



Network transformation outlook 2019-2024

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1. Background and Scope of the present document

This document is an update of the document “Network transformation outlook 2018-2023” and has been elaborated to answer the request for information of the BIPT as formulated in “het besluit van de conferentie van regulatoren voor de elektronische communicatiesector van 29 juni 2018 met betrekking tot de analyse van de markten voor breedband en televisieomroep”.

The present document has been constituted to Proximus’ best knowledge at present of the future evolutions of its fixed networks taken into account that several matters discussed in the present document are not covered by detailed or final decisions of the management and/or Board of Directors.

The present document contains the relevant information to what transformations in Proximus’ fixed network will take place in the coming 5 years that will or might have an impact on the existing wholesale services and wholesale access points.

Most statements in the present document constitute forward-looking statements. These statements may include, without limitation, statements concerning future technological evolutions, decisions and timelines, and statements preceded by, followed by or including the words “believes”, “expects”, “anticipates” or similar expressions. These forward-looking statements rely on a number of assumptions concerning future events and evolutions and are subject to uncertainties and other factors, many of which are outside our control that could cause actual evolutions to differ materially from such statements.

Data and information in the present document may be subject to re-evaluation, evolution and changes. Proximus cannot guarantee that this information is complete or that no new information will become available with an impact in the coming 5 years.

Proximus cannot be held liable for any mistake, omission or any other short coming of the present information, which has been provided based on our best knowledge and in good faith.

This document doesn’t constitute any binding offer from Proximus and doesn’t contain any commitment from Proximus.

This document and the information within are made independently of any form of appeal, present and future, against a decision or a regulatory requirement imposed to Proximus.

2. The Proximus Mantra program

Proximus' Mantra program (called "Move to All IP program" in previous years), in this document referred to as "Mantra", aims at adapting and transforming the fixed network of Proximus to the global technological evolution:

- Evolution of the Fixed Voice network and Voice Service Platforms.
- Evolution of network technologies (ATM/SDH, Ethernet) and anticipation of the end of life of multiple legacy technologies.
- Invest in network simplification to reduce OPEX and increase operational efficiency.

The Mantra network transformation process is being carried out in two phases:

- The first phase concerned the building of an MPLS & IP-based network and the porting/implementation of the Proximus product portfolio (retail and wholesale) on this infrastructure.
- In the second phase, the legacy network technologies are subject to consolidation and phasing out in view of optimizing the network infrastructure and deal with the fact that legacy technologies have become obsolete and without vendor support.

The first phase was divided into four steps:

- Deployment of an IP-based access infrastructure based on FTTC and VDSL2.
- Deployment of an MPLS & IP-based aggregation and core network. The current deployed MPLS & IP-based aggregation/core network supports bandwidths up to 10 Gbps and provides the reliability needed for future proof services. The current aggregation/core networks are being renewed to cope with the continuously increasing bandwidth needs up to 100 Gbps and whose roll-out started mid 2018 with the target to have finished it by end 2021/beginning of 2022.
- Deployment of the IMS platform for voice services.
- Porting most of the Proximus service portfolio on the MPLS & IP network. This entails both the retail and the wholesale portfolio of Proximus.

In line with our present expectations, the second phase includes all initiatives aimed at consolidating the customer installed base on the MPLS & IP infrastructure and at reducing the operational complexity of managing several network infrastructures in parallel (one per service).

- Phasing out of access legacy technologies (Leased Lines in all different flavours, X.25, PDH & SDH) and traffic transition to the MPLS & IP-based infrastructure.
- Phasing out of core legacy technologies (ATM, PDH & SDH, PSTN, ISDN, ...) and traffic transition to the MPLS & IP-based infrastructure.

Fig.1 below gives an overview of “the” Network Simplification program from which parts are already started or even already finalized.

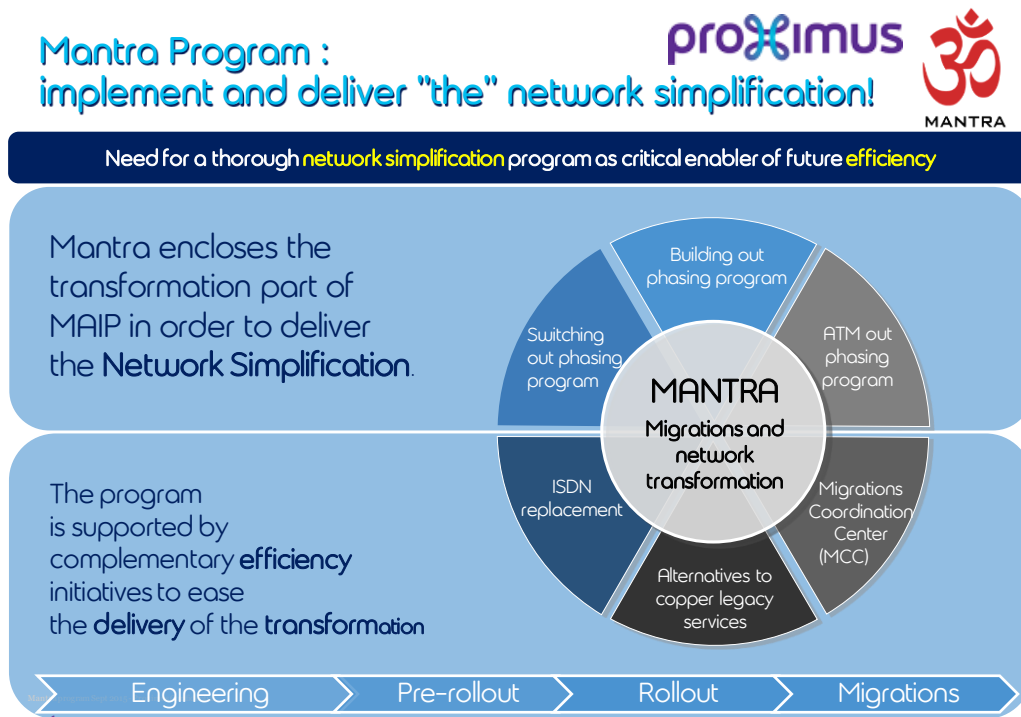


Figure 1: Network Simplification

The Mantra program has impact on the Wholesale services currently offered by Proximus. Below we summarize the most important impacts:

- **Broadband Access services:** The ATM-based Bitstream ADSL(2+) and SDSL services have been transformed to Ethernet-based Bitstream ADSL(2+) and SDSL services in order to meet the global technological evolution towards Ethernet.
- ATM is now fully phased out and replaced by Ethernet as uniform medium for access technologies such as ADSL, ADSL2+, VDSL2 and SDSL.
- **Data and Capacity services:** migration from BILAN and Leased Lines to Ethernet based services.
- **Voice Interconnect:** as the complete voice network (except remaining legacy ISDN-BAs) has now been migrated to an IMS based infrastructure, the current TDM interconnection model between Proximus and third party operators is evolving to an IP Interconnect model.
- **Local Loop Unbundling services:** as additional LEX buildings will be closed, the colocation and services delivered in and from these buildings will have to be terminated and/or migrated to alternative offers.

The Mantra program has a different impact on each of the wholesale customers. In that perspective, Proximus holds, since 2010, recurrent meetings with the wholesale customers in order to:

- Inform the wholesale customers about the products that will be out-phased and about the future products.
- Give them guidance on possibilities for evolution scenarios.
- Discuss with them the lists of impacted lines and create migration plans for these.

The removal of the older data networks (ATM) and the legacy telephone exchanges (Nokia¹ and Siemens) were key enablers to sell off a number of large technical buildings in city centres as described in chapter 6 “Building Outphasing”.

However the long term ambition of Proximus is to cover the centre of cities and communes with fiber (see chapter 3), to make in the non-fiberized areas great parts of the copper (feeder) network redundant and to further dispose parts of the total technical surface area mainly located in smaller buildings from mid-2019 onwards. This resulted in the decision to start the related works for “Mantra+” from 2017 onwards with a pilot of 10 buildings, for which the outphasing has been finalized, and the notification of 64 Mantra+ buildings (see chapter 6). At that stage, the technology will be located mainly in existing street cabinets, supplemented with newly designed small containers called Optimus containers. Some local nets will not be equipped with an Optimus container but with an OVD (Optische Verdeler), a passive street cabinet that patches the optical fibers to 1 or more neighbouring LEXes.

¹ Nokia acquired Alcatel-Lucent in April 2015.

3. Broadband Access Evolution

Preliminary statements in this chapter concern the technologies and services in general in Belgium. Specific circumstances may exist in outphased buildings as described in Chapter 6.

Proximus continues to deploy Fibre-to-the-Curb in selected areas allowing to extend the VDSL2 service coverage.

The impact of this evolution on wholesale access services is twofold:

1. The LEX based unbundling model becomes obsolete (which is confirmed by the fact that certain MDF sites are already closed down or are notified for closure).
2. The Bitstream ADSL(2+)/SDSL over ATM reference offer became obsolete and evolved to:
 - a. either a Bitstream access service for VDSL2 connectivity which is always Ethernet based,
 - b. or a Bitstream over Ethernet service for ADSL(2+) and SDSL connectivity.

ADSL(2+) will be gradually outphased in the copper distribution areas served by ROPs with all Living Units connectable in VDSL2 as an enabler to activate vectoring also in the downstream frequency bands between 552 kHz and 2,2 MHz. The opening of the VDSL2 zones 6 and 7 will trigger a list of additional homogenizable ROPs.

On 14 July 2017, SDSL has been notified aiming for a “stop sell” from 1/7/2018 and a full “stop service” by end 2019. In 2019, Proximus decided to shift the “stop service” date to mid 2020. On June 3rd 2019, the BIPT approved the “stop sell” and “stop service” of SDSL based on Proximus’ proposal to offer a lower priced EFM solution as an alternative for SDSL lines complying with certain conditions. The “stop sell” has been activated on July 1st 2019 and the “stop service” has been communicated for July 1st 2020.

3.1 Broadway

VDSL2 coverage

Proximus announced its Broadway plans publicly in 2004 with an initial target coverage for VDSL2 of 46%. This coverage target was progressively increased, so that Proximus has reached by end 2019 an effective service coverage for VDSL2 of 95,4%⁽²⁾.

Information on a more detailed basis regarding availability is provided if, where and to the extent relevant in the context of the existing wholesale access services.

² The current VDSL2 provisioning speeds range from 70 Mbps (vectoring zone 1) downstream to 8 Mbps (vectoring zone 7) and can increase through the DLM-process from up to 16,5 Mbps (in legacy zones 4 and 5), 30 Mbps in vectoring zones 6 & 7 to up to 100 Mbps (in vectoring zone 1).

The coverage as well as the attainable speeds with VDSL2 depend on attenuation and distance. For the current attenuation- and distance limits, please refer to the Bitstream xDSL offer published on Proximus' web site.

VDSL2 speeds

In 2010, the use of spectrum for VDSL2 has been increased to 17 MHz allowing attainable provisioning speed up to 30 Mbps downstream & up to 10 Mbps upstream on legacy and vector-friendly VDSL2 lines.

Since 2012, Proximus also applies the DLM (Dynamic Line Management) process to the VDSL2 lines, boosting part of its park of legacy and vector-friendly VDSL2-lines to up to 70 Mbps downstream speeds. The DLM allows part of the legacy and vector-friendly VDSL2 lines to benefit from higher bit rates than expected according to the provisioning rules based on loop length and attenuation, without increasing significantly the risk for transmission errors or instabilities.

Since 2014, Proximus also applies the DLM process to increase upstream speeds up to 10 Mbps on legacy and vector-friendly VDSL2-lines.

In collaboration with its VDSL2 equipment manufacturers Proximus has now upgraded its VDSL2 network with the roll-out of a new technology called vectoring. Based on new VDSL2 ISAM cards, downstream vectoring allows internet speeds up to 70 Mbps by neutralizing interferences between copper pairs lying in the same cable. DLM further boosts part of this park of vectored VDSL2 lines to up to 100 Mbps.

Since 2015, Proximus also implemented upstream vectoring which increases the upstream speed on vectored VDSL2-lines to up to 20 Mbps. The upstream speed was further increased to up to 40 Mbps in 2017.

From mid-2017 onwards, Proximus started gradually with the activation of vectoring in the frequency band from 1,1 MHz to 2,2 MHz on notified ROPs without ADSL2+ services to achieve further downstream speed increases for many of the subscribers which are connected to homogenizable ROPs, meaning they serve a copper distribution area that allows all Living Units to be connected in VDSL2. Such homogenizable ROPs are being gradually closed for ADSL2+ services.

In 2018, Proximus also started gradually with the activation of vectoring in the frequency band from 552 kHz to 1,1 MHz on these notified ROPs after the removal of ADSL1 services.

On 22 November 2018, Proximus extended the VDSL2 coverage by having added the new vectoring zones 6 & 7 for ROPs on which ADSL from ROP has been activated. This allows the homogenization of additional ROPs.

As of mid 2020 newly installed ROPs will be equipped with new DSLAM equipment (7363 MX-6). This new equipment contains a new line card, i.e. the RDLT-G card of Nokia and will consolidate all DSLAM functionalities (logic, processing, management functionalities) completely in the ROP. It will also support the future 35Mhz technology (see below). The introduction of this new DSLAM equipment is considered as a major network upgrade with the associated OLO CPE operators' roles and responsibilities. The gradual migration of the current DSLAM equipment in the existing ROPs, implying a short service interruption, is only foreseen as of 2022 at the earliest. The planning of these migrations will be communicated timely.

In the coming years, Proximus could implement solutions to further upgrade its VDSL2 network. In this respect, the following solutions might be investigated:

- Solutions that further increase downstream- and upstream speeds.
- The potential of the new “Long Reach” VDSL2 standard will be analysed.
- VDSL2 35 MHz, currently being tested with field trials, to further increase downstream speed through the use of the spectrum to 35 MHz. VDSL2 35 MHz would be enabled on the new VDSL2 platform as described above. The large scale activation of 35 MHz is not foreseen before 2022. Proximus will timely adapt the Bitstream xDSL reference offer with new 35 MHz VDSL2 line profiles, the impact on the UNI specification and an update of the OLO-CPE test plan in order to make sure that alternative operators can also benefit from this new 35 MHz VDSL2 technology when launched. Operators using an existing OLO CPE that may be 35 MHz compatible will have to recertify these CPEs conform the OLO-CPE test plan (that will be updated for 35 MHz VDSL2). It is important to note that the existing 17,6 MHz capable CPEs are expected to still function in 17,6 MHz VDSL2 profiles with the new MX-6 platform.
- VDSL2 Boost Box (VBB), to reduce the copper distance between the ROP and the customers.
- Pair bonding, to allow the use of several copper pairs to further increase downstream and upstream speeds is no longer envisaged to be developed for residential end-user oriented services.
- FTTdp (G.fast), currently being tested with field trials. Although being a DSL solution on copper, it will be deployed in the framework of FTTH to avoid the hassle of fiber civil works in private property and to deliver higher downstream and upstream speeds.

3.2 Physical Access Network Evolution

As Proximus deployed a fibre network to the vicinity of the Street Cabinet (KVD, Borne), by installing Remote Optical Platform units (ROPs) next to those Street Cabinets from which broadband- and voice services are provided, the MDF functionality in the Local Exchange (LEX) will be lesser and lesser used.

Therefore, as part of its roll-out, Proximus is able to dismantle a number of the local exchange buildings. Hence the current colocation and unbundling services at the LEX will be terminated or largely reduced, pursuant the regulatory framework as defined in the relevant regulated reference offers and the respective contracts.

In order to support the long-term target of the disappearance of the MDF functionality in the Local Exchange building (LEX), Proximus might reduce renewal investments in the copper feeder network by gradually outphasing copper feeder cables if and where they must be renewed (e.g. triggered by roadworks or cable damage).

The figure below gives an overview of the most important elements in the new access network, as well as the respective elements.

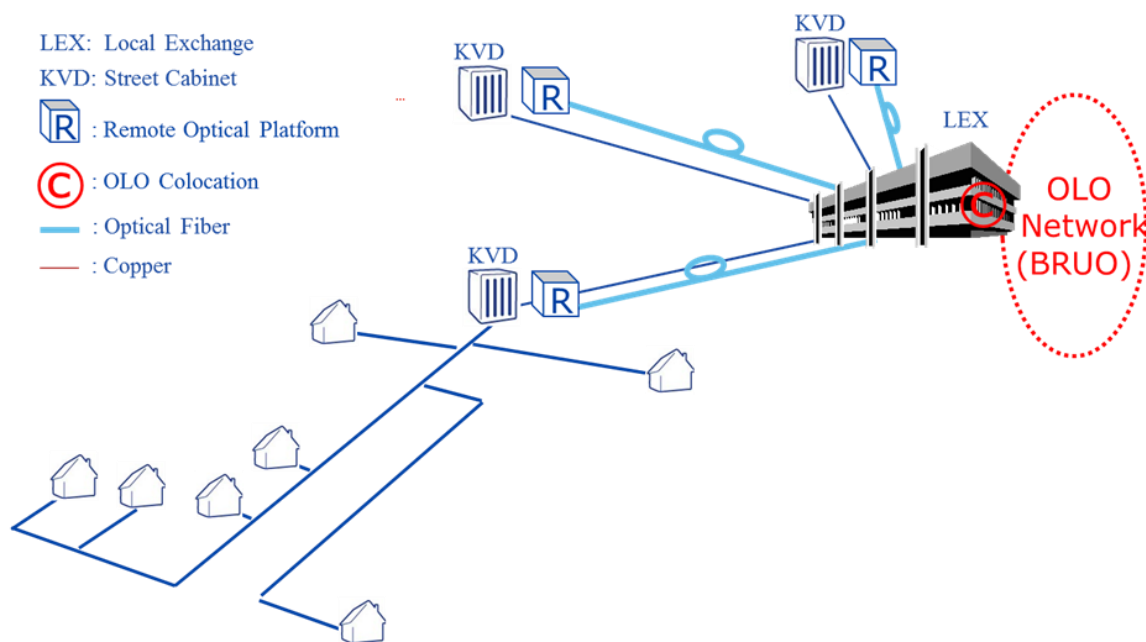


Figure 2: Physical Access Network Evolution

3.3 Wholesale Broadband VDSL2

The Bitstream VDSL2 service allows the alternative player to connect its end-users onto the Proximus network at a Proximus Service PoP using VDSL2 technology. The end-to-end transport between the end-user and the beneficiary is based on Ethernet.

Impacts of the vectoring technology on the Bitstream VDSL2 service

The application of vectoring on the VDSL2 lines is not compatible with the delivery of ISDN services on VDSL2 lines. As a result, since 2013:

- Ordering of new Bitstream VDSL2 products on end-user lines with ISDN service is not possible anymore. Ordering Bitstream VDSL2 on another pair will remain possible: Bitstream VDSL2 without Voice or Bitstream VDSL2 with Voice on PSTN.
- Proximus finished the uncoupling of all existing configurations where both Bitstream VDSL2 and an ISDN service were offered on the same copper pair. The ISDN service is moved on another pair, without impact on the Bitstream VDSL2 service of the end-user.

(Please refer to the Bitstream VDSL2 offer for further details)

The extension of vectoring on VDSL2 lines in the frequency bands between 552 kHz and 2,2 MHz is not compatible with the delivery of ADSL1 and ADSL2+ services from those ROPs. As a result, from 01/07/2017 for ADSL2+ and from 01/02/2018 for ADSL1 :

- Ordering of new ADSL1 or ADSL2+ products is not possible anymore for endpoints which are located in copper distribution areas in which all Living Units can be connected in VDSL2.

Reach Extended ADSL2 services are opened on all ROPs which support “ADSL from ROP” or which have been homogenized (meaning sub 2,2 MHz vectoring has been activated).

The speed of VDSL2 lines which are not equipped with a VDSL2 CPE which is at least “vector-friendly” at the moment of the activation of vectoring on the ROP concerned will be reduced to a Fall-back speed as defined in the Bitstream VDSL2 reference offer.

The Ethernet backbone investments project (introduced in chapter 2) - which aims at gradually replacing the current Ethernet aggregation/core networks - will add a third option to the current Bitstream VDSL2 and Bitstream Fiber GPON reference offers on top of the existing options “Shared VLAN” and “Dedicated VLAN”. No plans to outphase these existing options have been developed yet. The addendum of this new third option is now planned to be submitted to the BIPT in 2020.

3.4 ATM Outphasing

At the transport network level, Proximus consolidated the traffic on a common MPLS & IP-based infrastructure. Hence ATM outphasing was the most cost-effective path for the future. Proximus implemented the following strategy to accomplish this technological transformation:

- Nokia R5 Gigabit Ethernet NT cards have been installed in the R5 DSLAMs, and cover the whole of Belgium since mid-2011.
- ADSL(2+)- & SDSL traffic was mapped from ATM to the Ethernet backbone.
- Extension of Bitstream ADSL(2+) and SDSL to Ethernet transport.
- The Wholesale interconnection points on ATM level were closed and replaced by the 10 Ethernet Service Nodes.

Proximus performed with its customers the migration from ATM-based services to Ethernet-based services. Migrations have started in 2010 and Proximus now finished off-loading the ATM-network.

3.5 ROP-based ADSL(2+)

The ADSL(2+) and SDSL traffic can be transported on the Ethernet backbone thanks to the solution based on the Gigabit Ethernet NT cards installed in the ATM-DSLAMs hosted in every central office.

In the central office of buildings to be outphased and in copper distribution areas (these are the endpoints served by one street cabinet – see figure 2) for which the copper feeder will be cut, the LEX-based ADSL(2+) solution is not sustainable. Therefore Proximus developed ROP-based ADSL(2+) solutions, based on the Nokia NDLT-G vectoring cards (which also support multi DSL) installed in the ROPs. This allows to deliver ReADSL, ADSL1 and ADSL2+ solutions, but are not adequate for SDSL, nor for ADSL(2+) lines delivered with ISDN on the same copper pair. In this context, a stop sell of ADSL-services over legacy ISDN from 2017, February 1st onwards was notified and approved.

The ROP-based ADSL(2+) solution is applied for the different flavours of retail- and wholesale ADSL(2+) services (Fast Internet Access, Explore, Carrier and Bitstream) and Proximus launched it for building outphasing nets since end 2013.

Proximus extended the usage of the ROP-based ADSL(2+) solution in all local nets from late 2015 onwards to solve issues such as saturated or damaged feeder cables, improve ADSL(2+) access speeds and for the gradual outphasing of the current ATM-DSLAM-platform.

The ROP-based ADSL(2+) solution is only compatible with LEX-based SDSL-signals so all LEX-based ADSL(2+) services (including ADSL(2+) on BRUO-lines) must be moved to the ROP upon activation of ROP-based ADSL(2+) for that ROP. The impact on the BRUO reference offer has been covered with the creation of a new BRUO-service “Raw Copper Type 3” for SDSL-services on BRUO-lines.

The decision to gradually activate vectoring in frequency bands below 2,2 MHz also triggered the necessity of a further roll-out of ROP-based ADSL(2+) services as a preparatory step towards it.

(Please refer to the BRUO and Bitstream xDSL offers for further details)

The LEX- and ROP-based ADSL(2+) solutions based on the Nokia NDLT-G vectoring cards are also an enabler for the upcoming End-of-life outphasing of the current ATM-DSLAM-platform which also implies a “Stop sell” activated on July 1st 2019 and a future “Stop service” on July 1st 2020 of the Proximus SDSL-services.

3.6 Fiber To The Home

At the end of 2016, Proximus announced an investment of € 3 billion in the coming 10 years to accelerate the roll-out of Fiber in Belgium aiming at covering the centres of cities and communes, through deployment both on the façade of buildings and in certain sections in underground ducts.

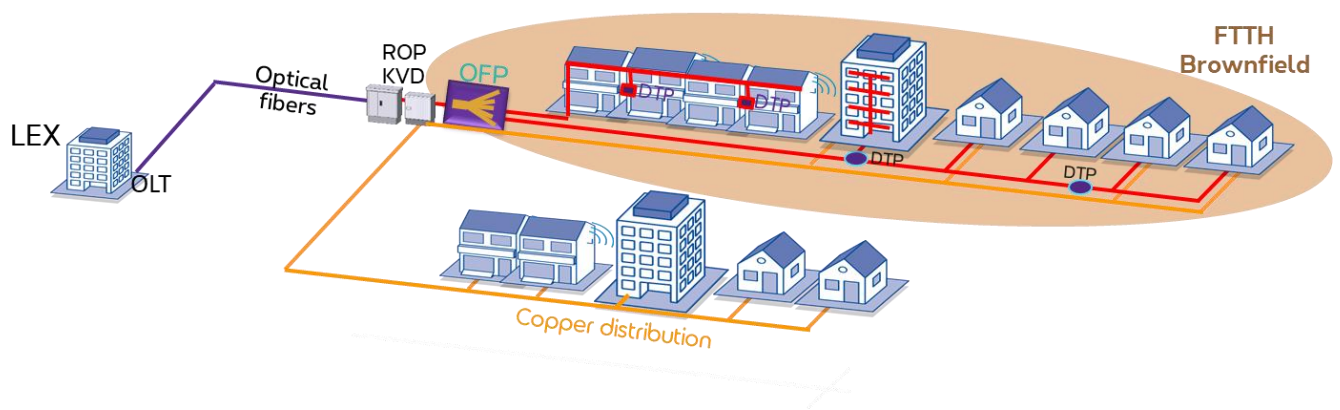


Figure 3: FTTH network

In the coming years, Proximus will fully fiberize dense city areas, starting with a progressive roll-out. Proximus started in the cities Antwerp, Brussels, Charleroi, Ghent, Namur, Liège, Hasselt, Roeselare, Evere, Leuven, Aalst, Vilvoorde, Knokke-Heist and Kortrijk. In such areas, migrations from copper to fiber will take place progressively following the full fiber coverage of the relevant geographic areas which will be notified for the copper plant outphasing (see also Chapter 7).

Proximus also continues to deploy FTTH in new residential zonings.

In 2014, Proximus presented its first commercial wholesale FTTH offer. In November 2018, a Bitstream Fiber GPON offer was presented in line with the Broadband market decision of 29 June 2018.

Proximus notifies its wholesale fiber customers and the BIPT on the planned network extensions of the fiber deployment progressively along the project:

- Twice a year, Proximus communicates the Fiberhoods for which the construction started to the BIPT and the wholesale customers.
- A stop service of all copper based services in these Fiberhoods is communicated to the BIPT and the wholesale customers conform the timings as defined by the BIPT. An overview of all Fiberhoods for which copper outphasing is planned can be found in Chapter 7.

With the exception of high-speed digital services such as LAN Extension Solutions (BLES), Optical Network Services (ONS) and a set of bitstream services, only IP-based services will remain available in FTTH areas.

Proximus currently expects to deploy XGSPON (10Gbps) in (part of) its Fiber GPON coverage area before 2026, in function of market evolutions to high bandwidths.

4. Data and Capacity Services

Preliminary, statements in this chapter concern the technologies and services in general in Belgium. Specific scenarios may exist in outphased buildings as described in chapter 6.

Bandwidth demand is ever increasing in today's data networks and these same networks are evolving more and more towards Ethernet. Therefore, in the long term, Proximus anticipates the Leased Lines services based on SDH to become obsolete, as data needs will be fulfilled by another type of supply, which forms part of a different market for data services.

The following planning was established:

- Analogue Leased Lines and digital Leased Lines lower than 2 Mbps are no longer sold since 1 January 2017 ("Stop sell") with a progressive "Stop service" afterwards for existing lines. The "Stop service" milestones have been notified with an end of service date of end-2019.
- Higher or equal to 2 Mbps Leased Lines, including partial circuits, backhaul and half links, will no longer be sold as of 31 December 2020 ("Stop sell")³ with a progressive "Stop service" afterwards. Current expectations are having outphased them all by end 2023 as a prerequisite for SDH outphasing.
- The BROTSOLL offer has been extended in 2014 with a Next Generation Leased Line service. NGLL is an Ethernet (Layer2) connectivity service; based on Ethernet over MPLS technology and it can be accessed via Ethernet over copper (Ethernet in the First Mile = EFM) and Ethernet over fiber. (Please refer to the updated BROTSOLL offer for further details).
- Ethernet services (10 Mbps) and Fast Ethernet services (100 Mbps) are currently implemented on top of the SDH-network which is planned to be outphased. Fast Ethernet services (100 Mbps) are planned to be developed on the Ethernet backbone but the 10 Mbps Ethernet services will no longer be sold as of 31 December 2020 and are planned to be outphased by end 2023 as a prerequisite for the SDH-outphasing.
- For Ethernet over copper (EFM), "Stop Sell" and "Stop Service" plans are still under evaluation as it is not a future proof technology but a target date to have them all outphased is not yet decided.
- BILAN ATM/FR services were migrated to MPLS Ethernet and the public X.25 service was stopped in 2013.

³ Except for TDM voice interconnect, see chapter 5.

5. Voice Interconnect Evolution

The legacy voice network was a 2-layer network which included about 180 Local Exchanges (LEX) for which hardware was installed in over 1.000 buildings which was fully phased out and replaced by IP-based solutions for PSTN-lines and PRA-lines by end 2017.

The technical solutions for this migration are based on the following elements:

- PSTN emulation via Access Gateway (AGW) as replacement for traditional PSTN services. AGWs are installed in the ROP (Remote Optical Platform) or in the central office and are controlled by an IMS platform. Figure 4 shows how it is built. PSTN lines are emulated via the voice access gateway.

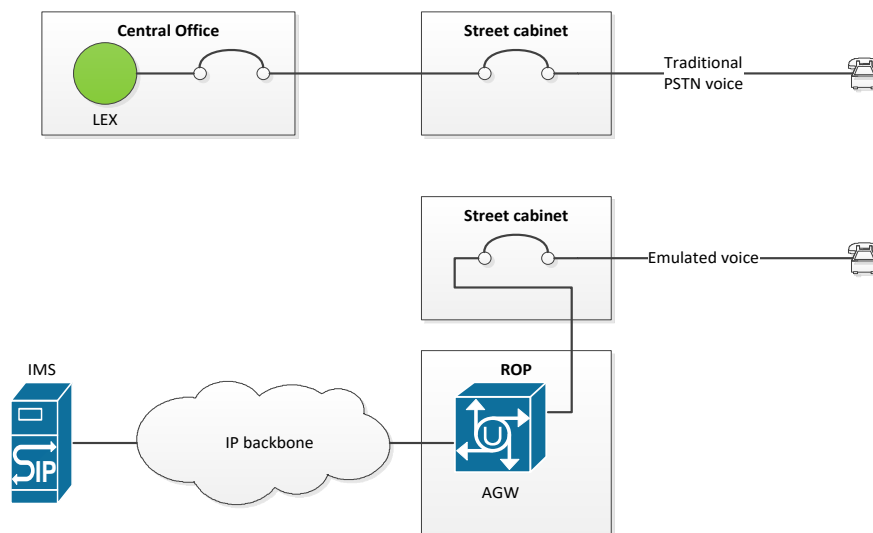


Figure 4: PSTN AGW solution

- ISDN emulation via IAD (Integrated Access Device), as a replacement for traditional ISDN-BA services. IADs are installed at the end-user & connected between the xDSL modem and the end-user ISDN device as shown in figure 5 and are controlled by an IMS platform. This solution needs a technical intervention at the customer's premises.
- An ISDN BA "Nokia S12 extend End-of-life" solution has been implemented on which $\pm 75\%$ of the remaining ISDN BA subscriptions have been migrated without any technical intervention at the customer's premises. A limited number of Nokia S12 Local Exchanges (LEX) remains active and S12 ISDN remote unit hardware has been installed in all central offices (except BO-nets) on which these remaining ISDN-BA lines are concentrated. A "Stop Sell" ISDN-BA from 1 January 2017 onwards (with some exceptions) has been notified to the market aiming at a gradual emptying of these platforms by end 2021. In this context, Proximus communicated on December 12th 2019 to the BIPT a stop service of xDSL services on ISDN-BA as from December 31st 2021, which was approved by the BIPT on February 6th 2020.

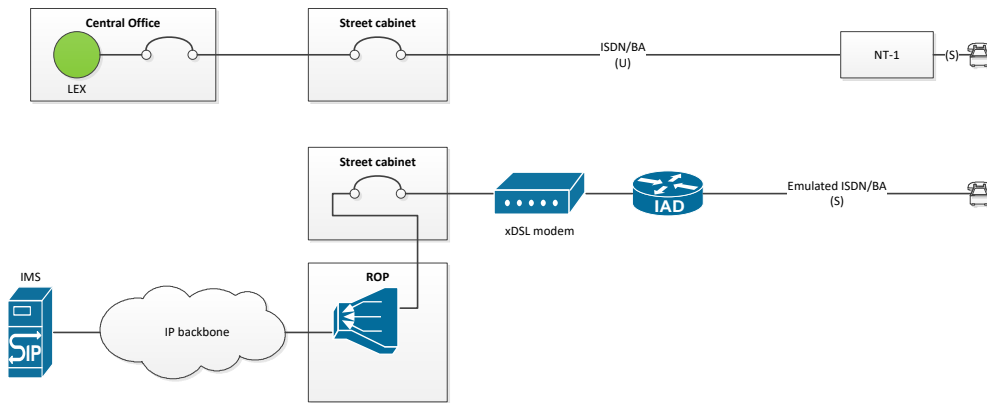


Figure 5: ISDN over IAD solution

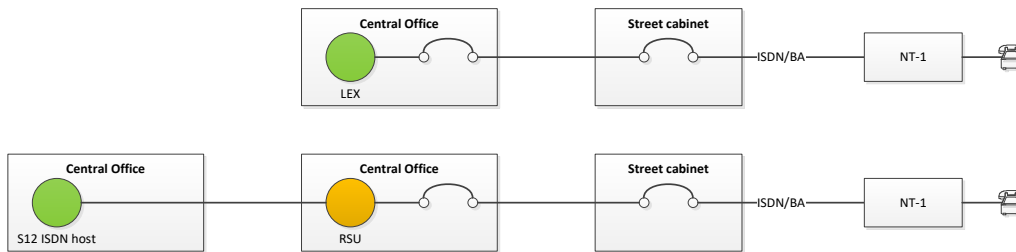


Figure 6: ISDN/BA on S12 ISDN host via Remote Switching Unit

- ISDN-PRAs that were not replaced timely with another commercial offering have been migrated without needing a technical intervention at the customer’s premises to a MGW-solution (Media Gateway) which is controlled by an IMS platform and became available in 2015.

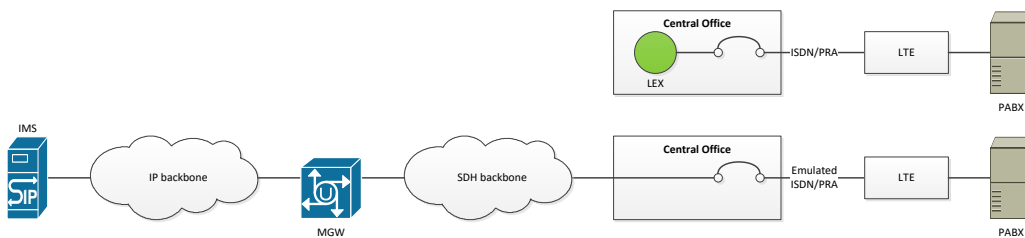


Figure 7: ISDN/PRA via Media Gateway

- ISDN emulation via IAD (Integrated Access Device) as a replacement for traditional ISDN-PRA services is under development and is planned to be available in the course of 2020. These IAD-30s are installed at the end-user & connected between the Ethernet interface of a broadband service and the end-user ISDN-PABX and are controlled by an IMS platform. This solution must be implemented for ISDN-PRAs that cannot be replaced timely with another commercial offering as a prerequisite for the SDH outphasing.
- Proximus undertakes to keep CPS and CS available to alternative operators for the above-mentioned solutions. In case the underlying classic PSTN, ISDN and PRA technology disappears for the end-user because of the evolution of the Proximus network infrastructure or because of

the Proximus-initiated migration to Voice over Broadband technology, CPS and CS are not supported anymore. Proximus plans to completely stop the CS and CPS services at 31 December 2022 at the latest and will inform the alternative operators 6 months in advance of the final stop service date. The conditions determining a potential earlier stop of CS and CPS are described in the reference offer.

A gradual migration towards voice over broadband services will further reduce the use of PSTN services emulated via Access Gateway (AGW) and the long term replacement strategy of the Access Gateway will require forced migrations of remaining PSTN services as probably from 2020 onwards. Proximus started therefore in 2017 with the delivery in its packs with voice of IP Phone lines instead of emulated PSTN. Note that CPS and CS services are not supported on IP Phone lines.

Impact on BRIO and BROTSoLLIC links:

BRIO local voice services (local Terminating and local Collecting) have been fully outphased since end 2017.

A TDM MGW solution (Media Gateway) was launched in 2015.

BRIO aggregated voice services (aggregated interconnect level) have been fully migrated in 2016 and 2017 without changes of the interconnect links (OIT) as Proximus reconnected the existing interconnect links on the TDM MGW solution.

As – except remaining legacy ISDN-BA-lines - the complete legacy voice network has been migrated to an IMS based infrastructure since end-2017, the current TDM interconnection model between Proximus and third party operators is evolving to an IP Interconnect model.

Therefore an IP interconnection solution has been developed. The gradual migration from TDM to IP interconnection started in 2018 aiming at closing the TDM interconnection afterwards. Proximus foresees to have TDM interconnection outphased in the course of 2022 in order to enable the SDH outphasing by the end of 2023. Voice TDM interconnection lines will at least be sold until end of 2021.

6. Building Outphasing

The Building Outphasing is an essential component of the Proximus Mantra Program. **A list of 65 buildings was initially identified** for closure between 2012 and 2021, and communicated to the market. In this initial plan, some large buildings were excluded, due to their technical complexity. The building outphasing plan has now evolved to a lower number of buildings, but puts more focus on the large buildings.

The table 2 below summarizes the current building outphasing planning of the “Mantra” program in the period 2012-2020. **This planning is only indicative and still subject to changes.** Upon OLO request, we have added a column giving the information whether – according to current planning and expectations - a mini-MDF will be present or not.

The table 3 below summarizes the current building outphasing planning of the first phase of the “Mantra+” program which includes a pilot of 10 local nets and phase 1 with 64 local nets from which the main building will be emptied and includes the changes notified on 19 December 2018⁴. The “Mantra+” concept does not accommodate for a mini-MDF solution so the column which indicates the presence of it has been removed.

Table 2: building outphasing planning of the Mantra program

End of Service Delivery	Local Net	Phase Out Year	Mini MDF	Address	Nr	City
30/06/2012	02EURO	2012	Y			
30/06/2014	02BRCO	2014	N			
30/06/2014	03WESO	2014	N			
30/06/2014	83CINO	2014	Y			
30/06/2015	02BOSO	2015	Y			
30/06/2015	02HALO	2015	N			
30/06/2015	55RONO	2015	N			
30/06/2015	87VERO	2015	Y			
16/12/2016	51ROEO	2016	N			
16/12/2016	67NIVO	2016	N			
30/06/2017	11HASO	2017	N			
09/10/2017	54NINO	2017	N			
09/10/2017	56KORO	2017	N			

⁴ Early January 2019 an erratum was sent to the BIPT and the wholesale customers to correct the End of Service Delivery date of 03DEUO, being 30/06/2021.

End of Service Delivery	Local Net	Phase Out Year	Mini MDF	Address	Nr	City
31/07/2018	14HERO	2018	N			
31/07/2018	80ST10	2018	N			
31/07/2018	03SILO	2018	N			
30/06/2019	65MONO	2019	N			
30/06/2019	02STRO	2019	N			
30/06/2019	03CENO	2019	N			
30/06/2020	91GKK	2020	⁵	Keizer Karelstraat	1	GENT
30/06/2020	03BERO	2020	N	Uitbreidingsstraat	325	BERCHEM
30/06/2021	03DEUO	2021	N	Terheydelaan	221-223	DEURNE

Table 3: building outphasing planning of the Mantra+ program

End of Service Delivery	Local Net	Phase Out Year	Address, Nr	City
30/06/2019	02KORO	2019		
30/06/2019	03KIEO	2019		
30/06/2019	53HAAO	2019		
30/06/2019	71ACOO	2019		
30/06/2019	71MOUO	2019		
30/06/2019	71WALO	2019		
30/06/2019	81FLOO	2019		
30/06/2019	91BASO	2019		
30/06/2019	91LANO	2019		
31/12/2019	02HOEO	2019		
30/06/2020	11HELO	2020	Kleine Heresteeg, 83	HOUTHALEN
30/06/2021	13LUMO	2021	Past. Frederickxstraat, 13	LUMMEN

⁵ Not applicable: the building 91GKK is a Service Node.

End of Service Delivery	Local Net	Phase Out Year	Address, Nr	City
30/06/2020	53LEDO	2020	Ommeganglaan, 79	LEDE
30/06/2020	81CHAO	2020	Chaussée de Louvain, 544	CHAMPION
31/03/2023	10JODO	2023	Avenue des Combattants, 18	JODOIGNE
30/06/2021	60CHIO	2021	Rue Reine Astrid, 5	CHIMAY
30/06/2021	91GAVO	2021	Stationsstraat 180	ASPER
30/12/2022	11ZOUO	2022	Nieuwstraat, 32	ZOUTLEEUW
30/09/2021	12RIEO	2021	Tongersesteenweg, 15	RIEMST
30/09/2021	16VERO	2021	Stationstraat, 87	VERTRIJK
31/12/2022	11GELO	2022	Steenweg, 81	KLEIN GELMEN
30/12/2022	50DUDO	2022	Herdersbruggestraat 2	DUDZELE
31/12/2022	55MUNO	2022	Heufkensstraat, 143	MUNKZWALM
31/12/2021	59EERO	2021	Westkerkestraat 30A	EERNEGEM
31/12/2021	57IEPO	2021	Vooruitgangsstraat, 1	IEPER
31/12/2022	87NESO	2022	Rue Franklin Roosevelt	FRAIPONT
28/02/2022	02GRIO	2022	Wolvertemsesteenweg 279	GRIMBERGEN
28/02/2022	03BOOO	2022	Antwerpsestraat, 97	BOOM
28/02/2022	84MARO	2022	Rue des Brasseurs, 8	MARCHE-EN-FAMENNE
31/03/2023	03JOB0	2023	Brugstraat, 137	ST JOB IN'T GOOR
31/03/2023	84RENO	2023	Route de Laroche, 1	RENDEUX
31/12/2023	81JAMO	2023	Rue d'Enhaive, 20	JAMBES
30/06/2022	52DENO	2022	Noordlaan, 25	DENDERMONDE
30/06/2023	10COUO	2023	Av. des Prisonniers de Guerre, 4	COURT SAINT ETIENNE
31/12/2023	02RODO	2023	Zoniënwoodlaan, 340	RHODE ST GENESE
30/09/2023	55KLUO	2023	Kontrijnstraat 44	BERCHEM
31/12/2023	65HAUO	2023	Place d'Hautrage, 7	HAUTRAGE
01/10/2023	69BLEO	2023	Rue Wilbaut Bouchart, 2	BLEHARIES
30/09/2023	87JALO	2023	Chafour (route d'état n°629)	JALHAY

End of Service Delivery	Local Net	Phase Out Year	Address, Nr	City
30/09/2023	89ASSO	2023	Kerkhofstraat, 2	AS
31/12/2023	03BOEO	2023	Boechoutsesteenweg, 171-173	HOVE
30/06/2023	82DINO	2023	Rue Bribosia, 9	DINANT
31/12/2023	16WMBO	2023	Steenweg op Ramsel, 25	WESTMEERBEEK
30/06/2023	68BRUO	2023	Rue Notre Dame	CAMBRON-CASTEAU
31/12/2023	81FAUO	2023	Rue de Croquet, 187	FAULX-LES-TOMBES
31/12/2023	81GRLO	2023	Rue de la Converterie, 10	GRAND-LEEZ
30/06/2023	41ANSO	2023	Rue Delvaux, 22-26	ANS
31/12/2023	69TOUO	2023	Rue Tête d'Or, 9-11	TOURNAI
30/09/2023	03SHOO	2023	Villerslei, 107	SCHOTEN
31/03/2024	03WOMO	2024	Jacobsveldweg, 15	WOMMELGEM
31/03/2024	65GIVO	2024	Ch. de Beaumont (entre 61 et 65)	GIVRY
31/03/2024	84ORTO	2024	Ortho, 23	ORTHO
31/03/2024	91WONO	2024	Zeeschipstraat 209	WONDELGEM
31/05/2024	03HOOO	2024	Gammel, 110	RIJKEVORSEL
30/06/2023	64LALO	2023	Rue de la Concorde, 17	LA LOUVIERE
30/06/2023	58KOKO	2023	Koninklijke Baan 81	KOKSIJDE
30/06/2023	91DEUO	2023	Kortrijksesteenweg 285	ST.-MARTENS LATEM
30/06/2024	71NALO	2024	Rue du Dépôt, 51	NALINNES
30/06/2023	91ZOTO	2023	Meerlaan 54	ZOTTEGEM
30/06/2024	41ENGO	2024	Rue Maréchal Foch, 2	ENGIS
30/09/2023	50TORO	2023	Aartrijkestraat 4	TORHOUT
30/09/2023	68GHIO	2023	Pavé d'Ath 144	HELLEBECQ
30/09/2023	71SOLO	2023	Rue Emile Vandervelde, 2A	SOLRE SUR SAMBRE
30/09/2023	80VIEO	2023	Rue de l'Hôtel de Ville, 7	VIELSALM
31/03/2024	11LOMO	2024	Einderpad, 43	LOMMEL
31/12/2023	14TIEO	2023	Tielendorp, 58	TIELEN

End of Service Delivery	Local Net	Phase Out Year	Address, Nr	City
31/12/2023	15RYMO	2023	Kruisstraat, 22	RIJMENAM
31/12/2023	54GERO	2023	Lessensestraat 105	GERAARDSBERGEN
31/12/2023	59MIDO	2023	Koninginnelaan 125	MIDDELKERKE
30/06/2022	81GEMO	2022	Rue Monseigneur Heylen, 9	GEMBLOUX
28/02/2024	41JUPO	2024	Rue de Visé, 360	JUPILLE
28/02/2024	71CHTO	2024	Allée de la Sambre, 2	CHATELINEAU
30/06/2024	91AALO	2024	Brug-Zuid 2	AALTER
30/06/2024	91EEKO	2024	Euerardstraat 39	EEKLO

Note that those dates are end of services delivery dates for **all** lines; which of course requires a progressive migration to get them all migrated in due time. Building outphasing automatically implies that the outphasing of legacy ISDN lines is performed simultaneously or beforehand.

Impact on co-location and LLU services:

- The first general rule is that the MDF and the copper feeding network are out-phased completely. In this standard case, co-location (including co-mingling) and LLU services are no more possible.
- In four local nets ⁶ a new Mini-MDF function was created to serve a *limited* number of customers who remain connected on copper pairs. For this limited number of lines, LLU remains possible. Proximus communicated to the Operators the list of Street Cabinets (KVDs) and Direct Feeds eligible for connection to the Mini-MDF in these specific LEXs.

In all cases the MDF of the current buildings, that are or will be sold, will have to be freed up completely.

Impact of the outphasing of the Ethernet Service PoPs 03CENO and 91GKKO

- These Service PoPs serve as a connection point for Proximus sited OLO Access Lines to collect Bitstream xDSL traffic and Proximus sited Aggregation Point Access Lines to collect NGLL traffic.
- These Service Nodes moved to neighbouring villages:
 - 03CEN (“Antwerpen-Centrum”) moved to 03WOM (“Wommelgem”);
 - 91GKK (“Gent – Keizer Karel”) moved to 91WON (“Wondelgem”).

Colocation is available in both new Service Nodes and Proximus developed in 2017 the “Distant Intro offer” which allows to reconnect Proximus sited OLO Access Lines and Aggregation Point Access Lines (OAL &

⁶ For current status: see column “Mini-MDF” in Table 2. The Mini-MDF function will not be created for Mantra+-buildings.

APAL) from these moved Service PoPs for OLOs who had not yet the possibility to order Proximus sited OAL/APAL ports from O3WOM and/or 91WON due to the absence of OLO-fiber there.

Impact of the outphasing of the building in the local net O2STRO

- The Ethernet Service PoP O2STR remains in service.

Impact of the outphasing of buildings with an Area Access Point (AAP)

- Operators who want to keep the TDM voice interconnection solution will be offered the possibility to introduce the impacted interconnection links via an Area Access Point in a different Area.

Impact on other OLO services:

- The following services will have to be migrated to alternative solutions before the end of service delivery date of the outphased building where they are currently in service:

Table 4: Services to be migrated to alternative solutions.

Product type
Co-location and co-mingling in current buildings
Explore EFM (or E-line EFM or NGLL EFM)
Explore ISDN back-up ^(a)
Analogue Leased Lines ^(b)
Digital Leased Lines less than 2 Mbit/s ^(b)
BRIO extra area half links (analogue and less than 2 Mbit/s) ^(b)
BrotsoLL Digital Leased Lines (less than 2 Mbit/s) ^(b)
BRUO (RC and SP) ^(c)
BROBA ADSL(2+) with voice ISDN ^(d)
BROBA Re-ADSL (possible from the ROP from 1/2/2018 onwards)
BROBA SDSL ^(e)
Carrier ADSL(2+) with voice ISDN ^(d)
Carrier Re-ADSL (possible from the ROP from 1/2/2018 onwards)
Carrier SDSL ^(e)
Explore ADSL(2+) with voice ISDN ^(d)

Explore SDSL (e)

- (a) A gradual “Stop Service” by end 2021 is planned for legacy ISDN-2 subscriber lines.
 - (b) Analogue- and less than 2 Mbit/s Leased Lines are in Stop service since end 2019.
 - (c) Not applicable in copper zones for OLOs with a valid contract for co-mingling in the new Atropos room.
 - (d) The ISDN-part of ADSL(2+) with voice ISDN services will be migrated to ISDN over IP by March 2020 at the latest.
 - (e) A gradual “Stop Service” by 1 July 2020 is planned for the SDSL services.
- As mentioned in different chapters higher in this document and in the footnotes of Table 4, certain Product types are or will be the subject of a global outphasing with “Stop service” dates that might precede notified “end of service delivery dates” of outphased buildings.
 - For services with ADSL and ADSL2+ access, like Bitstream ADSL & ADSL2+, Carrier ADSL & ADSL2+, and Explore ADSL & ADSL2+ a new technical solution is available (see above section 3.5 “ROP-based ADSL(2+)”) but it is recommended to migrate to VDSL2 where possible and mandatory to migrate to VDSL2 for homogenizable ROPs.
 - The technological migration of current ISDN-BA services to ISDN via IAD services will change the configuration of an OLO Broadband⁷ with ISDN-BA voice service to OLO Broadband without voice.

In order to avoid newly installed services to be migrated shortly later, Proximus sends yearly to each Wholesale customer a notice of “**Stop sell**” pursuant to the information delays contractually specified. Similarly, for each outphased building, Proximus will send to each Wholesale customer present in the concerned local net a **notice of service suspension** (“Stop Service”) pursuant to the information delays contractually specified for each impacted service, as well as a list of circuits impacted and of possible service alternatives.

⁷ OLO Broadband = Carrier xDSL, BRUO, Bitstream xDSL service.

7. Copper outphasing

Proximus' goal is to fully outphase the copper network (feeding and distribution) in the areas (fiberhoods) where FTTH is deployed. **All services provisioned on copper** will have to be migrated to alternative solutions (cfr. table 5) before the end of service delivery date of the fiberhood where they are currently in service.

The table 6 summarizes the current copper outphasing planning until 2024. **This planning is only indicative and still subject to changes.** Note that no copper outphasing is foreseen in FTTB⁸ zones.

Table 5: Services to be migrated to alternative solutions mainly include:

Product type
Explore EFM (or E-line EFM or NGLL EFM)
Explore ISDN back-up ^(a)
Analogue Leased Lines ^(b)
Digital Leased Lines ^(b)
BRIO extra area half links (analogue and less than 2 Mbit/s) ^(b)
BROTSoLL Digital Leased Lines ^(b)
BRUO (RC and SP)
Bitstream ADSL(2+)
Bitstream Re-ADSL
Bitstream SDSL ^(c)
Bitstream VDSL2
Carrier ADSL(2+)
Carrier Re-ADSL
Carrier SDSL ^(c)
Carrier VDSL2

⁸ FTTB = Fiber to the Business: industrial zones and buildings with a high concentration of business customers.

Wholesale Internet VDSL2
Explore ADSL(2+)
Explore SDSL (°)
Explore VDSL
PSTN on AGW
Legacy ISDN BA (°)
Legacy ISDN-30

(°) A gradual "Stop Service" by end 2021 is planned for legacy ISDN-2 subscriber lines.

(°) Analogue- and less than 2 Mbit/s Leased Lines are in Stop service since end 2019.

(°) A gradual "Stop Service" by 1 July 2020 is planned for the SDSL services.

Table 6: Copper outphasing planning

End of Service Delivery	Fiberhood
31/03/2022	W00-C-Anspach-FH01
31/03/2022	W00-C-Anspach-FH02
31/03/2022	W00-C-Anspach-FH03
30/06/2022	W01-C-Deurne-FH04
30/06/2022	W01-C-Gent-FH03
30/06/2022	W01-C-Charleroi-FH01
31/12/2022	W01-C-Deurne-FH03
31/12/2022	W01-C-Gent-FH04
31/12/2022	W01-C-Gent-FH07
31/12/2022	W01-C-Charleroi-FH03
31/12/2022	W01-C-Namur-FH06
31/12/2022	W02-D-Diamant-FH01
31/12/2022	W02-D-Liege-FH02
31/12/2022	W02-D-Hasselt-FH03
30/06/2023	W01-C-Gent-FH06
30/06/2023	W01-C-Gent-FH09
30/06/2023	W01-C-Gent-FH11
30/06/2023	W02-D-Liege-FH01
31/12/2023	W01-C-Deurne-FH06
31/12/2023	W01-C-Deurne-FH07
31/12/2023	W01-C-Deurne-FH08
31/12/2023	W01-C-Deurne-FH09
31/12/2023	W01-C-Gent-FH08

31/12/2023	W01-C-Gent-FH10
31/12/2023	W01-C-Gent-FH12
31/12/2023	W01-C-Roeselare-FH04
31/12/2023	W01-C-Charleroi-FH04
31/12/2023	W01-C-Charleroi-FH05
31/12/2023	W01-C-Namur-FH07
31/12/2023	W02-D-Liege-FH03
31/12/2023	W02-D-Hasselt-FH01
30/06/2024	W01-C-Deurne-FH10
30/06/2024	W01-C-Deurne-FH11
30/06/2024	W01-C-Gent-FH14
30/06/2024	W01-C-Gent-FH15
30/06/2024	W01-C-Roeselare-FH05
30/06/2024	W02-D-Evere-FH01
30/06/2024	W02-D-Leuven-FH01
30/06/2024	W03-C-Liege-FH04
30/06/2024	W03-C-Aalst-FH01

As mentioned in different chapters higher in this document and in the footnotes of Table 5, certain product types are or will be the subject of a global outphasing with “Stop service” dates that might precede notified “end of service delivery dates” in fiberhoods.

In order to avoid newly installed services to be migrated shortly later, Proximus sends yearly to each Wholesale customer a notice of “**Stop sell**” pursuant to the information delays contractually specified. A change of this “Stop sell” approach is currently under investigation and will be communicated timely when decided. Similarly, for each fiberhood, Proximus will send to each Wholesale customer present in the concerned fiberhood a **notice of service suspension** (“Stop Service”) pursuant to the information delays contractually specified for each impacted service, as well as a list of circuits impacted and of possible service alternatives.

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