Chapter 12
The New Generation Access Network

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ABSTRACT
This chapter offers a qualitative approach towards the development of the new generation access network, based on FTTx implementations. After a brief description of the current state of traditional access networks and an estimation of the expected data rate per household in terms of services, the chapter examines all the available Network Technologies (FTTx), Access Technologies (xDSL, Ethernet and PON) for both P2P and P2MP development schemes and their relevant implementations. The prospects of NGA are also strategically examined in view of the complicated multi-player environment, involving Telco (ILEC and CLEC), regulators and pressure interest groups, all striving to serve their individual, often conflicting interests. The chapter concludes with an outline of the different deployment strategies for both ILEC and CLEC Telco.

INTRODUCTION - BACKGROUND
NGA stands for New Generation Access, a new concept associated with the future access network architecture that is capable for providing sufficient bandwidth to all present and forthcoming applications, thus removing the bandwidth barrier from the last mile for the next fifty years. It is closely related with NGN, the New Generation Network platform that will transform the existing, traditional TDM-based multi-network structure into a universal all-IP network.

Nobody denies that the future access network will eventually be an all-fibre network in a “fibre-to-the-home” (FTTH) architecture, even though the offering of POTS (plain old telephony services) services over optical fibre requires a higher cost and imposes the need for local powering for opto-electronic conversion, which is unnecessary in the case of copper access telephony. Most Telco have already taken the decision to adopt FTTH solutions in “Greenfield” network implementations, and in

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most countries, new-house cabling regulations are coming in force for assisting the provision for future installation of optical fibres inside the buildings.

What is still under strong debate in the telecommunications industry is not the final outcome of the access network evolution towards fibre, but the evolution stages and duration. If one looks into the history of the conventional copper based access network in Europe and the USA, it is clear that the whole process of development was both costly and highly time consuming. It took more than fifty years to build, the development was gradual and the cost gigantic. To replace the existing copper access network with a new overlay optical fibre network, even in urban areas and over a period of ten years, is a substantial challenge requiring a huge amount of funding that can be hardly justified by present day economics and the heavily competitive Telco environment.

An alternative approach that goes via a “fibre-to-the-cabinet with VDSL2” stage (FTTC+VDSL2) seems a more economic intermediate step, because it takes advantage of the shorter copper lengths (<500m) of the existing distribution networks in order to deliver data rates of above 50 Mb/s to most of the customers at a small fraction\(^1\) of the FTTH cost. If it was only a matter of economics, nobody could honestly argue against the combination of FTTC+VDSL2 as the most viable solution for NGA development, particularly in areas with an existing copper network infrastructure. Nevertheless, in the present day complicated telecommunication environment, the strategy\(^2\) of the individual players in view of their contrasting interests may also play an equally important role that cannot be ignored. It is, therefore, essential to understand the basic NGA development strategies and assess all the different implementation scenarios from the perspective of each player.

The present chapter is divided in six sections examining: the traditional structure of the access network, the present and future services in terms of their bandwidth requirements, the available network and access technologies, different NGA network implementations and deployment strategies. The content of this chapter reflects the personal views of the author, which by no means imply official OTE policy.

**DEFINITIONS: THE TRADITIONAL STRUCTURE OF THE ACCESS NETWORK**

In accordance with the European Telecommunications Standards Institute (ETSI), the access network is defined as the network part that links the subscriber to its local exchange (LE) including the primary network also known as feeder, the secondary or distribution network and the customer or drop segment as shown in Figure 1. It is also often referred to as the Local Loop, Copper Loop or Last Mile.

Even though, in most cases, the three-segment “modular” design depicted above is followed, in some exceptions and for large customers (i.e. ministries, banks, hospitals, police etc.) the primary network may be directly terminated into the customer’s premises in a “fixed-feeder like” network approach\(^3\).

The access network was originally designed and gradually built over the last fifty years to provide ordinary telephony (POTS) services to customers. It employs cables consisting of unshielded twisted copper pairs or quads\(^4\), that start from the Main Distribution Frame (MDF) of the LE and terminate at the Network Termination Equipment (NTE) at the subscriber premises.

The primary network contains a number of high capacity cables of up to 2,400 pairs that start from the LE, split in smaller capacity cables of up to 400 pairs at intermediate junction points in a tree-like topology, covering the LE area and eventually terminate at outdoor cross-connect cabinets (XCC). The cables of the primary network are usually dry, kept under pressure and are
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