Migrating DSL footprint to FTTH, start with GPON or XGS-PON?

Problem Statement

An operator wants to move all subscribers to Fiber to the Home. He decides on an aggressive strategy to no longer invest in DSL technology upgrades but migrate network elements to FTTH when they need to be upgraded and wants to understand what is the best starting point: go with GPON or directly introduce XGS-PON?

High Level Assumptions

The current state of the 3M household passed network:

- Technology VDSL: 1.35M, GPON: 1M, ADSL2+: 0.65M
- Year over year Demand growth varies across footprint:
  - Upstream from 20% to 30%
  - Downstream from 30% to 50%

10 Yr. Analysis Comparison	Cost ($, M)		NPV ($, M)	
	Base	**Product**	**Base**	**Product**
XGS-PON	2,013	2,086	1,742	1,797
GPON	1,857	2,009	1,542	1,683
Difference	156	77	201	114

Network transformation paths:

Cost component assumptions: (all other cost identical for all scenarios)
  - GPON Costs (assumed constant): OLT Port: $1K, ONT: $100
  - XGS-PON (reduced with 30% year over year until at GPON level): OLT Port: $5K, ONT: $300

Brief Description of the AP-Jibe Approach

To give intuitive insights on the impact of both transformation paths a detailed access network level 10-year quarterly network transformation plan is calculated in AP-Jibe. For both transformation paths 2 scenarios are evaluated:

- A base scenario: triggering network element for upgrade when demand reaches 70% of capacity.
- A product scenario: where in addition to demand triggers, a high tier product roadmap requirement is added. A product trigger triggers a network element for upgrade if offered max tier is higher than the available headroom on the access link (headroom = capacity – demand). The product roadmap analyzed:
  - 2023: 2 Gig symmetrical
  - 2025: 5 Gig symmetrical

Results

Caution: These results are based on our high-level assumptions for illustrative purposes only. Actual results may vary based on each operator's environment.
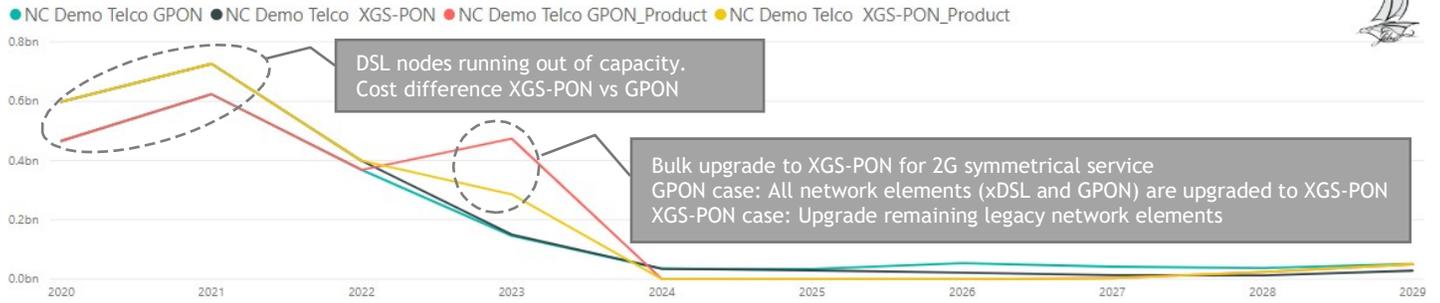
In this upgrade scenario, with the cost difference between XGS-PON and GPON equipment disappearing rapidly in the first three years, the actual results dependent heavily on the current congestion level of the DSL network elements in the brownfield network. The methodology used is representative of the type of analysis that needs to be done to make an informed upgrade decision on any brownfield network.

The result graphs on the next page give better insights on difference between both transformation paths and their respective flexibility to cope with additional requirements such as product roadmap changes. In addition to the few graphs shown here, AP-Jibe will generate detailed information on cost, resource and labor requirement, upgrade actions and many more.
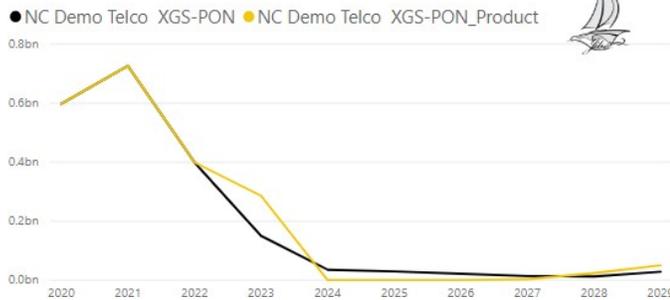
The costs for all the scenarios are higher in the first few years as upgrading from a DSL to a fiber to the home technology requires significant fiber construction. Technology upgrades from one FTTH technology to the next does not require any outside plant construction work hence the lower costs for future upgrades.

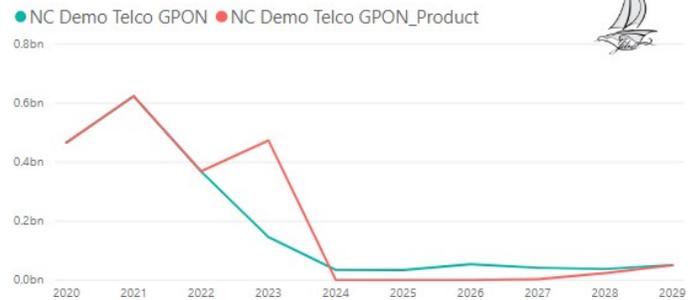# Migrating DSL footprint to FTTH, start with GPON or XGS-PON?

NC Demo Telco CAPEX Comparison
● NC Demo Telco GPON ● NC Demo Telco XGS-PON ● NC Demo Telco GPON_Product ● NC Demo Telco XGS-PON_Product

DSL nodes running out of capacity.
Cost difference XGS-PON vs GPON

Bulk upgrade to XGS-PON for 2G symmetrical service
GPON case: All network elements (xDSL and GPON) are upgraded to XGS-PON
XGS-PON case: Upgrade remaining legacy network elements

XGS-PON CAPEX Base vs Product
● NC Demo Telco XGS-PON ● NC Demo Telco XGS-PON_Product

GPON CAPEX Base vs Product
● NC Demo Telco GPON ● NC Demo Telco GPON_Product
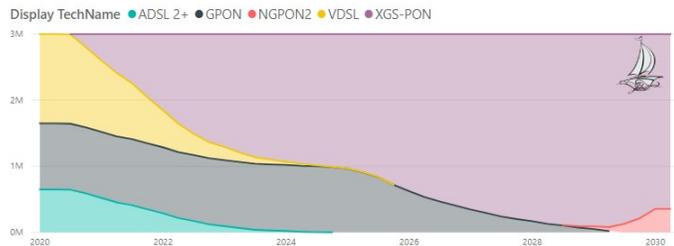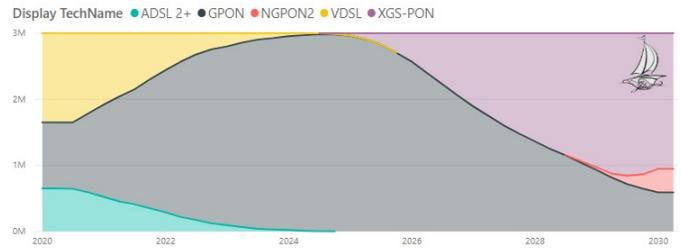
The graphs below show how the footprint in the network evolves over time for each of the 4 scenarios and visually demonstrate the momentous impact that product triggers can have on the network transformation plan.
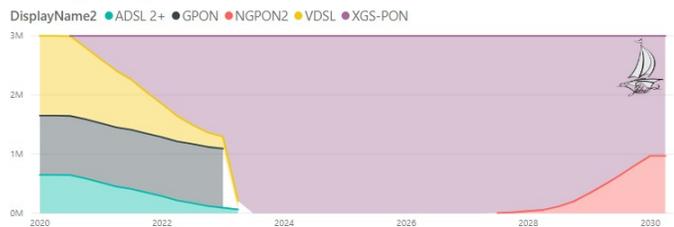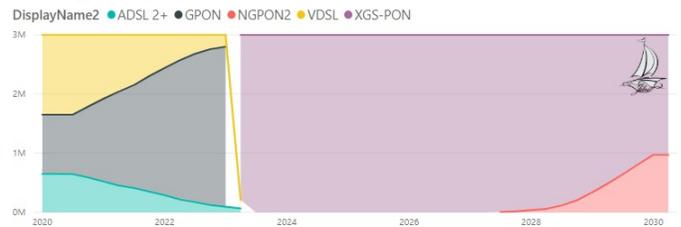
Total HHP by Technology — NC Demo Telco XGS-PON
Display TechName ● ADSL 2+ ● GPON ● NGPON2 ● VDSL ● XGS-PON

Total HHP by Technology — NC Demo Telco GPON
Display TechName ● ADSL 2+ ● GPON ● NGPON2 ● VDSL ● XGS-PON

Total HHP by Technology — NC Demo Telco XGS-PON_Product
DisplayName2 ● ADSL 2+ ● GPON ● NGPON2 ● VDSL ● XGS-PON

Total HHP by Technology — NC Demo Telco GPON_Product
DisplayName2 ● ADSL 2+ ● GPON ● NGPON2 ● VDSL ● XGS-PON

Closing remark

This application note demonstrates that many factors must be considered to answer the simple question "start with GPON or XGS-PON?" and the answer is - it depends on different factors as highlighted in this application note. To come to a real answer for a specific network a detailed long-term transformation plan should build with clear assumptions on growth and other upgrade triggers. With AP-Jibe this can be done in no-time, allowing for sensibility analysis through numerous what-ifs to come to the best possible transformation strategy.