Body of European Regulators for Electronic Communications

BEREC

BoR (19) 236

BEREC summary report on the outcome of an internal workshop on “Migration from legacy infrastructures to fibre-based networks”

5 December, 2019

Contents

Introduction

The roll-out of NGA networks, in particular of FTTH, results increasingly in situations in which the legacy copper network infrastructure becomes redundant and incumbent operators may want to de-commission this legacy network infrastructure. In this case, wholesale customers may have to be migrated from copper unbundling or DSL bitstream to other NGA wholesale access products (e.g. duct access, fibre unbundling, VULA or even to solutions based on FWA/mobile technology fulfilling NGA requirements). Rules for such a migration are provided for in the European Commission's recommendation on Next Generation Access (NGA) of 2010[1] (Art. 39 - 41) and also in the BEREC Common Positions on best practices in remedies on Markets 3a, 3b and 4 (within the competitive objective "Assurance of efficient migration processes from legacy to NGN/NGA network"), which were published in 2012.[2] In the future, NRAs also have to comply with the provisions for such a migration in the new European Electronic Communications Code (Art. 81).

This report summarizes country case presentations from Italy, Portugal, Spain, Norway and Sweden on migration from legacy infrastructure to fibre-based networks held at an internal workshop of the BEREC Fixed network Evolution working group on 4 September 2019 in Brussels. It also includes information on Estonia which is based on answers to a questionnaire. The purpose of the workshop was to better understand where these countries stand with regard to the migration from legacy infrastructures to fibre-based networks.

In light of the existing and future rules (see above) the presentations during the workshop addressed inter alia the following elements:

- which part(s) of the legacy access infrastructure the SMP operator wants to de-commission (e.g. the MDF location);
- the framework for the migration from copper to fibre-based access networks;
- the notice period including the factors (e.g. availability of alternatives) that were taken into account when it was set;
- the information on network modifications (e.g. de-commissioning MDFs) the SMP operator has to provide;
- how long the existing obligations remain in place;
- the procedures used by the NRA to establish the rules for the migration; and
- the stakeholders involved (e.g. alternative operators, associations, consumer organisations) and how they were involved (e.g. workshops, public consultation).

It is structured along a questionnaire which can be found in the Annex of this report to allow for some comparisons across countries.

The presentations were focused on the migration to fibre-based networks and did not consider the migration from traditional telephony network to NGN in general, which BEREC already analysed in two reports (BoR (15) 196, BoR (16) 163), and also not the migration from leased lines with traditional interfaces to Ethernet-based leased lines in general.

[1] European Commission's recommendation of 20 September 2010 on regulated access to Next Generation Access Networks (NGA) (2010/572/EU)
[2] BoR (12) 127, BoR (12) 128, and BoR (12) 126

1. Estonia (ECPTRA)

1.1. Context of migration in Estonia

423 633 subscribers were active on fixed broadband networks by the middle of 2019 and 93% of them are covered by three main competitors:

1) Telia Eesti AS - 223 482 active subscribers, around 2/3 of the access network is optic and 1/3 is copper and Telia is main service provider in copper access network (99% of active subscribers of copper access network);

2) Elisa Teleteenused AS - 120 450 active subscribers, transmission network is optic and access network is mainly coaxial (Docsis 3);

3) STV AS - 45 963 active subscribers, around 1/2 of access network is optic and 1/2 is coaxial (Docsis 3).

Telia is determined as undertaking with SMP in market 3a and 3b. In market 3a is only around 1000 active copper lines and less than 10 active fibre lines. In market 3b is only around 150 active connections.

Telia launched the VDSL vectoring migration project in 2018. Telia hopes to update all remaining copper lines to VDSL vectoring to end of 2023. Some rural areas with long copper lines will be migrated to mobile broadband solutions.

In 2019 a state aid program was launched aiming to build an access network with 40 000 optical lines in rural (white) areas by the end of 2023. The access network must be connected with opened transmission network and allow access at least five operators. Public tender winner[3] is Elektrilevi OÜ.

In the period between 2009 – 2019 an optical transmission network of 6000 km has been rolled out in rural areas allowing open access with public funding (EstWin project[4]) by the Estonian Broadband Development Foundation.

1.2. Current status of migration and planned migration

Type of MDFs which are closed and planned migration

NRA does not collect this information.

[3] https://www.elektrilevi.ee/en/kiireinternet
[4] https://ec.europa.eu/digital-single-market/en/country-information-estonia

Number of MDFs migrated

NRA does not collect this information. According to WIK (source Telia) 70% of copper exchanges at the end of 2018.

Type of access network to which subscribers are migrated

Subscribers of Telia's copper access network are migrated to FTTH, FTTB and VDSL2+Vectoring+Profile35b[5].

1.3. Framework for the migration process

Timetable and notice period

No special timetable, but the migration process may not be shorter than 6 months from notice given by SMP operator. The SMP operator must provide other regulated wholesale services in market 3a and 3b (ducts, unbundled fibre, shared fibre and bitstream).

Available alternative wholesale access products

Not any special wholesale access product. Access products imposed on SMP operator on markets 3a and 3b are ducts, unbundled fibre, shared fibre and bitstream.

Legacy wholesale access products that need to be migrated

Unbundled copper access; it has to remain in place no shorter than 6 months after notice is given by the SMP operator.

Available information for alternative network operators and end-users

No special information defined.

Other relevant conditions

No other conditions.

[5] https://en.wikipedia.org/wiki/VDSL#Vplus/35b

1.4. Procedures used by NRAs to establish the framework for the migration process

Type of procedure

No special procedures.

Stakeholder involvement

Migration process is managed by Telia, NRA comes in if disputes arise.

1.5. Further relevant aspects

Only about 1000 lines of copper-based wholesale products on market 3a (copper ULL). Therefore, the migration process affects only less than 1% active subscribers.

The NRA dealt with a dispute between Telia and Elisa from 2018 to 2019. Elisa complained that Telia discriminates Elisa with regard to the vectoring migration process compared to Telia's retail unit. Elisa withdrew their dispute application in 23.10.2019.

2. Italy (AGCOM)

2.1. Context of migration in Italy

The Italian incumbent operator in fixed markets, TIM, proposed a Plan for the decommissioning (switch-off of the legacy network) of Local Exchanges (LEXs). The Plan was published in May 2017 and then updated in August 2018.

The main reason justifying the Plan comes from the efficiency gain that can be reached reducing the number of active local exchanges (from about 10.000 to 4.000), reducing the cost of co-location, increasing the network efficiency and exploiting the convergence between data and voice services.

From the perspective of the market, the decommissioning of local exchanges has also a beneficial impact on the adoption of ultra-broadband services, as it leads to the migration of customers (at retail and wholesale levels) toward NGA-based solutions, pushing toward the achievement of the Digital Agenda objectives.

There are three different migration scenarios:

(i) Aggregation of local exchanges – where a cabinet area is connected to a different LEX and the previous LEX is switched off;

(ii) Switch-off of the primary network – copper cables (and services) from the LEX to the Cab are gradually switched-off with the migration of copper services to FTTC services;
(iii) Switch-off of the local network – copper cables (and services) from the LEX to the end-user are gradually switched off with the migration to FTTH services;

While scenarios (ii) and (iii) will lead to the switch-off of the legacy network as a natural and gradual evolution of the market, the first scenario, being characterised by more constrained deadlines, may have relevant impact on competition and, then, is subject to regulatory conditions.

2.2. Current status of migration and planned migration

Type of MDFs which are closed

As of today, no MDF have been closed.

TIM is on the way to communicate the first set of LEXs where the regulatory conditions to start the decommissioning have been reached (see Section 1.3).

Number of MDFs migrated

As of today, no MDF have been closed.

Type of access network to which subscribers are migrated

The plan is to migrate subscribers in the majority of cases to FTTC with FWA as an exception, for a limited percentage of customers generally located in "*white areas*".

Planned migration

In **2023** 6,678 LEXs will be switched-off (**65%** of total 10,200 LEX), of which 2,684 (**26%** of total LEX) in "*white areas*", according to decommissioning plan from TIM.

These are mainly small LEXs (comparatively low number of copper lines) that are planned to be migrated primarily according to scenario (i) (see 1.1).

2.3. Framework for the migration process

Timetable and notice period

Announcement of LEX switch-off is only possible if TIM reached:

- 100% NGA coverage (incl. FWA if necessary) and
- 60% of NGA retail take-up

Then LEX can be switched-off after:

- 24 months in white areas
- 18 months in areas with copper LLU, copper SLU and VULA
- 12 months in areas with only bitstream

The migration itself must be completed within 12 months. After the announced periods above, customer lines can be forcibly migrated to NGA after three months' prior notification to the customer.

In the majority of LEXs under switch-off, OAOs prefer service-based competition, based on bitstream wholesale services.

Available alternative wholesale access products

A wholesale service substitution matrix identifying for each wholesale legacy service the corresponding wholesale fiber-based service has been proposed and it is currently under trial phase.

The main wholesale services available on the new network are VULA, bitstream (in most cases based on FTTC) and SLU.

The Point of Handover (PoH) of copper bitstream is currently regional or national, but no local (at MDF location), therefore, no change of PoH is envisaged for bitstream services in the migration process.

Instead, Local PoH of LLU needs to be migrated to "neighbouring" MDF, whereas SLU service is not affected by the migration process.

Legacy wholesale access products that need to be migrated

LLU, Shared Access, WLR, CS/CPS, analogue leased lines and DSL copper bitstream will be not more available on the new MDFs and will be substituted following the wholesale matrix. Only in marginal cases, where MSAN are adopted by TIM, some of these wholesale services (bitstream DSL, CS/CPS, WLR) will be still provided using service emulation.

Available information for alternative network operators and end-users

TIM must inform the NRA once a month about NGA coverage and take-up in LEXs where customers will migrate. Early announcements are due under regulated conditions (see answer to 1.3).

Other relevant conditions

Some incentives to migration have been set through pricing regulation:

- TIM covers one-off wholesale costs of migration costs
- TIM covers additional costs for decommissioning co-location
- During migration period 'new' WAP has same price as 'old' WAP
- In case of early migration price of 'new' WAP is the same of 'old' WAP

2.4. Procedures used by NRAs to establish the framework for the migration process

Type of procedure

The following proceedings have been carried out:

- Technical forum has been conducted by AGCOM with operators;
- Switch-off trial amongst operators has been approved for a duration of 6 months;
- Framework for the migration has been defined in the market analysis procedure.

Stakeholder involvement

The usual stakeholders as in the market analysis procedure have been involved through both a technical forum conducted by AGCOM with operators and a public consultation in the framework of market analysis procedure.

2.5. Further relevant aspects

In setting regulation, the main objectives considered by AGCOM have been: avoiding as much as possible forced migration of customers; need to preserve competition in the migration process and to avoid crowding out of public investments in "*white areas*".

3. Norway (NKOM)

3.1. Context of migration in Norway

The total number of PTN/ISDN connections has decreased from 1.25 million at the end of 2009 to 331.000 at the end of 20186. In the same period, the number of DSL based broadband connections has decreased from 1 million lines to 490.000 lines. The opex associated with the copper based access network has not declined on a par with the associated decline in

[6] www.ekomstatistikken.no

revenues. Hence, the migration process was initiated by Telenor primarily for commercial reasons. In the market communication from Telenor related to the migration, the need to modernize their fixed and mobile networks in Norway to provide a reliable, safe and high-speed network has been the focus.

3.2. Current status of migration and planned migration

Type of MDFs which are closed

Telenor's profit/loss considerations as well as minimum notification period imposed in SMP decisions for wholesale access have been the major factors in deciding which MDF's to close down when. The MDF's closed down so far are typically small and rural MDF's: There are typically no active wholesale lines, and the operating costs per active line are high due to a low number of subscribers per MDF with long access lines in areas where O&M personnel are not available locally.

There is no formal categorization of MDF's by rural/suburban/urban categories.

Number of MDFs migrated

Between 600 and 700 small MDFs, mostly in rural areas, have already been closed down – out of a total number of MDF's of approx 4,500. Few or none of those have been migrated to other fixed NGA platforms. The number of MDF's shown above includes RSS type nodes.

Some will be decommissioned and replaced by services based on mobile technology. The BTS may or may not be located on the MDF site to be decommissioned. Nkom is now preparing guidelines on which criteria service offerings based on mobile and FWA technologies have to fulfil to qualify as NGA services.

Type of access network to which subscribers are migrated

The plan of the SMP player Telenor is to close down all MDFs and replace the copper lines with different technologies as indicated below. For MDF's already closed down, NGA services are practically not present – which in some cases will be because FTTH deployment has taken place in the area. Both voice - and to some extent basic broadband services – are replaced by services based on mobile technology.

The Telenor retail customers affected by the copper network decommissioning will according to Telenor be migrated to FTTH/HFC, "home broadband mobile" (geo-locked, specific tariffs) or ordinary mobile broadband. FWA based solutions are currently not expected to be deployed as a substitute for connections which are deactivated because of MDF's being decommissioned.

Planned migration

Current plan is to decommission all MDF's by end of 2022, and due to the factors influencing the time plan as described above, the larger, urban MDF's are likely to be the last ones to be decommissioned.

Telenor made the announcement on the planned timetable in January 2019.

3.3. Framework for the migration process

Timetable and notice period

Draft decision (supplementary to SMP decisions I Markets 3a and 3b from Dec 2018) expected in Q4 2019.

Current regime (decision of Dec 2018):

- Nkom requires Telenor to give 3 years' notice of changes in its access network in cases that result in the loss of accesses used by access seekers. Nkom also requires that such notices should contain specific information.
- If Telenor in such cases offers the access buyer a relevant replacement product, 6 months' notice will be sufficient.

In locations/areas where no access to buyers has been granted, it is sufficient for Telenor to give 1 month notice with regards to changes in its access network.

Available alternative wholesale access products

Regulatory obligations with regard to substitute products will be assessed in conjunction with upcoming supplementary SMP decision. The NRA draft decision is planned in Q4 2019.

Legacy wholesale access products that need to be migrated

Legacy wholesale access products that need to be migrated are copper LLU, DSL based bitstream and wholesale telephony access[7]. SMP decisions impose an obligation to notify wholesale customers in a timely manner, cf. (4) a.

Available information for alternative network operators and end-users

Telenor has a self-interest in providing good information. Telenor has seen the need to improve information to customers and other interested parties in light of first reactions from

[7]Sector-specific regulation was repealed 1 January 2017

the public, authorities and politicians to Telenor's announcement of planned copper switch-off.

One core issue is: Do access seekers get equal and timely information about replacement products, e.g. fibre or mobile products, as compared to Telenor's own retail arm.

NRA draft decision expected in Q4 2019 may also include rules on how the SMP operator has to inform the alternative operators and end-users.

Other relevant conditions

There is no other legal/regulatory framework than the obligation to provide notification to affected access seeker according to SMP decisions in Markets 3a and 3b.

NRA supplementary draft decision expected Q4 2019 may also include new conditions.

3.4. Procedures used by NRAs to establish the framework for the migration process

Type of procedure

The migration process has been established unilaterally by Telenor – except for the notification requirements included in the SMP decisions in Markets 3a and 3b in Dec. 2018.

NRA is working on a supplementary SMP decision planned to be floated for consultation in Q4 2019. Steps already done:

- NRA has gathered information from access seekers and Telenor
- NRA has meetings with the stakeholders

Stakeholder involvement

The NRA and the ministry has not had any formal involvement in the migration process, except for the SMP process (see above) and questioning a lack of communication/transparency with regard to the detailed migration plan and substitutes to be offered.

Stakeholders have been involved through:

- Public consultation of the SMP decisions in Markets 3a and 3b.
- Bilateral meetings between the incumbent Telenor and county/municipality administrations.
- Workshops between Ministry of Post and Telecommunication, Nkom and Telenor.
- Industry workshops related to copper network upgrade with FTTC (this is no longer expected to materialize).

4. Portugal (ANACOM)

4.1. Context of migration in Portugal

While historically, broadband access in Portugal was mainly based on ADSL and cable the more recent data shows that the majority of the broadband access lines is based on fibre to the home.

At the end of the first half of 2019, optical fibre (FTTH) was the main form of fixed broadband Internet access (48.2% of access lines) amounting to 1.9 million access lines, accounting for the growth in the number of broadband access lines. In particular, from the end of first half of 2018 to the first half of 2019, optical fibre access increased 20.9% (+322 thousand accesses). Cable and ADSL accounted for 30.6% and 14% of fixed broadband Internet accesses, respectively. The weight of LTE at a fixed location was 7.2% of total accesses[8].

Given this positive trend on the expansion of coverage of NGA networks (FTTH and HFC), the relevance of traditional copper networks across the country has considerably been reduced in recent years, which is an incentive for the migration process.

Similarly, Portugal has experienced a steady decline on the third party demand for access to copper wholesale regulated offers. The broadband accesses that are still supported on the unbundling local loop offer and the bitstream access offer represent circa 1.5% of total broadband accesses.

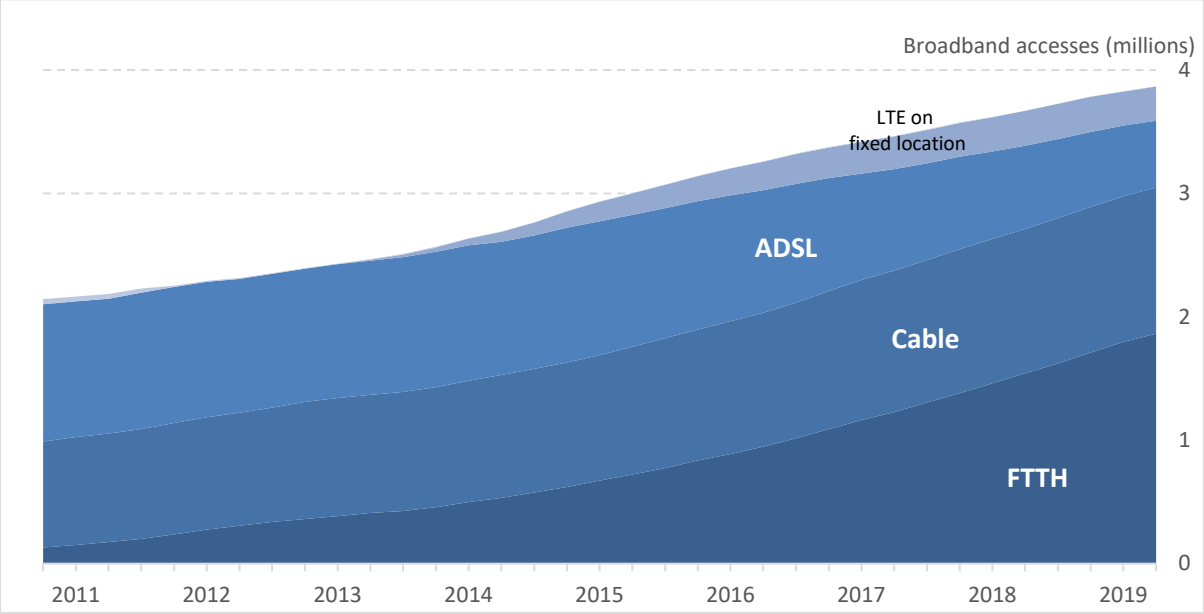

Figure 1 Evolution of the number of broadband accesses, by technology

[8] Source: https://www.anacom.pt/render.jsp?contentId=1483906

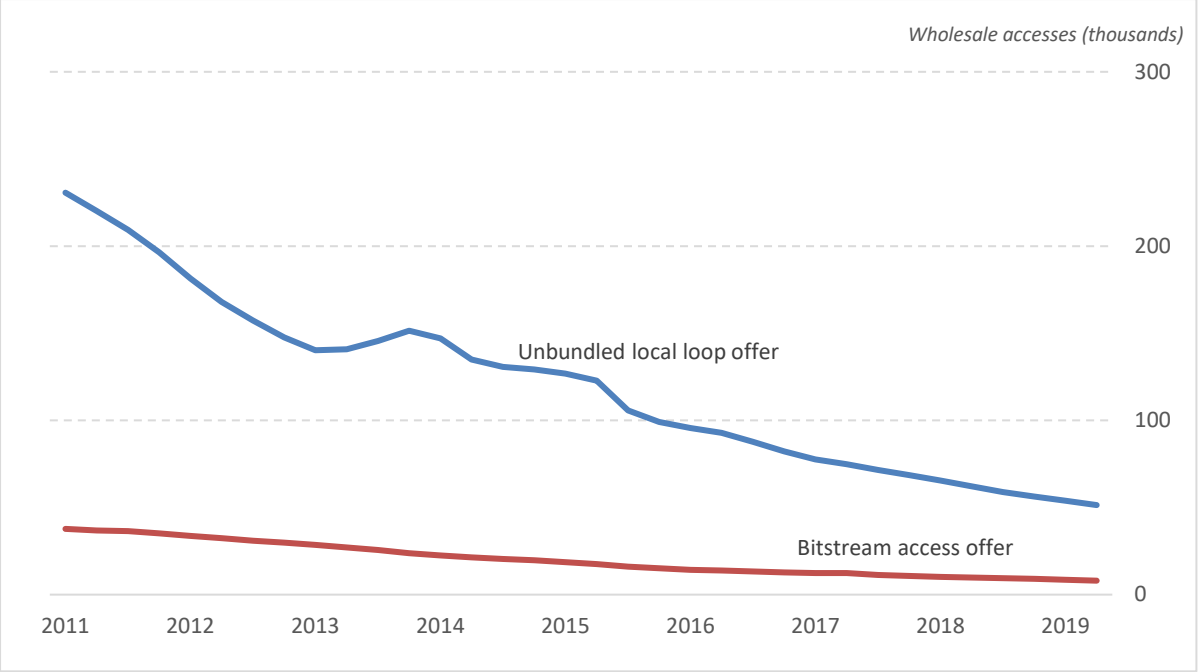

Figure 2 Access to copper wholesale regulated offers

A pilot project was set up by MEO (the incumbent operator) to test the MDF phase out process (6 MDFs were switched-off as of 30 June 2019). The pilot project has exposed some difficulties in the migration process.

Several incentives to the migration from copper to fibre have been identified, such as:

- Migration is a natural evolution, given the weight of FTTH/B subscriptions on fixed broadband in Portugal;
- Fiber will reduce operational costs, in particular those related to fault repair and energy. It will also increase occupation efficiency of ducts and poles.
- Migration will facilitate the sale of assets, including copper cables and central sites buildings
- Natural disasters, such as forest fires, can also act as a catalyst for migration. The tragic fires of 2017 in Portugal destroyed around 3.500 kilometres of communications copper and optical fibre cables burned. Such cables were entirely replaced by optical fibre cables.

4.2. Current status of migration and planned migration

Type of MDFs which are closed and number of MDFs migrated

6 MDFs have been phased out by the 30th June 2019.

Type of access network to which subscribers are migrated

Mostly FTTH, to some extent maybe cable or FWA.

4.3. Framework for the migration process

Timetable and notice period

As part of the timetable set by MEO, it was announced that 6 central sites for copper were switched-off on the 30th of June 2019 to test the process and gain experience.
At the moment, the remaining dates set in this timetable are confidential.

According to the 2017 market analysis procedure, the notice period is the following:

- **5-year** notice period for total switch-off of a MDF, a local exchange or an access point/connection with co-located operators
- **3-year** notice period if fully equivalent WBA is provided

Available alternative wholesale access products

Nothing defined by the NRA yet. This issue will be possibly revaluated in the next round of market analysis. No wholesale access was provided at the 6 MDF that were switched-off.

Legacy wholesale access products that need to be migrated

Only 15% of broadband access lines are still copper-based. Less than 2% of broadband access lines are based on LLU and wholesale bitstream offers.

Available information for alternative network operators and end-users

Nothing defined by the NRA yet.

Other relevant conditions

Nothing defined by the NRA yet.

4.4. Procedures used by NRAs to establish the framework for the migration process

Type of procedure

Current regime is based on market analysis procedure of 2017.

Stakeholder involvement

Migration process is managed by MEO and has to follow the rules foreseen under 2017 market analysis review (market 3a).

Further relevant aspects

Most of the access lines have already been migrated to NGA. MEO and alternative operators are investing in their own fibre network.

5. Spain (CNMC)

5.1. Context of migration in Spain

NGA deployment in Spain has been based on two access networks: FTTH and HFC. Other architectures (like FTTN) are not used for NGA. For this reason, copper lines have a bandwidth limit, given by ADSL2+ (VDSL2 presence is scarce). In order to achieve ultra-high speeds, customers have to change their access type from copper to either HFC or FTTH.

For several years now, there has been a steady growth in FTTH installed accesses, whereas HFC growth has been small. The same can be said about the number of active accesses for both categories. As of June 2018 FTTH coverage reached 77% of the population.

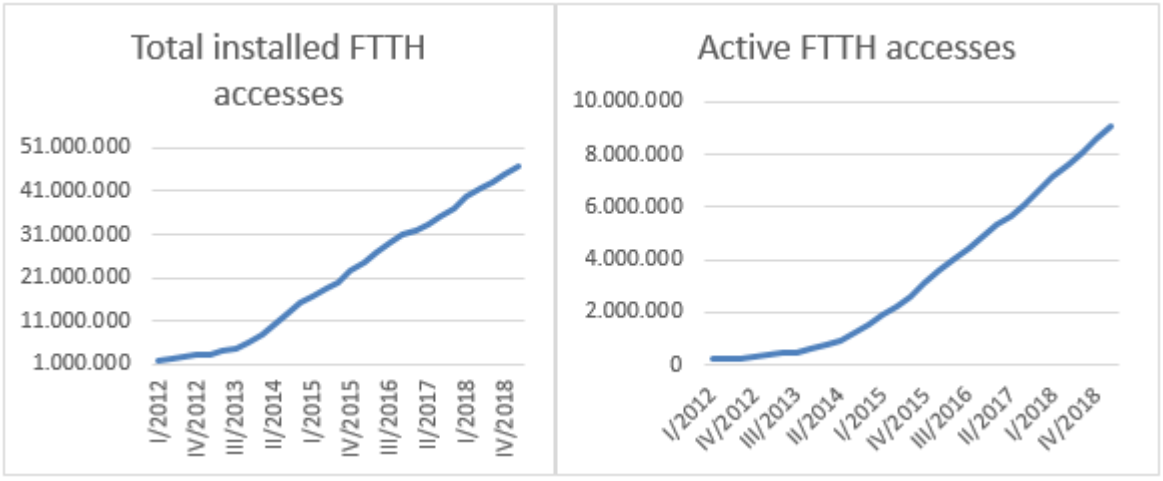

Figure 3 Evolution of FTTH

Several operators have deployed FTTH (via the duct access obligation of the incumbent operator) to a significant extent. This means that in broad areas, end users enjoy infrastructure competition and thus have access to several NGA networks, independent of the copper network of the incumbent.

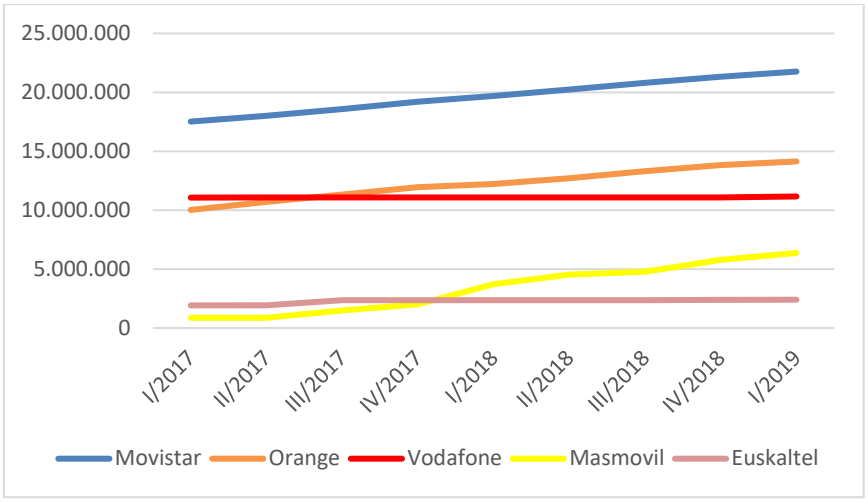

Figure 4 NGA deployment per operator

The result in the retail market has been a strong decline in the usage of copper lines (peak-copper was 2014), substituted by FTTH. Users migrating from copper to a NGA access can choose (depending on the area) between a HFC network, a FTTH network from the incumbent, a FTTH network from an alternative operator or a wholesale FTTH connection (VULA or enhanced bitstream).

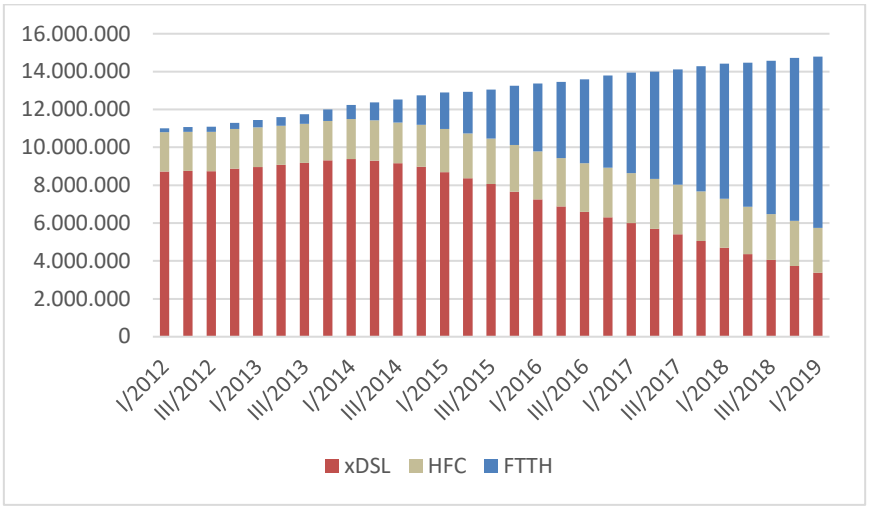

Figure 5 Broadband access evolution

The consequence is that there are several NGA networks, in overlay over the incumbent´s copper network, and this copper network is no longer competitive (shown by its decreasing usage), given the internet speeds (from 100 to 1000 Mb/s) and the services (UHD IPTV) offered over NGA. The incumbent has therefore an interest in foreclosing copper exchanges, in order to decrease costs. These copper exchanges are no longer the basis for broadband competition.

Closing an exchange means thus that the copper accesses from that MDF are no longer subject to access obligations, and neither the incumbent nor other operators can use its copper lines.

5.2. Current status of migration and planned migration

Type of MDFs which are closed

There is a list of exchanges which are notified to be closed, a part of them has already been closed (as the notice period expired). This list of exchanges to be closed grows steadily, as new exchanges are notified.

Currently, the notified exchanges are spread between all categories, from very small with only hundreds of lines to very big with tens of thousands of lines. Most of them though are smaller exchanges, with hundreds or a few thousands of lines. The notified exchanges are located in all kinds of municipalities, from small (hundreds of inhabitants) to big cities, most of them being in middle-sized municipalities.

Number of MDFs migrated

As of today there are 1614 notified exchanges to be closed (ca. 18% of total). End of 2019, 402 of them will be already closed (ca. 5% of total). The first closure involved 2 exchanges, end 2015.

Type of access network to which subscribers are migrated

As described, users migrate to NGA networks, which can be HFC or FTTH. Due to its extent, most users migrate to FTTH. In some rare cases, where NGA deployment cannot be achieved, users are migrated to radio access.

Planned migration

As of today there are 1614 notified exchanges to be closed (list grows steadily). All of them will be closed 2025 (after the notice period). Telefónica plans full fibre coverage before 2025, so presumably new exchanges will continue to be notified for closure in the next years.

5.3. Framework for the migration process

Timetable and notice period

Exchange closure refers only to close down use of copper access (including ancillary services to copper access, such as collocation).

All rules apply for closing a complete exchange (i.e., all copper lines of its MDF), partial closure is not part of the general procedure of exchange closure.

Telefónica notifies each exchange closure to operators and CNMC.

The notice period depends on the wholesale services of the exchange: **5 years** if ULL, **1 year** if bitstream, **6 months** if no wholesale. During this time full access obligations apply. The incumbent has the possibility to negotiate shorter periods with ULL operators.

After notice period:

- 6 months guard period
- No new customers allowed
- Customers still on copper must migrate

After guard period:

- No customers allowed on copper (for any operator)
- Dismantling of equipment can begin

Available alternative wholesale access products

Users migrating from copper to a NGA access can choose (depending on the area) between a HFC network, a FTTH network from the incumbent, a FTTH network from an alternative operator or a wholesale FTTH connection (L2WAP: VULA or enhanced bitstream). The availability depends on the location of exchange, as exchanges differ in the available alternative networks and are also subject to different regulated access products (markets 3a and 3b have geographical segmentation). There are also commercial agreements in place covering areas where no access obligations exist for L2WAP products.

Legacy wholesale access products that need to be migrated

Legacy wholesale access products that need to be migrated are all based on the copper lines of the exchange, such as copper unbundling and copper-based bitstream. Both need to be in place until the end of the notice period. Other services are not affected by the exchange closure: it does not affect the PoH of L2WAP products and access to ducts, collocation space and backhaul for own FTTH deployments in the MPoP.

Available information for alternative network operators and end-users

Telefónica notifies the operators with wholesale accesses in the exchange and documents the state of the exchange in its information system. The NRA publishes the list of exchanges in closing process on its website.

Telefónica provides information when notifying an exchange closure: date of closure and details about FTTH deployment in exchange (such as OLT locations, percentage of FTTH, homes passed). Additionally, detailed information about the copper network of the exchange and the relation of each exchange to its FTTH MPoP (and a 3 month forecast) are available in the wholesale information system.

Other relevant conditions

For exchange closure no explicit permission is needed – a general authorisation is granted, subject to the defined rules and notice periods, and motivated by the phase-out of copper and substitution with FTTH. CNMC monitors the process, and there are no conditions or obligations regarding the migration costs. This only applies for closing a complete exchange: partial closures (situations where parts of a exchange no longer have copper, due to catastrophic events, or requirements from public administrations) are subject to approval by CNMC, and have different conditions (including economic conditions), as they are not motivated by the systematic phase-out of the copper access network.

5.4. Procedures used by NRAs to establish the framework for the migration process

Type of procedure

The rules were settled in market analysis of broadband access, as part of the copper access obligations (market 3a, 2016). The first version was defined in the market review of old market 4, 2009.

Stakeholder involvement

The usual stakeholders of a market analysis procedure were involved.

5.5. Further relevant aspects

The migration process takes into account the strong FTTH deployment by the incumbent but also by other operators, and the big gap in features with respect to copper (as there is no vectoring or G.fast in the copper network). The FTTH network only needs a subset of the existing exchanges, due to the longer reach of fibre compared to copper.

6. Sweden (PTS)

6.1. Context of migration in Sweden

The Swedish market for internet access services is characterized by good accessibility for end users both in terms of fixed and mobile broadband.

In the fixed broadband market consumer demand for fibre is high, driven by a strong consumer demand for fast broadband. Many single family households (i.e. SDU-market) are willing to pay an installation fee of on average EUR 2,000 or more to connect their homes to a fibre network. Market competition is high. Retail operators compete at national level, but network

control and operation are undertaken by both municipal and local networks, as well as national operators.

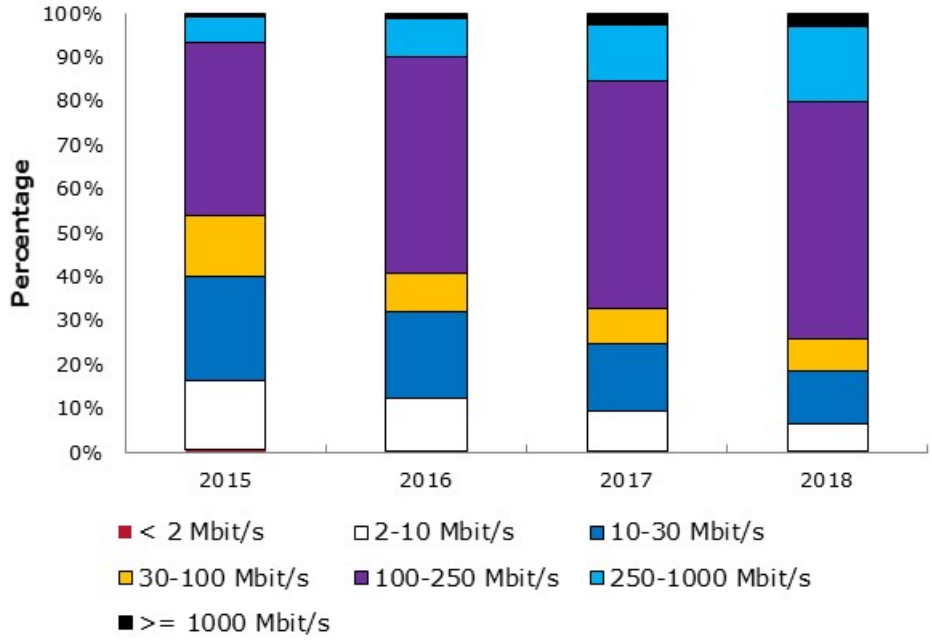

Figure 6 Proportion of fixed broadband subscriptions by speed

The increase in number of fibre subscriptions has meant that an average fixed broadband subscription offer ever higher speeds. On December 31, 2018 there were 2.9 million subscriptions with a download speed of at least 100 Mbit/s. This accounted for just under 75 per cent of the total number of fixed broadband subscriptions, and constituted an increase of seven percentage points compared to 2017.

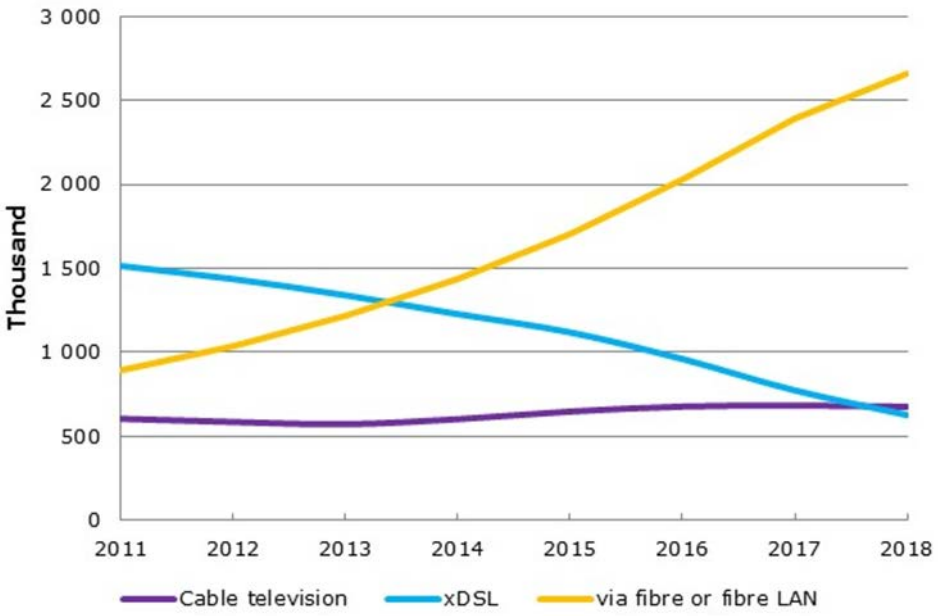

Figure 7 Number of subscriptions or fixed broadband

Fibre accounts for the entire increase in fixed broadband subscriptions. In total, this market increased by three per cent in 2018, while the number of fibre subscriptions increased by 11 per cent and amounted to 2.7 million subscriptions. For the first time, there were fewer broadband subscriptions via the copper network (xDSL) than broadband subscriptions via cable TV networks (0.6 and 0.7 million subscriptions, respectively).

In 2018 broadband investment in fixed networks declined by 10 percent. This means that 2018 was the first year since 2009 with declining fixed network investments. Given that most market players have reached or are nearing the peak of their investments, The Swedish Post and Telecom Authority (PTS) estimates that the pace of expansion is likely to slow further in the coming years. The main reason for the slowdown is that the broadband network deployment reaches more sparsely built-up areas where it is very difficult to make investment in broadband network deployment commercially viable. PTS has previously proposed a new national support program with a higher degree of strategic governance and regional prioritization in order to more easily direct funds to the areas where the need for broadband support is greatest.

Revenues from the retail market for electronic communications totalled just under SEK 51 billion in 2018, which was a decrease of two per cent. The reduction in revenue can be traced to fixed telephony, where revenues fell by 18 per cent. The number of subscriptions for fixed line telephony decreased nearly as much, and amounted to 2.2 million subscriptions. Fixed telephony has been long faced challenges from mobile telephony and Internet voice services, and this has led to a decline in subscriptions, call volumes and revenues.

The shutting down of, or migration, from Telia Company's (Telia) legacy copper-based network to fibre-based networks has been on-going for quite some time. In September 2011 PTS was commissioned to open an information service for Telia's dismantling process of the copper-based network. This service is now performed by the consumer organisation Telekområdgivarna. Migration or dismantling of MDF's has typically been taking place in small or rural areas. Information about the migration process, e.g. which MDF that are affected. is announced by Telia at the company's webpage (Framtidens nät). Telia has not communicated any final date for when the copper network will be fully dismantled.

6.2. Current status of migration and planned migration

Type of MDFs which are closed

Mostly rural and some suburban MDFs have been closed.

Number of MDFs migrated

Telia has closed less than half of the areas, which in most cases are equal to MDFs or locally distributed PSTN nodes as RSS (remote subscriber switch) or RSM (remote subscriber multiplexer). In some cases in suburban areas part of PSTN node has been closed, i.e. part

of a PSTN exchange has been closed when centrally placed MDF / RSS has been closed. Of these, almost all are rural, and only a small proportion are categorized as suburban.

The main driving force for migration is economical, i.e. that the cost for reinvestments in rural areas with copper networks in bad condition, and/or areas with low customer density, is too high.

Type of access network to which subscribers are migrated

There a few fibre network operators in Sweden. A few are operating nationally, some regionally and most locally. There are unfortunately no figures for what type of access the copper based customer has migrated to. The most common fixed access form is fibre, which indicates what sort of access network the end-users in total been migrated to. The SMP operator Telia has until now migrated some customers to fixed wireless access, but most customers choose fibre.

Planned migration

Until June next year 461 more areas are planned to be closed, of these 410 are rural and 51 suburban. Telia has not announced any plans or date for when to close all MDFs.

6.3. Framework for the migration process

Timetable and notice period

The Information process (see below) is obliged in a market analysis procedure:

- Subject to SMP regulation, Telia is obliged to inform co-localized operator 5 years before shutting down a MDF. Upon reviewing this obligation, within the scope of the SMP market analysis procedure, PTS has recently proposed to shorten this period of time to 18 months.
- Telia inform their consumers 12-16 months before the dismantling of copper network.
- In 5-6 months consumers contracts ended and information sent to inform of alternative solutions.
- Telia Wholesale inform all consumer 1 month before dismantling, including customers to other operations/suppliers.
- Telia inform PTS and local personal responsible for coordination of broadband at county level through the process.

All the information is available at Telias homepage. There is no obligation to keep the copper network.

Available alternative wholesale access products

There is no obligation for Telia to provide alternative connection if the copper network is dismantled and there are no fibre network. If Telia has a fibre network in the specific area, however, the company is obliged to offer wholesale fibre access. If there is no fibre in an area Telia normally offers end-users a FWA-solution which connects via Telia's LTE-network.

Legacy wholesale access products that need to be migrated

If Telia have or will deploy a fibre access network in an area where a copper network is being dismantled, Telia must offer co-localized operators the possibility to co-localize in the network node of the network. PTS has also proposed that in the future, Telia must inform co-localized operators about the possibility to migrate to the new fibre network, where applicable. If there are co-located operators at a MDF, Telia also needs to pay for depreciation costs.

Available information for alternative network operators and end-users

No obligation that SMP operator (Telia) have to make available information others than mentioned above (0).

Other relevant conditions

Information process (see 0 above) is the only obligation with regard to the migration process.

6.4. Procedures used by NRAs to establish the framework for the migration process

Type of procedure

No specific procedure, information obligation mentioned in 0 has been imposed within regular market analysis procedure.

Stakeholder involvement

The usual stakeholders as in the market analysis procedure have been involved.

6.5. Further relevant aspects

The universal service regulation gives consumers right to connection to a public communication network for voice and data. In mars 2018 the speed limit for functional access to the internet was increased from 1 Mbps to 10 Mbps. In Sweden there is no designated service provider to provide any of these services. Approximately 6 permanent residences or

permanent establishments lack access to telephony (satellite not included) (October 2017). Approximately 500 permanent residences or permanent establishments lack access to 10 Mbps (satellite not included) (October 2017). The government funding is regulated in a separated regulation but is a part of the universal service. PTS has been assigned by the Government to procure to all permanent residences or places of business that are not able to gain access from normal market conditions.

List of Abbreviations

ADSL	Asymmetric Digital Subscriber Line
AGCOM	Autorità per le Garanzie nelle Comunicazioni
ANACOM	Autoridade Nacional de Comunicações
BEREC	Body of European Regulators for Electronic Communications
BoR	Board of Regulators
BTS	Base Transceiver Station
CNMC	Comisión Nacional de la Competencia
CS/CPS	Carrier Select/Carrier Pre-Selection
DSL	Digital Subscriber Line
FNE	Fixed Network Evolution
FTTB	Fiber-to-the-Building/Basement
FTTC	Fiber-to-the-Curb
FTTH	Fiber-to-the-Home
FTTN	Fiber-to-the-Node
FWA	Fixed Wireless Access
HFC	Hybrid Fiber Coaxial
IPTV	Internet Protocol Television
ISDN	Integrated Services Digital Networks
ISP	Internet Service Provider
L2WAP	Layer 2 Wholesale Access Product
LEX	Local Exchange
LLU	Local-loop Unbundling
Mbps	Megabits per second
MDF	Main Distribution Frame
MPoP	Metropolitan Point of Presence
MSAN	Multi-Service Access Node
NGA	Next Generation Access
NGN	Next Generation Networks
NKOM	Norwegian Communications Authority
NRA	National Regulatory Authority
OAO	Other Authorised Operator
OLT	Optical Line Termination
PoH	Point of Handover
PTN	Public Telephone Network
PTS	Swedish Post and Telecom Authority
RSM	Remote Subscriber Multiplexer
RSS	Remote Subscriber Switch
SDU	Single Dwelling Unit
SLU	Sub Loop Unbundling
SMP	Significant Market Power
UHD	Ultra High Definition
ULL	Unbundled Local Loop
VDSL	Very High Speed Digital Subscriber Line
VULA	Virtual Unbundled Local Access

WAP	Wholesale Access Product
WBA	Wholesale Broadband Access
WG	Working Group
WIK	Wissenschaftliches Institut für Infrastruktur und Kommunikationsdienste
WLR	Wholesale Line Rental

Table of Figures

Annex 1 Questionnaire

Question 1. What types of MDFs (rural, urban, dense urban) have already been closed and are planned to be closed?

Question 2. How many MDFs have already been migrated in total and per type of MDF (see question 1)?

Question 3. What type of access network has the end-users been migrated to:

a) Access networks based on FTTH (Yes/No)?
   - If “Yes”, what share of the migrated end-users (%)?

b) Fixed wireless access (%)?
   - If “Yes”, what share of the migrated end-users (%)?

c) Other access technology (Yes(which?)/No)?
   - If “Yes”, what share of the migrated end-users (%)?

Question 4. With regard to the framework for the migration process:

a) What is the timetable of the migration process and in particular the notice period?

b) What alternative wholesale access products does the SMP operator have to make available?

c) What legacy wholesale access products need to be migrated and how long they have to remain in place?

d) What information does the SMP operator has to make available for the alternative network operators and the end-users?

e) What other relevant conditions does the framework for migration process define?

Question 5. Which procedures did the NRA use in order to establish the migration process?

Question 6. Which stakeholders have been involved in establishing the migration process (e.g. alternative operators, associations, consumer organisations)?

Question 7. How have the stakeholders been involved (e.g. workshops, public consultation)?

Question 8. Any further aspects which has been relevant?