GPP family and, from that perspective, EPS will benefit from the same ecosystem that made the success of GSM and UMTS technologies. In addition, it is believed that technical and architectural evolutions brought by EPS prefigure future 4G networks (also known as IMT-Advanced networks).

This book presents the EPS evolution, as introduced in Release 8 of the 3GPP standard. It is not a substitute to the 3GPP standard, and advanced readers willing to dig into any specific domain of EPS are encouraged to consult the 3GPP specification documents which are referenced, when appropriate, through the different chapters.

The objective here is rather to provide a comprehensive system end-to-end vision of EPS, from the radio interface to the service level, including network architecture, radio protocols, as well as subscriber and session management. As EPS was not thought of as a completely new and standalone technology, the authors have also tried to show the inheritance and relations with 2G GSM and early 3G UMTS in terms of ground principles and technical aspects.

The technical content of this book is based on early documents and standards available at the time of writing. For that reason, the view presented here might be slightly different from the actual reference standard. This should, however, be constrained to very limited parts or specific details of this book.

1

Introduction

This chapter is an introduction to the evolution of UMTS systems, also known as EPS (Evolved Packet System). It provides a picture of current wireless and cellular communications, as an introduction to the requirements and motivations for Evolved 3G systems, which are the subject of the next chapter.

This chapter presents the following elements:

- A brief history of digital cellular systems, from 2G to the latest 3G evolutions.
- The evolution of the subscriber base.
- The various organizations which are supporting 3G and Evolved 3G system specifications.
- An overview of the spectrum usage.
- A list of Web links and documents directly connected to Evolved UMTS.

1.1 Wireless World Picture

Wireless cellular communication is certainly one of the major evolutions provided to the telecommunication world, experiencing an exponential growth from the early 1990s.

Wireless communication systems started to emerge in the mid-1980s, first based on so-called 1G (first-generation) analogue technologies like AMPS (Advanced Mobile Phone System) in the United States or NMT (Nordic Mobile Telephone) in Northern Europe. Those systems have evolved to 2G (second-generation) digital radio – providing robustness and better spectral efficiency – and, ultimately, to 3G, so as to offer global mobility and improved end-user experience over a wide range of services.

The unprecedented success of wireless communication has multiple business repercussions, by developing the potential for voice traffic and added-value services like Instant text and Voice Messaging, Multimedia Messaging (MMS), high-value content delivery or streaming, location-based services, etc.

As of mid-2006, there were:

- 2.3 billion mobile subscribers worldwide.
- 1.8 billion GSM mobile subscribers – GSM represented a 78% market share of cellular subscribers.

Evolved Packet System (EPS) P. Lescuyer and T. Lucidarme