1

Introduction

Esa Markus Metsälä and Juha T.T. Salmelin
Nokia Networks, Espoo, Finland

1.1 To the Reader

This book intends to offer guidelines and insight for long-term evolution (LTE) backhaul planning and optimization tasks and is aimed at technical professionals working in the field of network planning and operations. With LTE backhaul, several functional areas like synchronization, Quality of Service (QoS) and security, to name a few, require major new analysis, when designing for a high-performing and well-protected network. And in addition, the capacity needs of the LTE and LTE Advanced (LTE-A) radio typically mandate a major upgrade to the currently supported backhaul capacity, which often means introducing new backhaul links and technologies.

As with any network design project, several feasible and technically sound approaches exist. Many of the examples given in this text highlight topics that the authors find especially important. For every design, high-level goals are unique, as are the boundaries set for the project, and the examples should be tailored where necessary to match the individual design target. All of the views presented reflect the authors' personal opinions and are not necessarily that of their employers.

The book aims to give an objective, standards-based view of the topics covered. Many of the LTE backhaul related aspects are, however, not written as binding standards. As such, there is room for different implementations, dependent on the capabilities of mobile network elements such as evolved NodeB (eNB), security gateways, backhaul elements and related management systems.

A basic command of LTE and Internet Protocol (IP) networking is useful for getting the most out of this book. Mobile backhaul, and its key services and functions, is discussed in greater detail in Metsälä and Salmelin (2012), which can be used as a reading companion.

The book's chapters approach each major topic of LTE with illustrations, complementing these with both short examples, including questions with model answers, and a few longer case studies.

Network designs are also influenced by non-technical drivers, such as the budget available for the project. Strategic input and comparing alternative designs from the financial side is important, which is why these topics are covered in a separate chapter.

1.2   Content

The book is divided into eight chapters. Chapter 2 is a bird's-eye view of LTE backhaul: what is it all about? While the book's focus is on technical matters and planning advice, the financial modeling of LTE backhaul is discussed in Chapter 3. Backhaul dimensioning is a challenge, and the theoretical basis for backhaul dimensioning and end user application behavior is covered in Chapter 4. Chapter 5 covers planning advice in the form of guidelines and examples, while Chapter 6 focuses on two bigger walk-through network design cases. Network management of the backhaul network and its relation to the LTE radio network management is the topic of Chapter 7 and the book is summarized in Chapter 8.

1.3   Scope

The essential scope of the book is the planning of the LTE IP backhaul, with focus on the LTE-specific design requirements and how to meet these requirements using Ethernet, IP and other packet protocols, with security of the backhaul taken into account in all phases of the design.

In order to help dimensioning LTE backhaul, the theoretical basis for analyzing backhaul capacity needs is given. As well, several end user aspects related to Transmission Control Protocol (TCP) behavior over the LTE network are investigated, since these may heavily affect end user perception of the LTE service.

Network management systems are traditionally separate for the backhaul and for the LTE radio network; however, several benefits can be exploited from the integration of these tools, as discussed in a Chapter 7.

Detailed planning of backhaul physical layer technologies—like optical links, wavelength division multiplexing and wireless (microwave) links—would all need a book of their own to be properly covered, and such reference books exist, and those should be used as additional sources of knowledge for detailed planning with those technologies.

The standards for the radio technologies discussed in this book in relation to the evolution of LTE-A are those finalized by the Third Generation Partnership Program (3GPP) at the spring of 2015. Constructing design guidelines for functionalities where standardization is in progress is difficult; however, key LTE advanced functions and their foreseen impact to backhaul are included in section 2.7.

Reference

Metsälä E. and Salmelin J. (eds) (2012) *Mobile Backhaul*. John Wiley & Sons, Ltd, Chichester, UK, doi: 10.1002/ 9781119941019.