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Virtual unbundling: Gift of nemesis to competition?

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Virtual Unbundling – Gift or Nemesis to Competition?

Discussion paper submitted to the 23rd Biennial ITS Conference, Vienna 2012

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Disclaimer: All views expressed are those of the author and do not in any way engage the Austrian Regulatory Authorities (Telecom-Control-Commission and RTR, the Regulatory Authority for Broadcasting and Telecommunications).

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1. Introduction

With the rising user demand for bandwidth, infrastructure upgrade and buildout of electronic communication networks has become a topic of foremost importance not only in regulatory discussion but also for the competitiveness of EU Member States. Regulation at its early stage back in the late 90s and subsequent years had focussed on opening up existing telecom markets and enable market entry by new players e.g. by obliging incumbent fixed network operators to allow call-by-call, carrier preselection and local loop unbundling on their networks and by setting asymmetric termination rates in favour of mobile networks due to high frequency cost. Internet services via leased lines and narrowband data services on the copper line were replaced by fixed broadband services first provided by cable operators and DSL incumbents. Regional carriers began to successfully market broadband access lines based on unbundling and added bitstream services from the incumbent as a complement to reach complete coverage of their retail broadband services in areas beyond their commercial footprint. Following the successful implementation of UMTS in mobile networks and the advent of smartphones in recent years, mobile broadband services have begun to play an increasingly important role. Mobile devices like tablets or smartphones and even TV sets are used at residential homes in WLAN environments which has contributed to the rising demand for bandwidth. With the introduction of new technologies to copper networks like bonding, vectoring or phantoming and at the same time massive infrastructure buildout measures for hybrid FTTx networks e.g. by laying optical cables and putting VDSL2 DSLAM cards in street cabinets, DSL incumbents try to exploit existing network resources and intend to maintain their retail subscriber base instead of seeing residential customers shift to mobile networks.

In many cases, fixed network incumbents are also SMP operators on the relevant markets for wholesale access to physical network infrastructure or wholesale broadband access markets¹ or both. They often have a more favourable situation compared to their competitors regarding financial resources, an existing network and customer base and are increasingly offering very large bandwidth broadband products to their customers based on FTTx network buildout combined with an optimization of network resources by deployment of the above mentioned technologies in their copper access networks. These NGA broadband services are easily replicable by cable operators who dispose of own infrastructure and powerful transmission technologies like DOCSIS 3.0 on their coax networks and also by other infrastructure providers with access to retail customers like utilities or municipal telecom providers disposing of a well-developed fibre infrastructure in densely populated areas. However, broadband products with very large bandwidths cannot be so easily replicated by competitive carriers without proper infrastructure whose broadband service proposals are mainly based on unbundled copper loops serviced from the local exchange and on complementary bitstream services. Those operators now face the problem of not being able to expand their service bandwidths beyond some 16 Mbit/s if based on conventional transmission technologies like e.g. ADSL2+ or SDSL due to an insufficient subscriber footprint at the street cabinet which prevents the construction of a valid business case for sub-loop unbundling.

National regulators find themselves in a complicated situation: on the one hand, rising demand for bandwidth requires that innovative products be made available to subscribers of electronic communication services. Without a high-quality infrastructure for electronic communication services, EU Member States will not be able to reach the Digital Agenda

¹Markets 4 and 5 as defined by Commission Recommendation 2007/879/EC of Dec. 17, 2007, OJ L 344, Dec. 28, 2007, p. 65 on relevant product and service markets within the electronic communications sector susceptible to ex ante regulation in accordance with Directive 2002/21/EC

targets for fast and superfast broadband so often evoked at political level. On the other hand, the expansion of sector-specific regulation in the 90s has led to new business models. Some of the regulatory remedies introduced at that time may – sooner or later and depending on the maturity of telecom markets in the Member State concerned – reach the end of their life cycle like carrier preselection in fixed networks which has lost some of its importance with the development of voice over broadband and VoIP. However, the situation cannot be considered to be equal with local loop unbundling (LLU) due to a higher degree of sunk cost resulting from investment in collocation and backhaul as well as equipment placed at the local exchange. Probably, the greater risk incurred by LLU operators as well as the need for and trust in regulatory predictability should be reflected by adequate regulatory measures in the light of new developments. In addition, many alternative operators may have difficulties to keep pace with the technological network upgrades introduced by the incumbent due to a smaller subscriber base and a resulting lack of economies of scale and scope for sub-loop unbundling.

The situation of competing LLU carriers does not become easier if infrastructure buildout measures by the incumbent lead to a situation where the provision of DSL broadband services from the local exchange will cause interferences with high bandwidth (VDSL2) services provided from the access remote unit (ARU, street cabinet). Such interference may be avoided by using Power Spectrum Density (PSD) shaping when providing the broadband service from the ARU (in order not to harm broadband service provision from the local exchange) but results either in a significant loss of performance for the service provided from the ARU or in a multiplication of the number of ARUs needed for a satisfying service bandwidth. In the aforementioned situation, the underlying business case will not be able to justify the financial expenditure incurred by the incumbent for the network upgrade. A VDSL2 DSLAM deployment at the ARU without PSD shaping requires additional limitations for the signal of existing DSL services provided from the local exchange to avoid interference. In such case, a competitive equilibrium can only be maintained if the alternative provider is offered a wholesale product at a different network layer which enables him to continuously provide existing services and to replicate high-bandwidth retail broadband services offered by the incumbent to customers in a network-buildout area.

Several regulators throughout Europe as well as the relevant Commission services (mainly DG Connect – the former DG Information Society and Media – and DG Competition) have tried in recent years to find answers to the questions mentioned above. As an example, reference is made to the NGA Recommendation which has tried to give guidance for the regulatory approach to NGA deployment to be followed by Member States in order to create favourable conditions for investments in infrastructure and innovative services while maintaining a competitive balance for alternative operators with their business models based on regulated wholesale access at the same time. National regulators have, mainly in their regular analyses of relevant electronic communications markets and by the imposition of remedies on the fixed wholesale markets for access to physical infrastructure and wholesale broadband access, found different responses how to enable competitive carriers in an NGA environment to provide broadband services to retail subscribers. In some cases, the focus was put on improving infrastructure competition by enabling infrastructure deployment based on ducts and (dark) fibre wholesale products as well as accompanying rules for civil works. In other cases (in an increasing number of Member States) to be discussed further below, it has been considered as more important to induce development and design of attractive layer 2 wholesale products (“enhanced bitstream access” or “virtual unbundling”).

2. The NGA Recommendation

The content of the “Commission Recommendation of 20 Sept. 2010 on regulated access to Next Generation Access Networks (NGA)”² has been commented in a Staff Working Paper by the Commission Services³ as well as by stakeholder contributions to repeated consultations of the drafts of this recommendation. However, the document contains several references which appear like a look into the future regarding problems evolving from the regulatory perspective when Member States and principal market players (mainly infrastructure providers of a relevant size) engage in measures to accelerate the development of their electronic communications infrastructure in order to make it fit for innovative services.

According to recital 10 of the NGA Recommendation, the transition from copper-based to fibre-based networks may change the conditions of competition in different geographic areas and may necessitate a review of the geographical scope of markets 4 and 5 or of remedies imposed on those markets in cases where such markets or remedies have been segmented on the basis of competition from local loop unbundling. NRAs are thus called upon to find a regulatory response to changes in the competitive landscape and to adapt access remedies in areas where LLU provided the basis for emerging competition. This is confirmed by Recital 20 stating the necessity to provide alternative operators, some of whom have already deployed their own networks to connect to the unbundled copper loop of the SMP operator, with appropriate access products in order to compete in an NGA context.

The perspective on wholesale products at another network layer (and virtual unbundling as one of them) is opened by recital 21 recommending to Member States that NRAs should be able to adopt measures for a transitional period mandating alternative access products which offer the nearest equivalent constituting a substitute to physical unbundling. ‘Transitional’ seems to invoke that such layer 2 services should be migrated to fibre unbundling in the long run, as underlined by recital 21 which concludes that NRAs, in any event, should in such cases mandate physical unbundling as soon as technically and commercially feasible.

Recital 26 elaborates on economical aspects in the context of ex ante price controls with regard to the deployment of NGA networks aiming to maintain effective competition between operators not benefiting from the same economies of scale and scope and having different unit network costs by holding that a ‘reasonably efficient competitor test’ will normally be more appropriate, and continues that NRAs when assessing a potential margin squeeze should properly specify in advance the methodology they will follow to identify the imputation test, the parameters to be used and the remedial mechanisms in case of an established margin squeeze.

The problem of insufficient scale and scope economies as a significant obstacle to sub-loop unbundling by access seekers is approached in recital 30 where NRAs are explicitly called upon to adopt appropriate backhaul measures to make such remedies effective. Besides dark fibre, Ethernet backhaul and duct access, this might also be addressed by applying appropriate price control remedies regarding terminating segments of leased lines and specific Ethernet connections as their substitutes.

² OJ L 251/35, Sept. 25, 2010, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:251:0035:0048:EN:PDF>

³ SEC(2010)1037, Sept. 20, 2010, http://ec.europa.eu/information_society/policy/ecomms/doc/library/recomm_guidelines/nga/document_travail.pdf

The need for enhanced technical features of wholesale broadband access products based on fibre (virtual unbundling understood as being one of them) is explicitly mentioned in recital 34 which expects those products to be technically configured in ways that allow for more flexibility and enhanced service characteristics (especially regarding business grade services) compared to copper-based bitstream products.

Finally, in case of changes that substantially affect investments and business case of access seekers, recital 40 evokes the necessity that an appropriate migration path be put in place in the absence of a commercial agreement.

As can be seen from the above references in the text of the NGA Recommendation, the Commission has taken thorough notice of the competitive problems arising in the course of NGA deployment and has also tried to give certain directions enabling NRAs to anticipate an educated guess on the outcome of the Commission services' view on the results of market 4 and 5 analyses conducted at Member State level and later notified to the ECCTF. When finding a regulatory balance between enabling innovative services for consumers made possible by NGA network deployment while avoiding competition distortions on retail broadband markets, NRAs will have to take into account the necessities evoked by regulatory measures which have led to business models now facing serious difficulties due to a shift of regulatory paradigms.

3. Selected expert opinions

A report with an overview on current developments with regard to NGA deployment which also contains references to virtual unbundling products (labelled “enhanced bitstream access” in the document) then being available in several Member States was published by BEREC in Feb. 2011⁴. In its final remarks, BEREC considers effective competition as one of the key drivers for efficient investments and regulatory certainty and consistency to be crucial in order to foster a competitive environment for long-term investments. However, BEREC acknowledges some evidence⁵ from studies by Analysys (on sub-loop unbundling)⁶ and by WIK Consult (on VDSL2 rollout profitability)⁷ indicating that actual take-up of NGA high-speed broadband services in almost all Member States significantly falls short of the coverage already achieved mostly due to limited willingness of consumers to pay a premium for very high-speed services and that these demand-side factors may feed back onto the viability of broadband projects from the supply side perspective possibly impacting on rollout plans. Other studies have outlined that investment in fibre is also influenced by the development of copper access charges and the underlying cost methodologies which has initiated a vivid discussion among stakeholders (Wholesale pricing, NGA takeup and competition⁸, April 2011; Copper pricing and the fibre transition – escaping a cul-de-sac⁹, Dec. 2011; Cost methodologies and pricing schemes to support the transition to NGA¹⁰, December 2011; The copper fibre transition – a guide for the perplexed¹¹, Feb. 2012). The debate cannot be summarized here in deeper detail but shows that there are interdependencies between investments in certain types of NGA deployment and technological developments which may also impact on transitional wholesale products created on other network layers.

In case of symmetrical fibre terminating access combined with duct access, a recent progress report on application of the NGA Recommendation within Member States (¹²) states a substantial risk that, in the absence of further remedies such as fibre VULA (virtual unbundling of local access) and wholesale broadband access, competition in the overall broadband market will deteriorate in the future; in case of asymmetrical terminating access combined with local or regional forms of wholesale broadband access, VULA at the MPOP (Metropolitan point of presence) would have to be imposed as long as a feasible form of unbundling for PON (passive optical networks) at the MPOP is not available. VULA as an alternative to fibre loop unbundling is seen as a viable substitute provided that pricing and quality of the service is comparable.

⁴“Next Generation Access – Collection of factual information and new issues of NGA rollout”, BoR(11)06, http://berec.europa.eu/doc/berec/bor_11_06.pdf and Annexes I and II

⁵ Earlier mentioned in “Supplementary Document to the ERG Opinion on Regulatory Principles of NGA“, ERG(07)16, rev. 2b, http://berec.europa.eu/doc/publications/erg_07_16rev2b_nga_opinion_suppl_doc.pdf

⁶“The business case for sub-loop unbundling in the Netherlands“, Jan. 2007, <http://www.opta.nl/nl/download/publicatie/?id=2120>

⁷Michael Brinkmann/Dragan Illic, “Technische und ökonomische Aspekte des VDSL-Ausbaus, Glasfaser als Alternative auf der (vor-) letzten Meile“, WIK Discussion paper No. 281, [http://www.wik.org/index.php?id=diskussionsbeitraegedetails&tx_ttnews\[cat\]=4&tx_ttnews\[year\]=2006&tx_ttnews\[tt_news\]=105&tx_ttnews\[backPid\]=93&cHash=4fd836e6b6](http://www.wik.org/index.php?id=diskussionsbeitraegedetails&tx_ttnews[cat]=4&tx_ttnews[year]=2006&tx_ttnews[tt_news]=105&tx_ttnews[backPid]=93&cHash=4fd836e6b6)

⁸WIK Consult for ECTA, <http://www.ectaportal.com/en/REPORTS/WIK-Studies/WIK-Study-Apr-2011>

⁹Plum Consulting for ETNO, http://www.plumconsulting.co.uk/pdfs/Plum_Dec2011_Copper_pricing_and_the_fibre_transition_-_escaping_a_cul-de-sac.pdf

¹⁰WIK Consult for ECTA, http://ectaportal.com/en/upload/File/Reports/WIK_Cost_Methodologies_Final_Report.pdf

¹¹Plum Consulting for ETNO, http://www.plumconsulting.co.uk/pdfs/Plum_Feb2012_The_copper_fibre_transition_-_a_guide_for_the_perplexed.pdf

¹²WIK Consult for ECTA: NGA Progress Report, March 2012,

http://ectaportal.com/en/upload/File/Press_Releases/2012/NGA_Progress_Report_final.pdf

4. The Austrian situation

The most recent market analysis decision by the Telekom Control Commission, the competent body to – besides other tasks – conduct market analyses and decide on remedies, regarding the wholesale market for physical network infrastructures – M 3/09-103 dated Sept. 6, 2010¹³ – found the DSL incumbent, A1 Telekom Austria AG (A1 TA), having significant market power on this market.

In order to remedy the competition problems identified, A1 TA was, among other remedies, ordered to grant access (including shared use) to unbundled loops and sub-loops as well as to ancillary services (e.g. collocation). However, as a consequence of changes in the competitive landscape by the incumbent's NGA rollout, the decision provided for further obligations of A1 TA regarding conditions for the use of the transmission system VDSL2 at main distribution frames and street cabinets. At the same time, the decision enabled the incumbent in cases of an NGA buildout in a given local exchange area to certain limitations concerning the maximum electrical length to subscriber's network termination point) in the provision of broadband services by alternative operators from the local exchange after fulfilment of certain conditions specified in the decision. According to one of these conditions, a limitation requires that the existing service can be continuously provided after having been migrated to an adequate wholesale product, a layer 2 service called "virtual unbundling" which shall be specified in a corresponding reference offer to be published within 3 months from the market analysis decision. This wholesale product was considered to be adequate when complying with the parameters listed below:

1. enabling a degree of innovation comparable with passive access (physical LLU)
2. utmost transparency for higher layers
3. option to provide multicast services
4. technology neutrality
5. flexible choice of terminal equipment (e.g. extendable whitelist)
6. interconnection at local exchange or comparable NGA access point
7. optional traffic handover on behalf of third parties
8. configuration access to all relevant connection parameters with utmost flexibility for access seeker

According to a press release by the RTR in its capacity as – among other tasks – the administrative office of the Telecom Control Commission¹⁴, the decision was seen as a landmark decision to define a general framework for broadband expansion.

A first version of this reference offer was published on Dec. 7, 2012 but was not considered by the NRA as sufficient to comply with the requirements laid down in the market analysis decision. As a result, the incumbent had to submit an updated version according to a press release of Dec. 21, 2010¹⁵. The updated reference offer published on Jan. 18, 2011 was subject to a public consultation¹⁶ from Jan. 26 to March 11, 2011. Contributions were provided by Tele2, UPC, ISPA (Austrian Internet Service Providers Association) and VAT (Association of Alternative Telecom Operators)¹⁷.

¹³<http://www.rtr.at/en/tk/ULL>, http://www.rtr.at/en/tk/M_3_09

¹⁴<http://www.rtr.at/en/pr/PI07092010TK>

¹⁵<http://www.rtr.at/en/pr/PI21122010TK>

¹⁶http://www.rtr.at/de/komp/Konsultation_ULL_vULL

¹⁷http://www.rtr.at/en/komp/Stn_ULL_vULL

After further discussions and modifications (with regard to forecasts, number portability, time-limits for fault repair and penalty amounts) initiated by the NRA, a revised version of the reference offer was published by A1 TA on July 20, 2011. In the meantime, the reference offer has undergone further modifications following the introduction of FTTH to retail customers in selected local exchange areas in Vienna. The current version (Nov. 7, 2011) is published on the website of A1 TA¹⁸.

The reference offer is structured in a main section with general contractual provisions followed by several annexes. Annex 1 („Technical Manual“) gives an overview on network and service architecture, handover points, service class parameters, bandwidth profiles and DSLAM configuration. Processes with regard to ordering, provisioning and cancellation as well as availability requests, schedules, migration processes, contact points and forms are subject to Annex 2 ("Operation manual"). While Annex 3 covers charges and Annex 4 maintenance and fault repair, Annex 5 describes rules for the use of modems. Annex 6 contains a specification for the Optical Network Termination to be deployed by the Virtual Unbundling Partner (“PVE”). A list of potential NGA buildout areas where virtual unbundling is available can be found in Annex 7 while Annex 8 gives instructions how to use the web frontend processes regarding ordering, provisioning, cancellation and fault repair. Finally, some abbreviations and definitions can be found in Annex 9. Several questions which have remained unresolved until now are subject to ongoing dispute settlement proceedings between A1 Telekom and various alternative operators before the NRA.

¹⁸http://cdn3.a1.net/final/de/media/pdf/Virtuelle_Entbuendelung.pdf

5. Virtual unbundling reference offer – selected details

The availability of the wholesale product “virtual unbundling” is limited to NGA buildout areas where A1 Telekom Austria has deployed FTTC/FTTB/FTTH (Annex 7). Traffic to and from the network termination point at subscriber’s premises is handed over from and to the Virtual Unbundling Partner (“PVE”) at a virtual unbundling handover point connected to PVE’s collocation at the local exchange via a 1 Gbit/s Ethernet port (single mode fibre). PVE can specify a certain bandwidth (1 Mbit/s minimum up to 4 Gbit/s) for traffic handover between DSLAM and handover point (“DSLAM management”) which is implemented as a logical connection between PVE and the relevant DSLAM. Traffic is categorized according to p-bits and prioritized according to p-bit value. Furthermore, various subscriber bandwidth profiles (“virtual unbundling services”) can be chosen between DSLAM and network termination point. Subscribers’ individual virtual unbundling services are collected per local exchange and DSLAM, mapped into a double-tagged VLAN (S tag and C tag) and handed over to PVE at the defined handover points. The VLAN ID definition (S tag for attachment to DSLAM, C tag for attachment to subscriber) is fixed by A1 Telekom in the provisioning process. PVE can thus address his subscribers via layer 2 and should ensure that its data frames are supplied with correct VLAN tags and p-bit marking in order to ensure control that the correct data frames are transmitted to the corresponding subscribers in the appropriate quality.

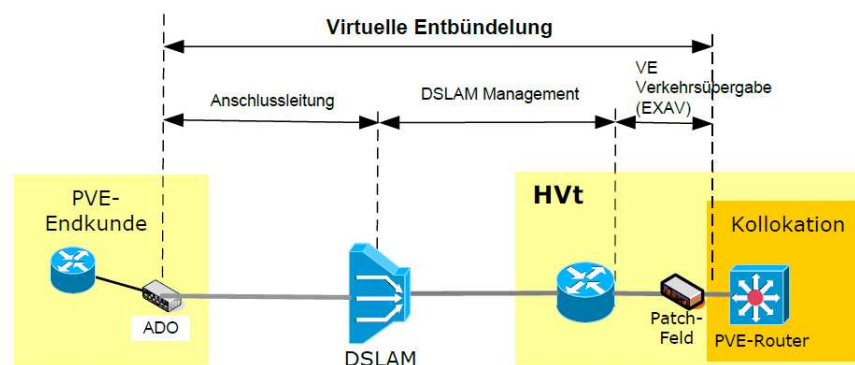


Fig. 1: Virtual unbundling based on FTTC/FTTB (source: Reference offer, A1 TA)

PVE can order via web frontend a certain bandwidth within the profiles defined by A1 TA and at the same time set a bandwidth overbooking factor for his subscribers per DSLAM.

As data frames are individually valued and prioritized in queuing, PVE can define their priority by p-bit marking. Data frames marked by higher value p-bits of e.g. 5 are transmitted faster through the network of A1 TA compared to data frames marked by p-bits with a value of less than 5. Within the p-bit matching of applications, “5” marks “Voice”, “4” marks “Video”, “1” marks “Business Internet” and “0” marks “Residential Internet”.

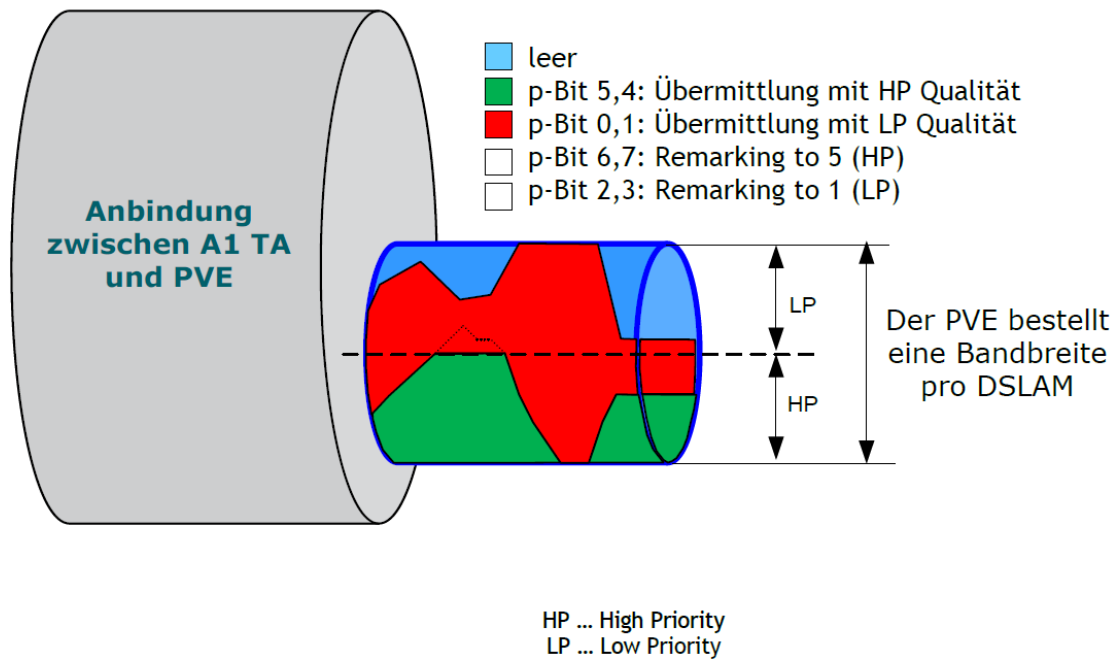


Fig. 2: Prioritization of data frames (source: Reference offer, A1 TA)

Data-frames are prioritized according to the rules below:

- 50% of the bandwidth specified by PVE per DSLAM are transmitted with High Priority (“HP”) quality
- the complete bandwidth specified by PVE per DSLAM can be used with Low Priority (“LP”) quality in case the HP remains unused
- in case the 50% limit available for HP quality transmission is exceeded, the data-frames exceeding this value are dropped (“4”-marked before “5”-marked)
- within LP quality transmission “0” is dropped before “1”
- p-bits marked “2” and “3” are remarked to “1”
- p-bits marked “6” and “7” are remarked to “5”

HP and LP are characterized by different thresholds for frame loss ratio, frame delay, frame delay variation and MTU frame size.

As ordering and fault repair processes for virtual unbundling – at least to a greater extent – follow a similar structure like those applied in the reference offers for physical unbundling and bitstreaming, they shall not be covered here in detail.

During the national consultation, several major questions have emerged discussed below.

5.1 MTU frame size

Operators have criticized the maximum MTU frame size of 1522/1526 bytes (in an FTTC/FTTB scenario) available for user data. Due to the need to encode additional information in the protocol overhead like VLAN tags or MPLS header, the protocol overhead increases which leads to a smaller MTU frame size with a resulting loss of transparency. As a consequence, certain services like Ethernet P2P, TDM services (E1, ISDN 30) and PWE3 services which could previously be provided via unbundled lines can no longer be provided.

To avoid this, a maximum frame size exceeding 1570 Byte is needed but currently not available within the network of A1 TA. However, the Reference Offer explicitly states that the MTU frame size will be adapted as soon as hardware and software allow such adaptation.

5.2 P-bits

Alternative providers would prefer a transparent transmission of all p-bits. However, A1 TA can only make available p-bits 0, 1, 4 and 5 for transparent transmission while p-bits 6 and 7 are reserved for routing protocols and p-bits 2 and 3 for other internal network management purposes and therefore have to be remarked to p-bits 0, 1, 4 and 5. Alternative operators claim this will lead to partial dropping of remarked p-bits with the result that they will not be able to provide certain broadband services where transparent p-bit transmission is indispensable like e.g. several health card services.

5.3 Online view

LLU operators who were used to have complete technical control with regard to monitoring each copper line and its features from their network operations centre will now be forced to change habits when migrating to virtual unbundling in its present form as a layer 2 service. A1 TA tries to keep full control of the DSLAM and will not enable access for its wholesale customers at individual DSLAM port level arguing that the DSLAMs currently used within its networks are not prepared for a multi-operator setting and therefore do not allow port configuration access for individual wholesale partners. Besides limited interest of operators in such features and security considerations by the incumbent, this is not yet a widespread feature among DSLAM vendors who seem to prefer proprietary solutions.

Thus, alternative operators will be limited to use specific templates made available via web interface giving a view on typical line characteristics (so called “last mile status analysis”) like line profile (service bandwidth actually available on the line), relative occupation capacity, noise margin (describing the signal-to-noise ratio distance), attenuation of the line, output power, impulse noise protect, interleaving delay (fixed at a value of 8 ms for VDSL2), attainable data rate based on G.997.1 down-/upstream, status of DSL connection (synchronous/asynchronous), modem type and modem software version actually in use. Alternative operators have explained in their consultation statements that the limited number of parameters available via web interface is not sufficient to evaluate a request for fault repair or to detect fault sources in order to allocate responsibility for fault repair.

5.4 Modem whitelist

Since new VDSL2 modems should be prepared to cope with new technologies like vectoring to avoid the necessity of a modem exchange at a later stage, the choice of models to be included in a modem whitelist either by A1 TA itself or on request of a wholesale customer after technical compliance tests by A1 TA can become increasingly narrow. In addition, the majority of LLU operators in Austria is providing broadband services from the local exchange and mainly based on ADSL2+. However, problems might also arise from a more generous definition of mandatory modem parameters due to the incumbent’s obligation imposed in the market analysis to compensate wholesale partners in case of a subsequent modification of modem requirements.

5.5 Migration

Successful migration of existing services to virtual unbundling is currently limited to those services that can be provided under the technical limitations for a layer 2 wholesale product with a maximum MTU frame size of 1522/1526 bytes and a loss of data packets to be expected due to p-bit remarking. In addition, a migration of ADSL services from the unbundled line to a virtual unbundling service will cause specific problems with regard to the ATM transmission of virtual paths/virtual channels which would require a common understanding among the incumbent as well as all of its wholesale customers on the numbering convention for these virtual paths/virtual channels that currently does not exist.

Another point of discussion focuses on the provision of services with symmetric bandwidths based e.g. on SDSL or SHDSL.bis. The current reference offer is limited to an upstream bandwidth of 4,096 kbit/s and does therefore not allow to provide symmetric services – being of special importance for servicing business customers – with bandwidths exceeding 4,096 kbit/s (except in areas with FTTH availability where symmetric bandwidths can go up to 5,120 or 10,240 kbit/s). As a consequence, existing SDSL/SHDSL.bis services of 8,196 or 16,384 kbit/s currently cannot be migrated to a virtual unbundling service in FTTC/FTTB areas.

5.6 Pricing

The pricing scheme follows a similar structure like pricing for physical unbundling: one-off charges for line connection or order cancellation as well as monthly charges for a basic line service with a bandwidth of 8,192/768 kbit/s (5.87€) and for premium maintenance and fault repair SLAs are the same. However, prices are differentiated with regard to bandwidths available at subscriber level as well as bandwidths available at DSLAM level (on the optical access line between DSLAM and PVE's point of presence). Monthly charges for bandwidths at subscriber level vary from 8,192/768 kbit/s to 20,480/4,096 kbit/s (9.07€) and 30,720/4,096 kbit/s (14.87€) for FTTC/FTTB and to 51,200/5,120 kbit/s (25.15€) and 102,400/10,240 kbit/s (36.64€) for FTTH. Monthly charges for bandwidths at DSLAM level vary in steps of 2/4/6/8/10/15/20/30/40/60/80/100 up to 800 Mbit/s and 1 up to 4 Gbit/s starting at 8€ up to 308€. Like in physical unbundling, penalties are due in case of delayed service provision and fault repair.

Alternative operators have criticized in the reference offer consultation that a differentiation of service charges according to bandwidth cannot be justified in comparison to physical unbundling where a copper line allows to provide services with different bandwidths at a uniform wholesale price. According to WIK, it is debatable whether virtual unbundling as it is available in Austria is a valid substitute for sub-loop unbundling due to bandwidth dependency and high prices.¹⁹ However, the a.m. market analysis decision M 3/09/103 requires the SMP operator to apply a retail-minus approach to its virtual unbundling wholesale charges which, at the same time and corresponding to physical unbundling, may not exceed the cost of efficient service provision calculated according to FL-LRAIC. It is also explicitly stated that A1 TA may differentiate between existing non-NGA bandwidths and future NGA bandwidths. It is thus possible to avoid a margin-squeeze and to mirror investment of the incumbent operator in NGA deployment to a certain extent. As far as bandwidth at DSLAM level is concerned, connectivity needed for backhaul between collocation and the PoP of the wholesale partner already had to be covered by corresponding expenses of a LLU operator in the past.

¹⁹WIK NGA Progress report for ECTA, Fn. 12, p. 37

6. International comparison

6.1 United Kingdom

In the UK, the development of a virtual unbundling product already started several years ago. In a major consultation on Next Generation Access of September 2009, Ofcom identified two types of solution to promote competition in NGA: sub-loop unbundling and Active Line Access as a primitive variant of Ethernet which retains as much as possible of the innovation potential inherent in passive forms of line access like sub-loop unbundling.

In its latest market review on Wholesale Local Access of Oct. 7, 2010, Ofcom, following BT's announcement to connect 10 mio. households with super-fast broadband by FTTC/FTTH deployment and considering that GPON unbundling at ODF or optical splitter level would be too costly, imposed a "virtual unbundled local access" (VULA) remedy to be provided in FTTC/FTTH deployment areas²⁰.

VULA is an electronic means to provide virtual bitstream-type access that is supposed to offer functionalities similar to local physical access (handover at the local exchange, service agnosticism, dedicated capacity for the subscriber between CPE and local exchange, control of access including management of QoS parameters by access seeker, CPE control). VULA thus allows other communications providers to offer high speed fibre broadband products in the retail market in areas where the incumbent has upgraded its access network, without needing to invest in duplicative deployments. The Commission stressed in its comments to the notification VULA should be seen as a transitional measure as long as fibre unbundling is not widely available²¹.

Since June 2010, BT Openreach offers a Generic Ethernet Access wholesale product in areas of NGA network deployment which has not yet been approved by Ofcom. Current industry negotiations aim at establishing technical specifications in order to ensure that the features of BT Openreach's GEA product comply with the requirements set in Ofcom's market review for the VULA wholesale product.

6.2 Germany

Taking the broadband strategy of the German government as a starting point, Bundesnetzagentur published "Key points on the regulatory framework for the development of modern telecommunication networks and the creation of a powerful broadband infrastructure"²² in March 2010 and initiated the NGA forum as an advisory body which shall support a successful buildout of broadband networks as well as the dialogue between NRA, operators, vendors, federal states and municipalities²³. Members of the NGA forum include

²⁰Ofcom Statement on Wholesale Local Access Market Review, Oct. 7, 2010,

http://stakeholders.ofcom.org.uk/binaries/consultations/wla/statement/WLA_statement.pdf

²¹Commission comments pursuant to Art. 7 (3) Directive 2002/21/EC on Ofcom WLA and WBA market reviews, Case UL/2010/1064, 1065 C(2010)3615, June 1, 2010, http://www.circa.europa.eu/Public/irc/info/ecctf/library?l=/commissionsdecisions/commission_decisions_4/uk-2010-1064-1065/_EN_1.0_&a=d

²²http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/BNetzA/Sachgebiete/Telekommunikation/Regulierung/NextGenerationAccess/NGA_Eckpunkte_Id16268pdf.pdf?__blob=publicationFile

²³http://www.bundesnetzagentur.de/cIn_1912/DE/Sachgebiete/Telekommunikation/RegulierungTelekommunikation/NGAForum/NGAForum_node.html

representatives of several major fixed network operators, the NRA, the Federal Cartel Office, the Federal Ministry of Economics and Technology, WIK and others. At the same time, Deutsche Telekom announced to accelerate its fibre deployment in order to provide FTTH connections to 10% of German households by end 2012.

In Sept. 2010, the NRA concluded its analysis of the wholesale broadband access market and found Deutsche Telekom to have significant market power. Among other remedies, Deutsche Telekom was obliged to provide access in the form of a layer 3 IP bitstream access and also a layer 2 Ethernet bitstream access product²⁴. As a logical consequence, the specification work which would also become relevant for the content of a future reference offer was to be elaborated by a sub-group of the NGA forum which had already set up a respective work package.

Following an interim report in Dec. 2010²⁵, the NGA forum published a principal document in May 2011 on “Technical and operational aspects of access to fibre networks and other NGA networks”²⁶. In a definition section, different NGA layers (0 – 4), network topologies and interfaces (transport/order/diagnosis) are introduced. A technical section, after listing various NGA products per layer (layer 0: ducts, layer 1: dedicated channels, layer 2: L2 transmission, layer 3: L3 transmission, layer 4: applications, over-the-top services), gives an overview on access network technologies in fixed and wireless networks. An evaluation section separates wholesale products of major (ducts, dark fibre, WDM-PON, Ethernet-bitstream) and minor importance (leased lines, P2P Ethernet, wireless and optical channels, L3 IP bitstream) before giving general recommendations for specifications regarding ducts and dark fibre and describing L2 Ethernet bitstream interfaces. The section on business processes, after explaining the participants and their roles, gives snapshots on typical processes like ordering, cancellation, fault repair and change of provider and lists requirements for technical interfaces regarding process execution. The paper concludes by announcing a generic service proposal for a Layer 2 enhanced bitstream access product after having set up in greater detail the description of a standardised process interface.

The generic service proposal for a Layer 2 enhanced bitstream access product was published in Oct. 2011 and consists of a framework document²⁷, a technical description²⁸, a more detailed outline for the business processes²⁹ listed in the May 2011 principal document and

²⁴BNetzA decision on regulatory remedies as adopted on Sept. 20, 2010, Case DE/2010/1116, http://circa.europa.eu/Public/irc/infso/ecctf/library?l=/germany/adopted_measures/de20101116

²⁵http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/BNetzA/Sachgebiete/Telekommunikation/Regulierung/NGAForum/ZwischenberichtDez2010.pdf?__blob=publicationFile

²⁶http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/BNetzA/Sachgebiete/Telekommunikation/Regulierung/NGAForum/12teSitzung/NGAForum20110506_AG_InteropGrundsatzdokument.pdf?__blob=publicationFile

²⁷http://www.bundesnetzagentur.de/cln_1912/SharedDocs/Downloads/DE/BNetzA/Sachgebiete/Telekommunikation/Regulierung/NGAForum/Arbeitsergebnisse/L2_BSA_I_Rahmendokument_V10.html?nn=153474#download=1

²⁸http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/BNetzA/Sachgebiete/Telekommunikation/Regulierung/NGAForum/Arbeitsergebnisse/L2_BSA_II_TechSpezifikation_V10.pdf?__blob=publicationFile

²⁹http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/BNetzA/Sachgebiete/Telekommunikation/Regulierung/NGAForum/Arbeitsergebnisse/L2_BSA_III_Geschäftsprozesse_V10.pdf?__blob=publicationFile

several annexes regarding a diagnostic interface³⁰, a web interface process description³¹ and specification documents for a change of provider³².

Since access to most of Deutsche Telekom's reference offers is limited to its wholesale customers it is unclear whether a reference offer for enhanced bitstream access has already been made available. Apparently, proceedings with regard to compliance of the L2 reference offer to be submitted by Deutsche Telekom with the corresponding obligation imposed in the M5 market analysis have not been initiated yet.

6.3 Italy

In its decision on market analysis of the wholesale broadband access market (notified in May 2011³³ and finally adopted on Jan. 18, 2012), AGCOM found Telecom Italia to have significant market power and obliged Telecom Italia, among other remedies, to provide an Ethernet bitstream access service with multicast functionality over fibre loops independently of the fibre network infrastructure (FTTN, FTTB, FTTH) at the local exchange in the form of a virtual unbundling – VULA – service. The proposed VULA product features include access at local exchange level (without backhaul), service agnosticism with sufficient freedom for the alternative operator to choose CPE, a dedicated Ethernet connection between subscriber's premises and handover point and finally sufficient (remote) control of the access by the alternative operator.³⁴

In its comments to the notification by AGCOM of the remedies envisaged, the Commission stated, given AGCOM's recognition that the migration process of Telecom Italia towards an NGA network – today at an early stage of roll-out – will have a considerable impact on the markets during the reference period of this analysis, that access to passive infrastructure and VULA over optical fibres would not be sufficient to safeguard effective competition. Remarkably, the Commission therefore called on AGCOM to re-assess, in line with Article 8 of the Access Directive as well as Recommend 22 of the NGA Recommendation, the need to impose, already for the time-frame of the current market review, an obligation to mandate physical unbundling of existing fibre lines where technically feasible³⁵.

Price control depends on the area where the service is provided: cost-orientation according to BU-LRIC (bottom-up long-run incremental cost) cost of efficient service provision in areas without infrastructure competition, costs incurred considered appropriate as long as they comply with non-discrimination and replicability of Telecom Italia's retail offers. At a later stage, the price control and cost accounting obligation for VULA will only apply in areas

³⁰http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/BNetzA/Sachgebiete/Telekommunikation/Regulierung/NGAForum/Arbeitsergebnisse/L2_BSA_IV_Diagnoseschnittstelle_V09.pdf?__blob=publicationFile

³¹http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/BNetzA/Sachgebiete/Telekommunikation/Regulierung/NGAForum/Arbeitsergebnisse/AK_SPRI_SST_V30.pdf?__blob=publicationFile

³²http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/BNetzA/Sachgebiete/Telekommunikation/Regulierung/NGAForum/Arbeitsergebnisse/AG_Anbieterwechsel_Teil0_Allgemein.pdf?__blob=publicationFile

³³Draft measure by Agcom on M 4&5 remedies as notified to ECCTF, May 23, 2011, http://circa.europa.eu/Public/irc/info/ecctf/library?l=/italia/registerednotifications/it20111230/mkts_nga_remedies&vm=detailed&sb=Title

³⁴Final decision by Agcom on analysis of Markets 4 & 5, https://circabc.europa.eu/d/d/workspace/SpacesStore/a5ed5cc8-52ca-411a-b572-409a61cf782a/Delibera%2012_CONS%20-%20final%20decision.pdf

³⁵Commission comments pursuant to Art. 7 (3) Directive 2002/21/EC on Remedies on the market for (physical) infrastructure access at a fixed location and on the market for wholesale broadband access, Case IT/2011/1230, 1231 C(2011)4763, June 27, 2011, http://www.circa.europa.eu/Public/irc/info/ecctf/library?l=/commissionsdecisions/it-2011-1230-1231/_EN_1.0_&a=d

where there is no infrastructure competition over fibre networks or where it is not likely to develop in the near future.

A VULA reference offer has been published by Telecom Italia on March 19, 2012³⁶. It consists of three parts one of which labelled “Offerta di riferimento” describes technical and commercial features in greater detail followed by a “Manuale delle procedure” outlining the procedure to follow application for and provision of NGA bitstream services and by an SLA with details on time-limits for the provision and fault repair regarding NGA bitstream services.

While it seems that there have been no objections by AGCOM against the contents of the reference offer itself until now, pricing is still subject to further examination by the NRA.

6.4 Spain

Following a respective market analysis decision by the Spanish regulator CMT dating back to Jan. 2009 where Telefónica had been found to have significant market power on the wholesale broadband access market³⁷, CMT, in July 2010, notified to the European Commission (and later adopted in November 2010) a proposal of technical specifications for a new Ethernet bitstream service up to 30 Mbit/s to be provided by Telefonica starting Jan. 2012.³⁸ EC comment³⁹ Telefonica was to submit a reference offer on “NEBA” (Nuevo Servicio Ethernet de Banda Ancha”) by March 2011. In Nov. 2011 a CMT blog⁴⁰ announced the publication of the latest version⁴¹.

NEBA is a Layer 2 Ethernet service made available at 50 regional points of interconnection where Ethernet frames from subscriber’s premises are handed over to the alternative operator without a need to involve higher network layers of Telefonica. Three QoS levels include different SLAs indicating frame loss, frame delay and frame variation which is also reported to the alternative provider. Bandwidth profiles are predefined but new bandwidth profiles can be introduced on request.

The NEBA reference offer is divided in two main parts: a functional specification mainly describing technical features of the service and a procedural manual covering business processes with regard to service provision and fault repair.

³⁶Offerta di Riferimento 2012 – Servizi Bitstream NGA, servizio VULA e relativi servizi accessori (Mercato 5), March 19, 2012, http://www.wholesale.telecomitalia.com/it/c/document_library/get_file?uuid=1b0e8183-51ce-426d-ae7f-54bc304ed17e&groupId=10165

³⁷CMT M4&5 decision as adopted on Jan. 22, 2009, http://circa.europa.eu/Public/irc/infso/ecctf/library?l=/espaa/adopted_measures/es20080804-0805/markets_4-5&vm=detailed&sb=Title

³⁸CMT Draft measure on remedies DT/2009/497 as notified to ECCTF, June 15, 2010, http://circa.europa.eu/Public/irc/infso/ecctf/library?l=/espaa/registeredsnotifications/es20101097/market_remedies/draft_measurepdf/_ES_1.0_&a=d, Summary Notification: http://circa.europa.eu/Public/irc/infso/ecctf/library?l=/espaa/registeredsnotifications/es20101097/market_remedies/summary_notification/_EN_1.0_&a=d

³⁹Commission comments pursuant to Art. 7 (3) Directive 2002/21/EC on Implementation of remedies imposed in the markets for wholesale broadband access and call origination on the public telephone network provided at a fixed location, Case ES/2010/1097, 1231 C(2010)5437, July 30, 2011, http://circa.europa.eu/Public/irc/infso/ecctf/library?l=/espaa/registeredsnotifications/es20101097/es-2010-1097_endate/_EN_1.0_&a=d

⁴⁰<http://blogcmt.com/2011/11/16/nueva-oferta-de-referencia-de-acceso-mayorista-de-banda-ancha/>

⁴¹http://blogcmt.com/wp-content/uploads/2011/11/Oferta_NEBA.pdf

Following a respective motion by Telefonica in Dec. 2011, CMT recently granted permission to shift the start of this wholesale service from Jan. to July 2012 because no operator had announced an intention to realize NEBA-based services until then⁴².

6.5 Belgium

In its latest market analysis of the wholesale broadband access market, CRC found Belgacom to have SMP on this market and, among other remedies, imposed an obligation to publish a reference offer⁴³. In addition, CRC requested this reference bitstream offer to be a “worthy alternative” to physical unbundling due to closing of local exchanges and limited business case for sub-loop unbundling⁴⁴. In its analysis of the market for wholesale physical network infrastructure access at a fixed location, CRC had decided to no longer impose an obligation to grant access to unbundled sub-loops, apparently with the argument of VDSL2 vectoring being incompatible with SLU⁴⁵. In its comments to the notification, the Commission acknowledged that, “there appears to be sufficient evidence to sustain that it is neither justified nor proportional to impose such remedy, since there is currently a lack of demand for SLU products and the imposition of such remedy could hamper the NGA investment strategy of Belgacom and thus run counter to the need to promote and ensure sustainable investment in the development of high-speed networks”⁴⁶.

A reference offer on Wholesale Broadband Access VDSL2 has been submitted by Belgacom to BIPT for approval on Feb. 16, 2012⁴⁷. It consists of a main body including a technical description of the service, a part concerning operational processes and a part on pricing and billing as well as appendices describing the OLO access line (between DSLAM and OLO PoP) and listing the service areas.

⁴²<http://bandaancha.eu/articulos/telefonica-consigue-retrasar-neba-hasta-8246>

⁴³CRC market analysis decision on large-bandwidth markets as adopted on July 1, 2011, http://circa.europa.eu/Public/irc/info/ecctf/library?l=/belgiquebelgi/adopted_measures/be20111227-1228/m4-5-decision-publicatio/_FR_1.0_&a=d

⁴⁴BEREC Report on Next Generation Access as cited in Fn. 4, BoR(11)06, Annex I, http://erg.eu.int/doc/berec/bor_11_06b.pdf, p. 19

⁴⁵WIK NGA Progress report for ECTA, Fn. 12, p. 21

⁴⁶Commission comments pursuant to Art. 7(3) Directive 2002/21/EC, Case BE/2011/1227, 1228, C(2011)4535, June 20, 2011, http://circa.europa.eu/Public/irc/info/ecctf/library?l=/belgiquebelgi/registerednotifications/be20111227/be-2011-1227-1228/_EN_1.0_&a=d

⁴⁷Belgacom Wholesale Broadband VDSL2 Reference Offer, Feb. 16, 2012, http://www.belgacomwholesale.be/wholesale/gallery/content/documents/vdsl2/WBA_VDSL2_offer_approved_by_the_BIPT_on_120403.zip

7. Conclusions

1. Virtual unbundling is a regulated wholesale product which can assist alternative operators without own infrastructure in keeping pace with the competitive pressure from higher bandwidth broadband offers by an incumbent SMP operator resulting from infrastructure upgrades at street cabinets without incurring the risk of potentially sunk cost for sub-loop unbundling. Thus, virtual unbundling can represent a valuable contribution in maintaining a competitive equilibrium during a migration to NGA services.

2. Eventually, it will not be possible to realize a similar creative freedom with a virtual unbundling wholesale product compared to the unbundled copper loop. However, there is an abundance of technical features which can be made available to wholesale customers in order to promote a greater degree of product differentiation.

3. Regulators throughout Europe have found individual ways to deal with NGA deployment and the requirements resulting from these developments for the competitive landscape. Interestingly, the responses found by regulators when imposing remedies on different markets seem to have led to a certain consent with regard to the measures seen as appropriate to maintain a competitive balance in the course of NGA deployment.

4. Measures taken at wholesale level to enable alternative operators to cope with the results from infrastructure upgrades in the course of NGA deployment must not hamper innovation. Innovation is indispensable for making advanced electronic communication services available to residential and non-residential customers and thus supporting the further development of a knowledge-based society. The relation between the incumbent's need to lower the cost for its NGA deployment measures must be carefully considered in comparison to limitations created by such measures for alternative operators by NRAs (e.g. introduction of vectoring as a justification for abandoning access to unbundled sub-loops). The call for necessity of innovation shall not serve as a vehicle to create new barriers to competition in the field of electronic communication services.

5. In cases of a mandatory migration of existing broadband services provided on unbundled copper loops to virtual unbundling, NRAs should ensure to the utmost extent possible that LLU operators can continuously provide their current services with the same features as previously available. The incumbent's obligation to provide a virtual unbundling wholesale product with adequate features like previously available on the physically unbundled copper loop must be seriously taken into account when examining regulatory compliance of product features as described e.g. in a VULA reference offer. However, certain limits of a layer 2 service will also have to be considered. As the obligation to grant access to unbundled copper loops has generally been limited to existing facilities, the same rule should be applied to the range of technology features currently available within the incumbent's network which may be required to form part of a VULA reference offer.