GPON-IN-A-BOX

GPON

Developing a range of GPON products to be produced by the domestic industry allowing to provide complete solutions of this technology, in terms of active components, both in terms of passive components, to be inserted in the new generation of optical networks with the operator telecommunications.

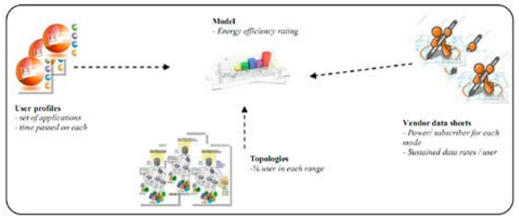

Fig. 1 Energy efficient model ingredients.

Fig. 2 Extender Box inside view.

Main Project Team

Antonio Luis Jesus Teixeira	**OCP-Av**
Paulo Sérgio de Brito André	OCP-Av
Mário José Neves de Lima	OCP-Av
Armando Nolasco Pinto	OCP-Av
Rogério Nunes Nogueira	OCP-Av

Funding Agencies

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Indicators

Journal papers	1
Conference Papers	7
Concluded PhD Theses	2
Concluded MSc Theses	11

Two Main Publications

A. Teixeira, A. Shahpari, M. J. N. Lima, **Factors in Energy Efficiency Rating in Optical Access Networks**, International Conference on Transparent Networks – ICTON, Stockholm, Sweden, June, 2011

J. Davim, S. Ziaie, A. N. Pinto, **CAPEX model for PON technology using single and cascaded splitter schemes**, EUROCON and CONFTELE 2011, Lisbon, Portugal, April, 2011

PROJECT WEBPAGE URL

https://www.it.pt/Projects/Index/1209

GENERAL MOTIVATION AND OBJECTIVES

GPON-IN-A-BOX project aimed to assess the possibilities of using optical technology in multi-gigabit access networks. This project has developed and validated a laboratory prototype based on several alternative low-cost components. It was intended also to assess the cost and reliability of the technology used in order to enable development of a commercial application. This proposal observed the feasibility of developing an "extender box" that expands the reach of GPON devices regenerating the signal of an active, yet without any electronic processing that may that would interfere with the evolution to new scenarios (eg Next Generation Networks).

CHALLENGE

Implement a "in-a-box" GPON solution that is able to regenerate GPON signals, extend the reach, allows the migration from GPON to WDM-PON in an efficient and low cost approach.

WORK DESCRIPTION AND ACHIEVEMENTS

One of the core aims of this project was to develop a set of GPON products that can be produced by the national industry that enable the deployment of solutions (with active and passive components) for the next generation of optical networks. In order to achieve that goal several tasks were carried out. We start first with the techno-economic studies with the identification of technical solutions which enable a migration with reduced impact to customers and are economically affordable for the operator. Then, we develop a technical-economic model for the operating costs of WDM-PON technology as well as a scenario of coexistence of both technologies (GPON and WDM-PON). The estimation of OPEX was extended with the development of models for the costs of installation and operation, as well as a techno-economic model for the costs of migration. Regarding the topic of energy consumption, that is nowadays paramount for optical networks deployment, we also estimated and compare both GPON and WDM-PON technologies.

As stated above, the major challenge of GPON-in-a-Box was the implementation of a "in-a—box GPON solution among other features, extend the reach, thus the extender box was one of the projects achievements. We recall that by using a reach extender, the number of central offices and aggregation nodes will be decreased. The prototype was specified and built with the appearance of the picture in the cover and capable of extending up to 60 km reach using SOA and a 1:64 split and 25w power consumption, which can be used for multichannel amplification co-existence with XGPON1.

Security issues were also approached. It was demonstrated that there might be a very serious threat in security of GPON network when various clients are sharing the same splitter with an attacker, being verified that the attacker's success highly depends on the photo-detector used, in which the APD provided the preferable choice.

Clients and industries have been demanding bandwidth that only Passive Optical Networks (PON) can achieve and a crucial feature for the evolution of Gigabit Passive Optical Networks (GPONs) towards higher capacity Wavelength Division Multiplexed-Passive Optical Networks (WDM-PONs) is the reuse of existing infrastructure. WDM allows coexistence between two or more PON generations over the same infrastructure by provisioning multiple channels on the PON allowing deployment of different migration technologies or capacity extensions transparently, where devices of a generation are unaware of the coexistence with other generations. Furthermore, WDM-PON requires the replacement of the optical Power Splitter by an Arrayed Waveguide Grating (AWG) at the Remote Node (RN).

WDM-PON architecture was specified considering the simplest approach: an AWG in the OLT to allow single-fiber working, a direct modulated laser or array of this laser for OLT transceivers, an APD or PIN receiver or array of these photo detector receivers for OLT receiver, a tunable laser for colorless ONU transceiver and tunable filter and receiver for ONU receiver.