BROADBAND ACCESS NETWORKS: DRIVERS AND EVOLUTION

DR MAMOUN GUENACH

ALCATEL-LUCENT BELL N.V., BELGIUM

With the explosion of demand for higher capacity multimedia applications, more and more pressure is put on the different building blocks in the end-to-end networks connecting the end user and the content laying deeper in the network. More importantly the traffic shape is changing due to the mixture of traditional and new emerging applications that have different quality of service requirements. Therefore the network equipment and its enabling technologies must evolve in order to accommodate these requirements.

Communications networks are typically composed of access, metro and core networks that are all impacted in one way or another to meet the new requirements. In this lecture we particularly focus on the broadband access networks or the last mile that are typically the bottleneck in the end-to-end link, because they are the most expensive to upgrade. We show how access networks are impacted and what challenges remain to be addressed to sustain the continued evolution of access networks. The higher capacity and stringent QoS requirements are achieved by e.g. shortening the last mile in the access and by placing more access nodes closer to the end-users and potentially going for a new physical layer design. These transformations in the access architecture pose a number of challenges for the operators that will be briefly covered.

As a use case we elaborate on the evolution of copper access networks and show the major breakthrough in digital subscriber line (DSL) enabling gigabit transmission over the existing infrastructure. Copper access networks are leveraged to provide a cost-effective solution for ultra-broadband access and form a stepping stone towards the full deployment of the fiber to the home. DSL technology benefiting from the use of existing infrastructure is not only considered as the main broadband access for business and residential market with 60% market across wireline access technologies and 35% across all access (wireline and wireless) technologies, but also has the potential assets as backhaul solutions for small cells.

In the meantime, optical access networks are evolving to meet traffic demand of both the residential and the business markets and also to backhaul the traffic from other access technologies like copper and wireless. Passive optical networks are evolving from GPON with an asymmetrical rate of 2.5/1.25 Gbps using TDMA/TDM towards standardized XG-PON1 with 10/2.5 Gbps and NG-PON2 with a symmetrical 10 Gbps.

We summarize at the end of this talk some of the main challenges facing the current and the next generation access networks that should be researched by both industry and academia.

Mamoun Guenach is a research scientist with the Alcatel-Lucent Bell Labs. He received the degree of engineer in electronics and communications from the Ecole Mohamadia d'Ingénieurs in Morocco. Following that, he moved to the faculty of applied sciences at the Université Catholique de Louvain (UCL), Louvain-La-Neuve, Belgium, where he received an M.Ss. degree in electricity and a Ph.D. degree in applied sciences. He served as a post-doctoral researcher in the department of telecommunications and information processing at the Universiteit Gent, Ghent, Belgium prior to joining Alcatel-Lucent.