STEM example model

Next generation access costing 'without a map'

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WORK IN PROGRESS

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Next generation access costing 'without a map'

Installation of next generation access (NGA) infrastructure is a key concern for network operators and a priority of the Digital Agenda for Europe.

We have developed an efficient and credible methodology for evaluating the cost of upgrading a copper-based local-access infrastructure to provide high-speed broadband access or so-called next generation access (NGA). Our example model includes scenarios that compare the headline revenues and capex of deploying VDSL connectivity with feeder fibre or a complete GPON solution for FTTH against a baseline greenfield or current ADSL implementation.

We characterise a generic city with a division of households between four separate *density classes* (households per sq km). A representative street pattern is used to derive general rules to link coverage of households with distance covered for buildings passed and households connected, with awareness of how multiple dwellings and tower blocks distort the relationship between buildings passed and potential households connected.

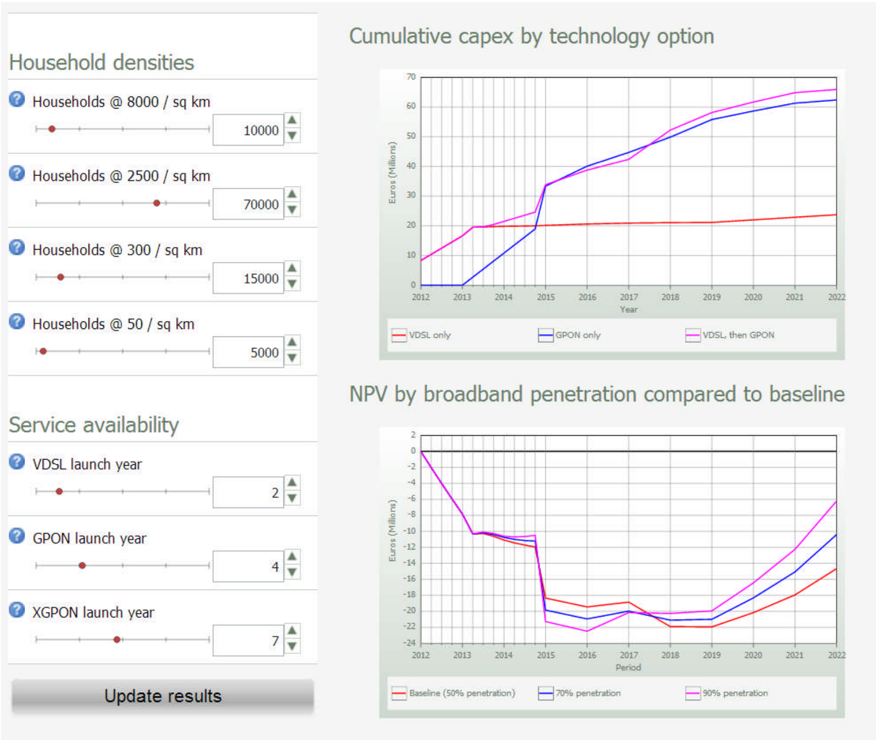

Figure 1: Live snapshot from the model on www.impliedlogic.com

Implied Logic can work with you to customise this methodology to your individual market and current network position in order to fast track a credible financial assessment of your strategic options.

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1. Overview

Infrastructure supporting broadband access is seen as a key development factor. Broadband services can be supported using different technologies. This model investigates fibre rollout as the way to implement NGA solutions as seen by the Full Service Access Network (FSAN) group and International Telecommunication Union (ITU).

The model aims at the operator of the access network and so it concentrates on the access functions. Content and core network are beyond the scope of this model.

Traditional copper structures are not modelled. The model copes with necessary VDSL extensions and fibre rollout using GPON technology as a starting point and extending to XGPON at a later stage.

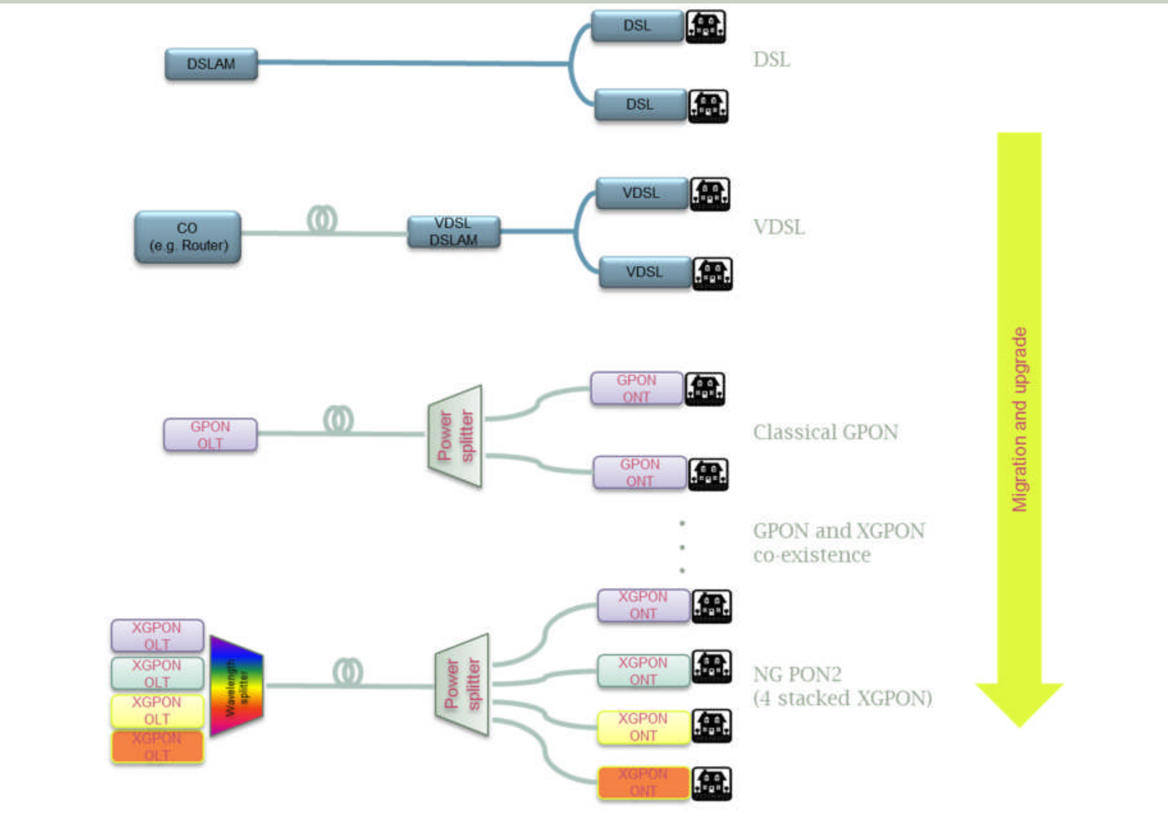

Figure 2: Migration path

2. Modelling geography

The model mainly focusses on the rollout of fibre (FTTB/FTTH) and the installation of GPON systems to provide broadband services. The rollout of fibre infrastructure requires accurate and GIS-based planning and optimisation. For high level analysis this approach is not practical, as it requires a lot of detail and effort. The conflict between inaccurate high level modelling on one side and accurate but time-consuming and input-intensive planning on the other is addressed as follows:

- The area to cover is divided into regions (a region being a town or city, or a collection of similar towns or cities, or a part of a city). This is completely flexible.

- Each region is modelled separately; the model for a region is contained in a template, which can be replicated for as many regions as needed.
- A region is divided into four density classes (*low density*, *medium density*, *high density* and *very high density*); these density classes are mainly chosen to reflect different geographical conditions and infrastructure costs. The usage of density classes is flexible regarding the definitions (e.g. household density per km²) and not all classes must be used for each region.
- Main inputs are given per region and density class; the model relies on available statistical data (e.g. number of households, household density, area covered etc.).

Thus, an operator will be able to plan just a few representative areas, 'tune' the model and finally use the model for the whole area. The model assumes that there is an existing copper infrastructure, which can be 'duplicated' with fibre. Existing street cabinets can be used or extended to house the splitters.

3. Market segments

Market segments and services are derived from the number of households in a given region. Households are assigned to each of the four defined density classes.

A promising market segment is *mobile backhaul*. The market for mobile backhaul is not explored in this model, but it has huge revenue potential for the phase in which XGPON is deployed and nearly all of the populated areas/streets are served in a given region.

Households can be served by various different technologies such as:

- wireless
- coax cable solutions (DOCSIS)
- traditional copper-based solutions (DSL, VDSL)
- fibre-based solutions (GPON/XGPON).

As the model covers the migration from copper- to fibre-based solutions the next step takes care to derive the number of households served by copper and potentially by fibre from the total number of households. This approach allows the consideration of different competition situations, different geographical and other constraints on a per region and even on a per density class level.

4. Services

The model focusses on the access part of the network and so services are reduced to broadband access over different technologies. The following services are included:

- *DSL* represents today's standard connection over existing copper lines.
- *VDSL* offers higher bandwidth and requires changes in the copper network and fibre rollout.
- *100M* represents the fibre-based product using GPON technology. A completely new infrastructure is required, with fibre directly up to the customer.
- *1G* stands for the XGPON variant. Replacements of CPE and central equipment are required, but the fibre network stays unchanged.

Services are derived from the *Copper and fibre* market segment using an assumed penetration. The modelling approach gives enough flexibility to cope with situations like migration and coexistence of copper and fibre based networks, or greenfield fibre rollout for new entrants.

5. Infrastructure

The model contains only a few elements for the copper-based part. This is driven by the fact that a huge part of the infrastructure is already in place. For the VDSL rollout the following extensions are considered:

- DSLAM (VDSL)
- feeder fibre (distribution fibre for PON rollout can be installed in parallel to save cost in the future)
- street-cabinet extensions.

5.1 Fibre infrastructure

The main focus is on the passive fibre infrastructure. It can be divided into:

- *Feeder Fibre* – fibre between Central office and splitter; one fibre per system
- *Distribution Fibre* – fibre from splitters along the streets, one fibre per customer, cables are chosen to handle the maximum number of customers in area served by that cable
- *Fibre drop* – cable connecting Distribution fibre and building (from the closest splicing point on the street into the building), one fibre per customer, cables are chosen to handle the maximum number of customers per building.

The model is prepared for different possibilities (*own fibre*, *leased fibre*, *own or leased duct*, *aerial fibre*) with different shares and costs per region and density class. Results can be influenced by 'tuning inputs' in order to reflect accurate Geographical Information Systems (GIS)-based planning.

Operators need to build the fibre proactively. Feeder and distribution fibres are likely to be rolled out long before the service is marketed (comparable to geographical coverage of a mobile network). The fibre drops to buildings can probably be installed in a more demand–oriented way.

The *splitter* is a device which splits the optical signal coming from the feeder fibre into n parts (often n = 32) and reversely combines the signal coming from n ports into one common signal towards the feeder fibre.

Each *building* requires additional cost (e.g. in-house cabling), and so buildings are a separate resource per density class.

5.2 Other components

Other model elements are:

- *CPE* – one CPE (or ONU) per household, which must be replaced in the case of XGPON migration
- *OLT* (optical line terminal) – the central equipment for a GPON
- *XGPON OLT* – the central equipment for a XGPON (the parallel existence of GPON and XGPON or several XGPONs on one optical network requires additional wavelength splitters)
- *wavelength splitters* (for the coexistence of several PON systems on one fibre).

Although the focus is on GPON/XGPON as the preferred option for passive optical networks (by FSAN), an adaptation to EPON wouldn't require huge changes to the model.

6. Cross section of results

The model shows the rollout of a FTTH infrastructure as a base for broadband access. Subscribers are migrating from traditional copper-based services (DSL, VDSL) towards fibre-based services (GPON and XGPON).

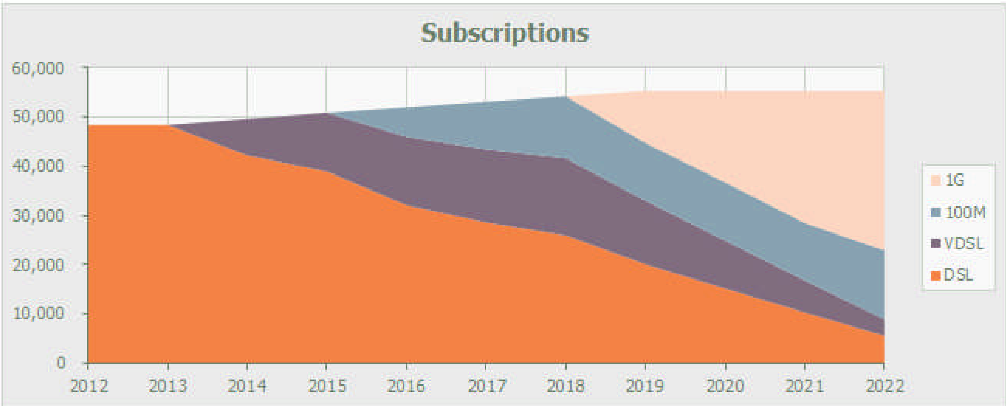

Figure 3: Number of broadband subscribers

Investment at the start is mainly driven by feeder fibre and distribution fibre rollout, whereas subsequently the connection of buildings is the major component. Active components (e.g. CPE) play only a minor role.

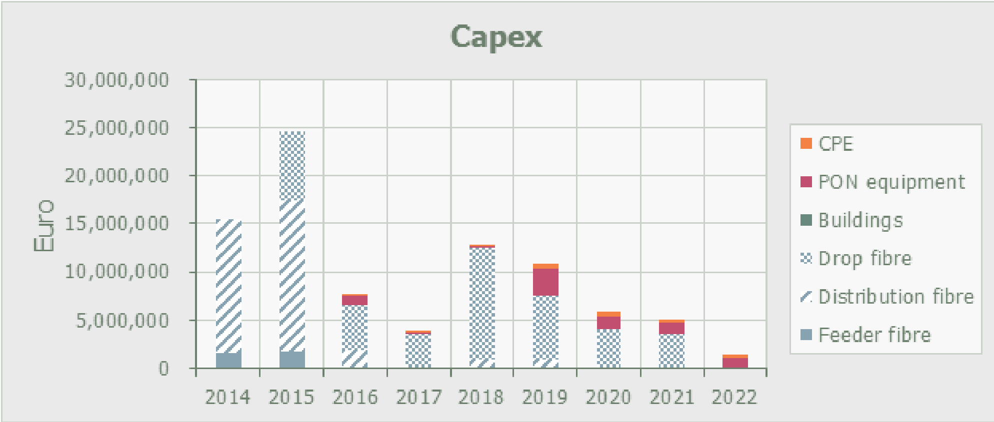

Figure 4: Capital expenditure

Technical and financial results are available per region and show the proactive fibre rollout, where feeder and distribution fibre are practically independent of the number of customer connections, and the number of fibre drops increases with increasing subscriber numbers.

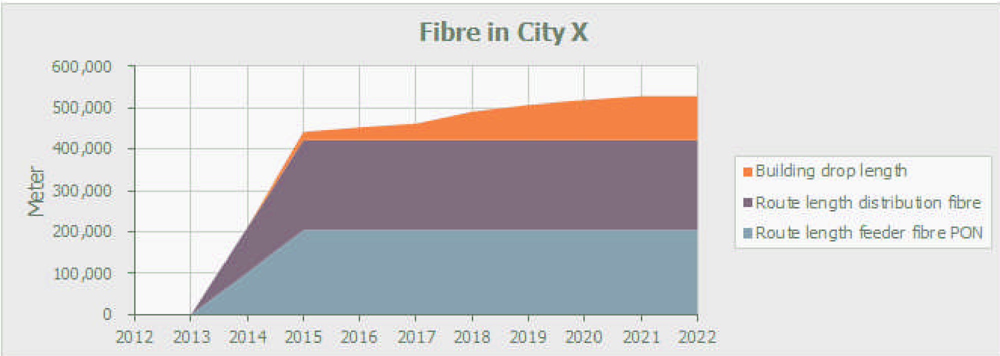

Figure 5: Fibre rollout in a region

In some regions the geographical constraints lead to large capital expenditure, which make it hard to justify fibre rollout at all.

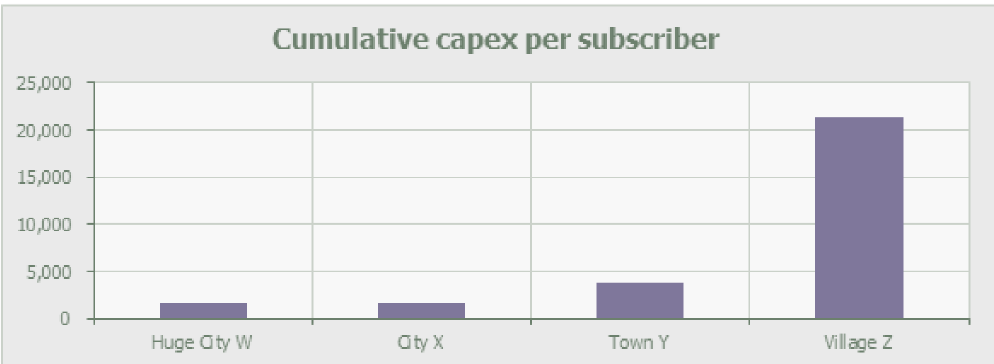

Figure 6: Cumulative capex per subscriber in different density classes

The business case for fibre rollout shows the typical huge investment up front, leading to long payback periods (in the region of 15 years). The use of capacities which can be leased (e.g. duct) significantly changes the business model.

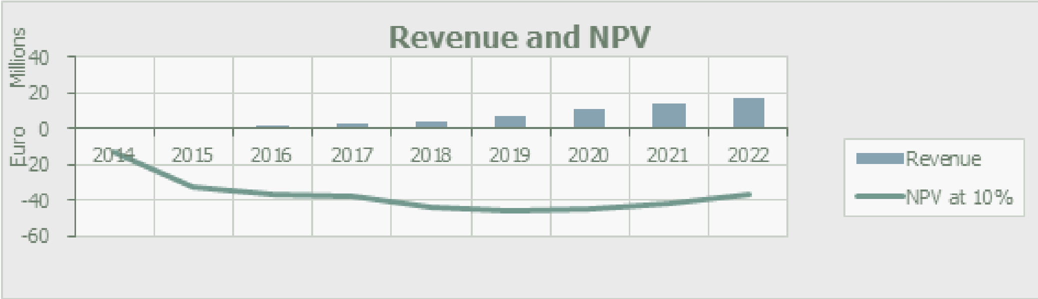

Figure 7: Revenue and NPV

7. External interfaces

STEM supports different ways to input data (e.g. directly or via MS Excel). In this model, one MS Excel workbook is used to input data for each region. This workbook holds statistical data, and market and infrastructure-related assumptions.

Model results can be presented directly with the STEM results program. Alternatively, it is possible to access results from MS Excel. The workbook 'key results' contains some overall results, and also presents detailed results per region and density class. A web-enabled version can be accessed live at www.impliedlogic.com.

For more information please contact:

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