



Open Access and Local Loop Unbundling on GPON Networks



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Introduction

With access networks migrating to fiber infrastructures, the debate continues between PON and P2P approaches. Two of the aspects that are being brought into this debate are those of Local Loop Unbundling (LLU) and Open Access Networks.

The Need for Fiber Access LLU and Open Access Networks

Unbundling for Promoting Competition

Local Loop Unbundling was introduced several years ago by legislators in order to allow alternative carriers to provide services in the access network.

It was implemented in the copper access network by sharing the copper pair to the subscriber between the incumbent operator and the alternative carrier.

Local Loop Unbundling has proven to be beneficial in the DSL arena as it was associated with increased competition driving higher levels of broadband penetration at lower prices. For this reason, regulators are promoting the need for FTTH deployments in order to similarly provide the possibility of unbundling.

Open Networks

Many local governments and municipalities are laying fiber access networks in order to provide a new broadband infrastructure for enhancing the quality of life of the residents and increasing the value of local properties. In this case, the municipality or other local government acts as the infrastructure provider. Sometimes local government may want to provide governmental e-services and other public services over the network, and promote e-learning for the general public. In addition, and in cases where it does not provide services itself, it allows other service providers to connect to subscribers by means of its infrastructure.

There are several benefits to the Open Networks approach, as described in the following sections.

Minimizing Disturbance to End User

From the end customer's perspective, it is desirable that the disturbance to the environment be minimized and not repeated for every operator deploying a separate infrastructure. This dictates a coordination of infrastructure work or sharing of a single infrastructure. Having a central infrastructure provider minimizes the disturbance to residents as the streets are only dug up once.

Saving Costs

Total costs are also minimized, as the work is done only once and the same infrastructure costs are shared by all fiber broadband users. Since the major component of deploying an FTTH infrastructure is the cost of the civil works, this could be a major saving.

By opening the access network to competition, the infrastructure provider also drives down the costs of broadband services.

Offering Attractive Service Packages

To ensure a good take rate, the service package must be appealing with a variety of choices. In addition, different population groups within a set area may have different tastes and service preferences. These preferences may be best met by different service providers, some of whom, for example, could provide content for local interest only.

Perceptions from the Copper World

Previous experience in the LLU was based on copper pairs in one of two possible models, full unbundling and line sharing.

Full Unbundling

Each alternate operator received complete control over the copper pair from the central office to the end user. In this case, the alternative operator co-located its own equipment in the incumbent's central office and provided both the broadband service and the analog telephony, or the only broadband connectivity, while analog telephony was provided on a separate pair by the incumbent or other provider.

Line Sharing

In this model, the copper pair was divided up into low band and high band pass sections. The incumbent operator continued to provide the analog telephony service. The alternate operator was given access to the high band pass section for providing services over DSL. In this case, the alternative operator owned its users but not the physical access line to their homes.

Current Perceptions

When people think of sharing the access fiber network infrastructure, there is a tendency to think exclusively of the full unbundling model. This leads to the assumption that the optimal way of implementing unbundling in the fiber access network is by means of mimicking what was done with copper pairs, i.e., physically allocating a dedicated fiber from the customer location to the alternative operator in a P2P fashion.

This perception motivates some groups to favor P2P over a GPON fiber access architecture. However, GPON architectures provide more than adequate solutions for unbundling and open access network needs.

Open Access Networks and LLU with GPON

There are two possible ways of achieving open access networks of LLU with GPON: Fiber Path Unbundling and Data Path Bit Stream.

Fiber Path Unbundling

The Fiber Path Unbundling approach allows the alternative carrier to own or lease its own infrastructure to the subscriber while benefiting from the advantages of the GPON architecture. The incumbent operator or infrastructure provider performs all the civil works related to laying fiber ducts, fibers, splitter cabinets, and splitters required to build a PON network. Thanks to PON’s conservative use of fibers (each PON tree requires only a single fiber per path), the same infrastructure overhead of ducts and splitter cabinets can be used to allow for multiple duplicate PON trees within the same infrastructure, practically without requiring any additional investment. (The splitter cabinets may need to be slightly bigger depending on the circumstances, but this would still be much smaller than the alternative P2P solution.)

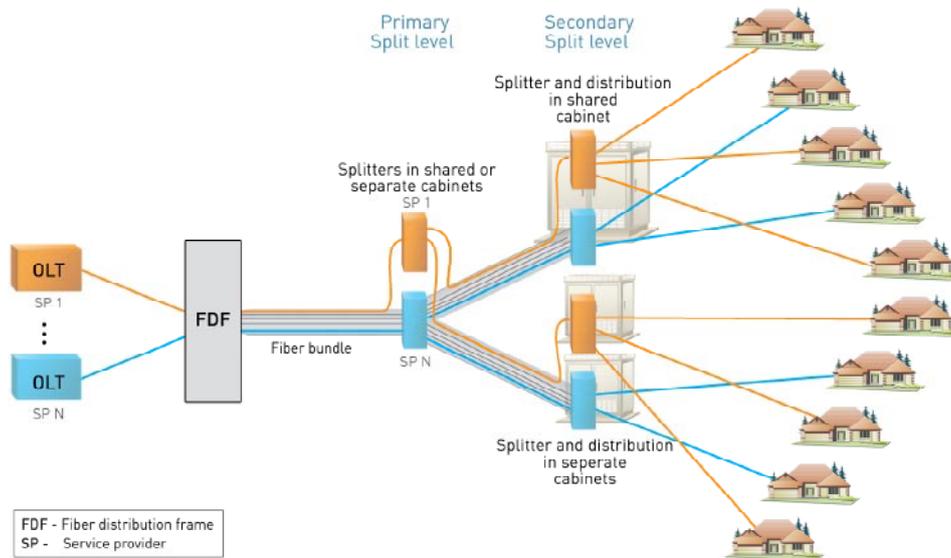


Figure 1: Fiber path unbundling

At the outset, all infrastructure belongs to the incumbent. At any stage, initial or later, that an alternative operator requests access to a subscriber or a fiber serving area, a full PON path can be sold or leased on a per-fiber basis, including connectivity via the splitter cabinets.

Data Path Bit Stream

With the Data Path Bit Stream method, the fiber infrastructure still belongs to the incumbent, and allows for a modular and cost-effective sharing of the connectivity between many alternative operators.

With this method, the infrastructure provider divides the 2.5 Gbps D/S and 1.25 Gbps US fiber into virtual pipes. Each pipe is allocated to a different connectivity provider (alternative carrier).

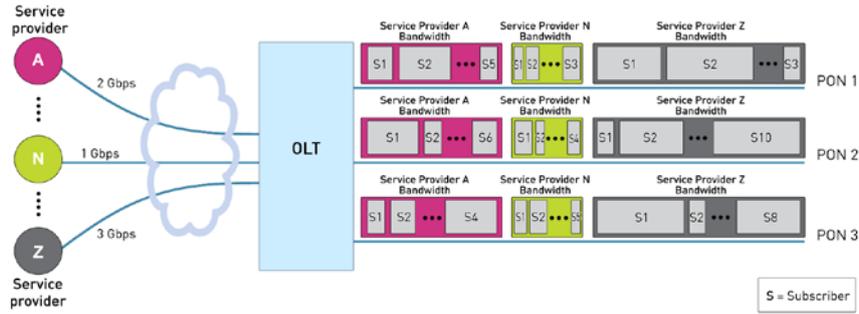


Figure 2: Multiple service providers on open access network implemented with data path

Because the pipes can be of any size, this approach allows alternative providers to provide services even in areas where there is low penetration of their services and where the Fiber Path Unbundling approach would possibly not be economically viable.

For successful unbundling, the alternative operator needs to have a critical mass of customers to cover its overhead costs. With the Data Path Bit Stream approach, since the alternative operator is paying only for bandwidth streams and not for ownership of physical infrastructure, the overhead costs are much smaller than other methods, and thus the critical mass needed for a sound business case is greatly reduced.

The Data Path Bit Stream method also provides the flexibility required by alternative operators to enter the market and grow with their demand, as the bandwidth pipes can be increased according to their customer take-up.

Implementation of Data Path Bit Stream

Policing per Service Provider per PON

If the Datapath Unbundling model is used, multiple service providers will be using the same PON tree. As such, there will be multiple levels of bandwidth competition on the PON, as follows:

- Competition between users of each service provider
- Competition between the different services of each user and between users
- Competition between different service providers per PON as service providers try to provide maximum service to their customers

Due to the additional element of bandwidth competition between service providers, it is necessary to control the amount of bandwidth used by each service provider. This needs to be done on the PON level, as the number of users per service provider will vary from PON to PON. In addition, the bandwidth pipe provided over the network between the OLT and the service provider will likely differ from the bandwidth on the individual PON.

Each alternative service provider (or infrastructure provider) will likely be providing multiple service types (or connection to different service providers). There are two ways in which service type differential SLAs can be achieved: Infrastructure Provider Controlled or Alternative Operator Controlled.

Infrastructure Provider Service SLA Control

With this method, the alternative operator provides a definition of its customer needs to the infrastructure provider. The infrastructure provider uses QoS functionality of the OLT to ensure fairness on the per-user-per-service level. Although this requires continual interaction between the infrastructure provider and the alternative operator, it potentially simplifies network operation of the alternative provider as no network configuration and less expertise are needed. It may be beneficial at the alternative provider's initial market entry. The infrastructure provider on the other hand, achieves another source of revenue from this ongoing service it provides to the alternative provider.

Alternative Provider Service SLA Control

With this method, the infrastructure provider gives the alternative provider a controlled pipe on the GPON without any additional control or differentiation between services and users. The alternative carrier implements control per user per service SLA control using its own Ethernet QoS mechanisms. This model may be appealing when independence from the incumbent is needed and the alternative carrier has developed its network sufficiently to provide its own SLA control.

Summary

GPON has sufficient and ample mechanisms to allow LLU and support open access networks, and additionally provide the advantages of a PON infrastructure. Data path bit stream on GPON provides for a higher level of competition than possible in P2P architectures, as it lowers market entry barriers for alternative operators. As such, when comparing GPON and P2P architectures, the claim that P2P is a better approach to allow open networks as well as unbundling is not valid. To the contrary, in many cases PON offers a better alternative for providing these in the fiber access.

About ECI Telecom

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