Body of European Regulators for Electronic Communications

BEREC

BoR (11) 43

BEREC Report on the Implementation of the NGA-Recommendation

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A Introduction

A.1 Scope of the document

The Commission issued the NGA-Recommendation on 20th September 2010 as one of the key measures of its Digital Agenda. The NGA-Recommendation, building upon the experience of the Commission in the context of the regulation of Market 4 (and 5), throughout the implementation of local loop unbundling and the resulting competitive effects, promotes physical unbundling including access to the terminating segment[1]. Also in this case, as for each of the envisaged NGA remedies, it is generally recommended that NRAs:

- Mandate access;
- Demand a reference offer; and
- Impose cost oriented prices.

BEREC had provided three opinions on different versions of the draft Recommendation on Next Generation Access including the latest one, which was the first BEREC Opinion provided under the new provisions of Article 19 of the Framework Directive under which the Commission is required to take the utmost account of BEREC opinions. The Commission modified its proposed Recommendation which was adopted in September.

BEREC shares the aim of the Commission to foster the development of the single market by enhancing legal certainty and promoting investment, competition and innovation in the market for broadband services, in particular in the transition to NGA networks.

In this report BEREC looks at how the NGA-Recommendation has been implemented in MS so far.

To this end this Report builds on the updated country case studies (Annex I to the BEREC Report "*Next Generation Access – Collection of factual information and new issues of NGA*

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1 In the NGA-Recommendation, 'terminating segment' represents "*the segment of an NGA access network which connects an end-user's premises to the first distribution point. The terminating segment thus includes vertical in-building wiring and possibly horizontal wiring up to an optical splitter located in a building's basement or a nearby manhole*".

roll-out" [February 2011])[2] as well as on the BEREC Report *"Next Generation Access - Implementation Issues and Wholesale Products"* (March 2010)[3].

Moreover BEREC collected information on the current status of availability and regulation of NGA wholesale access products, on migration and pricing/risk issues in Member States that are summarized in Tables as an Annex to this document.

The following Member States (MS) have submitted notifications of market 4 and 5 remedies since the NGA-Recommendation came into force:

- Market 4: Belgium, Bulgaria, Czech Republic *(remedies and price control),* France, Germany (*remedies, price control), Greece, Hungary,* Italy (*remedies)* Lithuania (*re-notified), Poland, Slovenia, Sweden, and UK*
- Market 5: Austria (SMP + Remedies), Belgium, Denmark, France, Greece, Hungary*,* Italy (*details*), Poland, Slovenia, Sweden

This project aims at developing elements of best practice to implement access and price regulation for markets 4 and 5 in line with the NGA-Recommendation, however it appears too early to come to definite conclusions at this point in time.

In this Report BEREC also addresses pricing and costing issues that will be further elaborated upon by the Regulatory Accounting EWG. Therefore this work is also linked with the work the Commission announced on consistent access pricing.

Art. 28 of the Recommendation dealing with co-investments based on multiple fibre lines is subject to a separate PRD dealt with by the CEA EWG. This topic is therefore not analysed in this document.

BEREC has agreed that the Broadband Common Positions need to be updated and extended to NGA remedies taking account of the NGA-Recommendation. This Report shall be used

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2 Annex I (BoR (11) 06b) as well as the main document and Annex II providing country answers in a comprehensive form are available at: http://erg.eu.int/documents/berec_docs/index_en.htm#board

3 The report (BoR (10) 08) and the related annex (providing practical experiences with various wholesale products in different countries as well as examples where regulation of wholesale products is based on specific national laws) are available at: http://erg.eu.int/documents/berec_docs/index_en.htm#board

as a basis to update the Broadband CPs[4] with regard to NGA remedies taking account of current market developments.

A.2 Structure of the document

The chapters of the document follow the different types of access products (chapters B to G) as defined by the Recommendation followed by chapters on migration and pricing issues as set out in the Annex of the Recommendation (chapters H and I).

Each Chapter on the wholesale products is divided into the following subsections:

1) Relevant provisions of the NGA-Recommendation
2) Availability in practice
3) Commission's Comments
4) Product description
5) Implementation Issues

The Chapters on Migration and Princing principles follow roughly the same line however without a section on product description.

Chapter B on Access to civil engineering infrastructure contains a separate section on the provision of an information database.

Furthermore some Chapters are complemented by additional sections on national experiences (D fibre unbundling, I Pricing principles).

Chapter J contains some concluding remarks of a preliminary nature. It also adresses dilemmas to be further developed.

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4 ERG (06) 69Rev1 *„ERG Common Position on Best Practice in Bitstream Access Remedies Impose as a consequence of a Position of Significant Market Powern in the Market for Wholesale Broaband Access"* and ERG (06) 70Rev1 *"Common Position on Best Practice in Wholesale Unbundled Access (Including Shared Access) Imposed as a consequence of a Position of Significant Market Power in the Relevant Market"*.

A.3 NGA deployment strategies

As stated in previous BEREC reports and confirmed by the data collection performed for this report operators in different MS do follow different NGA deployment strategies involving different degrees of using own infrastructure or focus on using active resp. passive wholesale products etc.) due to a number of factors and characteristics:

- The business case for NGA roll-out is driven by resp. influenced by inter alia the following factors
    - population density, geographies etc.;
    - costs of deployment influenced inter alia by factors such as availability of ducts, access to sewage system;
    - (lack of) demand;
    - willingness to pay for higher bandwidth/ARPU;
    - competitive conditions regarding inter platform competition, more specifically the presence of cable networks and intra platform competition;
    - penetration achievable for NGA networks;
    - speed of migration towards NGA networks

- In some MS incumbents tend to invest heavily in NGA roll-out, however focusing on different architectures and technologies.

- The current state of deployment in each MS also reflects the “history” with regard to both market developments and current generation remedies. This may impact on the migration towards NGA and NGA remedies. Some important factors are listed hereafter:
    - “path dependence” in the sense that LLU countries are more likely to want to continue with this approach ;
    - costs of NGA deployment vs cost of current generation deployment (opportunity costs of no longer paying for LLU as a driver) impacts on the roll-out incentives of both incumbents and competitive operators;
    - current generation price is generally geographically averaged; In case next generation access prices are geographically deaveraged (e.g. dens/non-dense) it is a challenge to ensure consistency of wholesale access prices across the value chain and conduct margin squeeze tests;

A.4 Ladder of investment

BEREC's analysis is based on the ladder of investment principle[5] (See Fig. below) that is also reflected in Rec 3 of the in the NGA-Recommendation (Rec. 3: "The appropriate array of remedies imposed by an NRA should reflect a proportionate application of the ladder of investment principle."). All NRAs follow the concept of the ladder of investment principle that regulated access promotes competition and investment, thus fostering a competitive NGA roll-out.

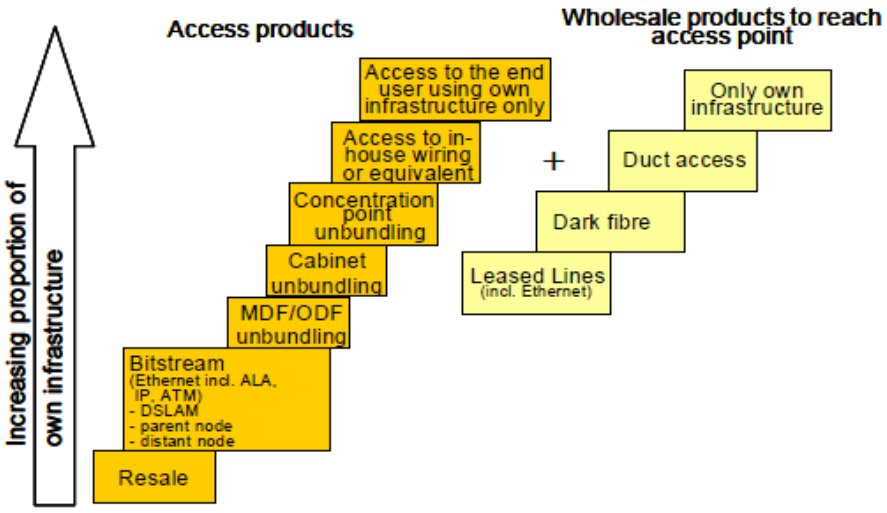

Figure 1: NGA Ladder of investment

The left hand side of the ladder displays the different access products (linked to access points), while the right hand side depicts wholesale products in the access/ concentration network, that an alternative operator may use to reach the access points from his own PoP. Various combinations of access products (left hand side) and backhaul products (right hand side) are possible depending on the scenario and network architecture, implying different degrees of own infrastructure.

The intensity of regulatory intervention depends on the competition problems found in the market analysis (market 4 and 5), i.e. the number of obligations according to Art. 9 to 13 AD[6] per wholesale product imposed. Generally it will depend on the specific situation in member states and scenarios used, which combination of wholesale products are being considered as proportionate and appropriate acc. to Art. 8 AD.

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5 For further details on the ladder see NGA Wholesale Product Report (2010)

6 SMP regulation may include: an access obligation (Art. 12 AD), transparency obligation (Art. 9 AD), non-discrimination obligation (Art. 10 AD), accounting separation obligation (Art. 11 AD), and price control and cost accounting obligations (Art. 13).

B Access to civil engineering infrastructure/ducts of SMP Operator (Art. 13-17*)*

B.1 Relevant provisions of the NGA-Recommendation

Where SMP is found within Market 4, and if duct[7] capacity is available, duct access should be mandated, according to Art. 13 of NGA-Recommendation.

Referring to the access conditions, the Recommendation points out that:

1) for the deployment of parallel fibre networks, alternative operators should have the possibility to deploy their fibre networks at the same time as the SMP operator, sharing costs of civil engineering works;

2) to be effective, mandated access has to the provided to third-party access seekers under the same conditions applied by SMP operator to its own downstream arm(s).

Access should be provided in accordance to the 'principle of equivalence' as set out in Annex II of NGA-Recommendation. In particular, to provide access on a strictly equivalent basis, SMP should:

1) Share and provide to third-party access seekers the same level of information on its civil engineering infrastructure[8] as is available internally[9].

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7 Art. 11 NGA-Recommendation defines ""Duct" means an underground pipe or conduit used to house (fibre, copper or coax) cables of either core or access networks."

8 According to Art. 11 NGA-Recommendation ""*Civil engineering infrastructure" means physical local loop facilities deployed by an electronic communications operator to host local loop cables such as copper wires, optical fibre and co-axial cables. It typically refers, but is not limited to, subterranean or above-ground assets such as sub-ducts, ducts, manholes and poles*."

9 The information should cover, organization of the civil engineering infrastructure, technical characteristics of the different elements of which infrastructure consists and, where available, the geographical location of these elements (ducts, poles, distribution points and any other physical asset) including available space in ducts. The list of connected buildings should also be provided.

2) Apply the same/equivalent procedures for access ordering and provisioning to those provided internally. The same level of visibility on the progress of the requests should also be provided to third operators and negative answers should be objectively justified.

A Reference Offer and SLA (Service Level Agreements) are pointed out as instruments to ensure a proper application of the 'principle of equivalence'. According to Art. 15, NRAs should mandate a Reference Offer where there is a request, and it should be in place no later than six months after such a request has been made.

Referring to the economical conditions, Art. 14 of Recommendation states that NRA should ensure that access to existing civil engineering infrastructure is provided at cost-oriented prices in accordance to Annex I, consistently with the methodology used for pricing access to the unbundled local copper loop[10].

Besides of access to existing infrastructure, NRAs should (Art. 16), in accordance with market demand, encourage, or, where legally possible under national law, oblige the SMP operator, when building civil engineering infrastructure, to install sufficient capacity for other operators to make use of these facilities.

Art. 17 foresees that "*NRAs should work with other authorities with a view to establishing a data-base containing i formation on geographical location, available capacity and other physical characteristics of all civil engineering infrastructure which could be used for the deployment of optical fibre networks in a given market or market segment. Such database should be accessible to all operators."*

Furthermore, according to Annex II, access to civil engineering should be "*provided on a strictly equivalent basis. NRAs should require the SMP operator to provide access to its civil engineering infrastructure under the same conditions to internal and to third-party access seekers*"

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10 And NRAs should not consider the risk profile to be different from that of copper infrastructure, except where the SMP operator had to incur specific civil engineering costs — beyond the normal maintenance costs — to deploy an NGA network

B.2 Availability in Practice

Duct access is available on a mandated basis in: Austria, Croatia (on a symmetrical basis)[11], Denmark, Estonia, FYROMacedonia, France, Germany, Greece, Hungary, Italy, Lithuania (on a symmetrical basis), Norway, Poland, Portugal, Slovak Republic (under consultation), Slovenia, Spain, Switzerland, Turkey, United Kingdom.

Ducts access is not imposed in Czech Republic, Finland, Latvia, Malta, Romania, Sweden.[12] In Belgium and Netherlands, no ducts are available.

In Austria and Denmark a reference offer is available for access to ducts and dark fibre as an ancillary service to sub-loop unbundling. In Croatia a reference offer of the incumbent is available for access to ducts to the alternative operators for construction of their own access network.

In France, Italy, Portugal and Spain, access to civil engineering of the SMP operator will include both ducts access and associated infrastructure and overhead infrastructures (poles)[13]**.** In these MS a regulated Reference Offer[14] is in place and is widely used.

In France, it is mandated to install only fibre cables (in Portugal and Spain also coax cables are allowed) and, on the other hand, in Spain the access obligation covers both, ducts located in urban areas and non-urban areas[15].

In the UK a remedy is in place mandating access to the incumbent's Physical Infrastructure Access ("PIA"), which will allow competitors to deploy their own NGA infrastructure between the end-user and the local exchange, using BT's duct and pole infrastructure and a reference offer for PIA is available from BT.

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11 There is also a direct obligation for all infrastructure operators to provide access to ducts by the Croatian Electronic Communications Act.

12 For further details concerning duct access see Annex "General table" and table "C. Ducts"

13 As this type of civil engineering is widely used in the non-dense areas of the country.

14 In Portugal, the reference offer is in place since 2006 and covers all the civil infrastructure of the SMP operator.

15 The latter in case the ducts are of similar type to the ones used for urban areas (this provision covers connections to business parks and similar located outside cities).

B.3 Commission's comments on M4 notifications

Regarding duct access the comments of the Commission seem to be closely aligned with the NGA-Recommendation.

Main arguments from the Commission

The Commission invites the national regulators to ensure effective access to civil engineering infrastructure, even if unbundled access to the fibre loop is mandated (Germany 2010, Romania 2010) Access to civil engineering should be imposed even if the product is not explicitly included in the market definition[16] or there is no demand for the product. Also, when the incumbent owns overhead infrastructures (i.e. poles), these infrastructures should be included in the civil engineering access product (France 2011).The Commission remarks that duct access product should be mandated everywhere and the availability of the product should not depends on the geographical availability of another product, especially fibre unbundling (Romania 2010, Poland 2010, Hungary 2011, Lithuania 2011 and Italy 2011). The Commission notes also that the product should be cost oriented and that the analysis should be separated from other product in order to ensure consistency in the pricing, especially between duct access and dark fibre (Austria 2010).

a) Germany (2010)

"*In addition* [to '*mandating unbundled access to the fibre loop irrespective of the network architecture or technology implemented by the incumbent'*]*, the Commission underlines that access to ducts can be imposed at the remedies stage of the market analysis without its explicit inclusion in the relevant market*[17]*. Access to ducts and civil engineering infrastructure in general is crucial for the deployment of parallel fibre networks and to also ensure the effectiveness and viability of unbundled access to the copper sub-loop. As a result, the Commission invites BNetzA to ensure an effective access to the ducts of the SMP operator and, in an FttC/FttB scenario, that unbundled access to the local loop is supplemented by measures including access to duct and/or dark fibre ensuring the effectiveness and viability of such remedy*".

b) Austria (2010, before the NGA-Recommendation)

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16 "See for example cases FR/2008/0780 and EE/2009/0942"

17 "See for example cases FR/2008/0780 and EE/2009/0942"

"*The Commission notes RTR's proposal to require TA to provide access to its unlit fibre only in circumstances where the provision of duct is technically not possible. However, RTR does not appear to analyse in detail the cost differences of using duct and dark fibre to backhaul traffic. It cannot, therefore, be excluded that in certain cases it might only be economically feasible for alternative operators to reach the street cabinet or in-premises distributor by accessing dark fibre instead of laying down own fibre lines in TA's ducts. In the Commission's view, it is important that SLU is supplemented by appropriate backhaul measures to make SLU effective and that access seekers should be able to select the solution best fitting their requirements. The Commission, therefore, invites RTR to ensure that the objectives laid down in Article 8 of the Framework Directive are met by re-defining the proposed remedies in a way that access seekers can opt for dark fibre even where there is spare duct capacity should cost considerations justify such a choice*".

c) Romania (2010)

"*the Commission notes that ANCOM does not consider it justified to mandate access to the incumbent's ducts given the lack of the current demand for unbundled access to the local loop. In this regard, the Commission recalls that ensuring access to the incumbent's civil engineering infrastructure is, as a matter of principle, a prerequisite to ensure effective sub-loop unbundling remedies. Access seekers should have the right incentives to select the solution best fitting their requirements whether it is dark fibre, Ethernet backhaul or duct access. Even in the specific circumstances of the Romanian broadband market, access to the incumbent's civil engineering infrastructure might be required in some instances, especially if the market conditions change, e.g. if aerial networks are banned in specific areas. Therefore, the Commission asks ANCOM to re-assess the need to mandate access to ducts*".

d) Poland (2010)

"*UKE proposes to impose on TP a conditional fibre unbundling obligation, i.e. TP would only be required to provide unbundled access to fibre in case access to ducts, access to dark fibre or to backhaul services was not available. The Commission would like to recall that according to Recommend 22 of the NGA-Recommendation, National Regulatory Authorities (NRAs) should in principle mandate unbundled access to the fibre loop, where the SMP operator deploys FTTH. Any exception could be justified only in geographic areas where the presence of several alternative infrastructures, such as FTTH networks and/or cable, in combination with competitive access offers is likely to result in effective competition on the downstream level. This has not been shown by UKE*".

e) France (2010 and 2011)

"*The Commission recalls, in line with the NGA-Recommendation, that access to civil engineering infrastructures, including above-ground assets, is crucial for the deployment of NGA based infrastructure competition. Moreover, mandating the publication of an adequate reference offer by the SMP operator appears proportionate to the objective of encouraging efficient investment and infrastructure competition. In this regard, the Commission invites ARCEP to revise as soon as possible the scope of the civil engineering infrastructure access remedy in order to include access to aerial infrastructures and complement accordingly its proposed measure with the applicable cost accounting rules and pricing methodologies*".

In 2008, "*The Commission issued several comments on ARCEP's proposed limited SMP regulation and symmetrical measures. While the Commission welcomed the imposition of a duct sharing obligation*"

f) Slovenia (2010)

Duct access imposed, no comments from the Commission.

g) Bulgaria (2011)

Duct access imposed, no comments from the Commission.

h) Hungary (2011)

"*Conditionality of duct access"*

The Commission takes note of the fact that NMHH proposes to mandate duct access only in those cases where unbundling is not technically feasible and to mandate access to dark fibre only where duct access is unrealizable for objective technical reasons. In this respect the Commission points out that in the Commission's NGA-Recommendation no such conditionality has been established between unbundled access to the fibre loop and access to civil engineering infrastructure of the SMP operator. On the contrary, the NGA-Recommendation clearly sets out that in Market 4 an NRA should, in principle, mandate both access to civil engineering infrastructure and unbundled access to the fibre loop. Access to civil engineering infrastructure is crucial for the deployment of parallel fibre networks. In the light of this, the Commission requests NMHH to re-consider the extent of the proposed access obligations and to require the SMP operator to offer duct access alongside unbundled access to the fibre loop".

i) Lithuania (2011)

"*The Commission calls on RRT to impose on the SMP operator an obligation to provide fully unbundled access to its fibre loops in addition to access to civil engineering infrastructures and not make fibre access conditional on the availability of the latter*".

j) Belgium (2011)

"*The withdrawal of the SLU remedy renders unjustified the maintenance of a duct sharing obligation". No comments from the Commission*.

k) Italy (2011)

"In addition to duct and dark fibre access obligations AGCOM proposed as a substitute of unbundling access of the fibre loop the provisioning of an e2e (end to end) service consisting of a passive access service provided by TI from the local exchange or the point of presence where the alternative operator is co-located to the customer premise equipment, including all the elements (physical infrastructure and dark fibre) in the form of a single fibre line, the connection to the Optical Distribution Frame and, in addition, all technical services necessary for the provision of the retail service (this fibre line is also tested by lightening in order to test parameters such as compliance transmission parameters; however, the fibre line is provided unlit)". The Commission remember to AGCOM that in accordance to the NGA-Recommendation unbundled access to the fibre loop should be mandated irrespective of the network architecture and technology implemented by the SMP operator (for example WDM on point to multipoint architectures). Moreover the Commission state that e2e service may only be justified as proportionate access remedy in the absence of the availability of access to the fibre already built out by TI. In view of this, the Commission stress that the e2e service remedy should be considered as a transitional measure only, until fibre unbundling becomes a technically viable solution.

B.4 Product Description

Art. 11 of the NGA-Recommendation defines 'civil engineering infrastructure' as the *"physical local loop facilities deployed by an electronic communications operator to host local loop cables such as copper wires, optical fibre and co-axial cables. It typically refers, but is not lim-*

ited to, subterranean or above-ground assets such as sub-ducts, ducts, manholes and poles"[18].

In this document, the term 'access to civil engineering infrastructure' is also designated as 'access to ducts'.

Therefore, access to the civil engineering infrastructure can include access to underground infrastructure, namely duct and access to overhead infrastructures, namely poles[19], and also additional ancillary services as (space for) co-location[20] for the purpose of installing next generation networks, e.g. fiber optic and/or coaxial cables.

Duct access is a wholesale access product and in principle can be used by the operators to install all type of cables: copper, fibre or coax. However, given that copper is not expected to be deployed by alternative operators and is only of interest for NGA in the case of FTTN/FTTB VDSL2 deployments, it can be considered that access to the ducts as mandated by the Recommendation should be granted only to deploy either optical fibre or coaxial cables for local loops (i.e., for NGA access to customers).

The product can be specified in different forms such as access to full duct, access to segments of ducts, to micro-ducts.

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18 In the same Art. 11 the following definitions are provided:

- 'Duct' means an underground pipe or conduit used to house (fibre, copper or coax) cables of either core or access networks.
- 'Manholes' means holes, usually with a cover, through which a person may enter an underground utility vault used to house an access point for making cross- connections or performing maintenance on underground electronic communications cables.

19 In areas where the SMP operators has deployed only overhead infrastructure, pole access can complement duct access in the provision of support for fibre cables for FttH deployments.

20 Duct access can optionally also include additional ancillary services, like for example in Spain, where the SMP operator has the obligation to provide space for collocation at the exchanges in order to complement duct access and install its active equipment, in a similar manner to the obligation for unbundled access to copper.

B.5 Implementation Issues

a) Access obligation

Duct access is mainly regulated under the Market 4. In some countries duct access constitutes an ancillary service remedy to other products Market 4 (Austria, Croatia, Denmark, Germany, Ireland, Norway, Portugal[21], Spain, and the UK) whereas it is explicitly included in Market 4 in France. A separate duct access market has been defined in Switzerland.

BEREC considers that the following points are of special relevance:

1. The definition of "civil engineering infrastructure" explicitly refers to "local loop" (Art. 11 NGA-Recommendation). The implication is that the mandated access to "civil engineering infrastructure" affects only those facilities (like ducts) deployed to host local loop cables, which generally run from the ODF/cabinet/manhole to the subscriber (or its proximity). As a consequence, ducts from the SMP operator which do not host local loop cables (like ducts between exchanges/ODF/cabinets) are only included in the access obligation if they are necessary for enabling backhaul. e.g. ducts running from an MDF to the cabinet.[22] Thus, they constitute a wholesale product to reach the access point (see right side in the figure on the ladder on the ladder of investment).
2. Duct access shall be mandated "*where duct capacity is available*" (Art. 13). This could imply that only those ducts with spare capacity are part of the obligation; there is no mention in the Recommendation about any obligation to make capacity available if ducts are fully used, or to impose another type of obligation (like access to dark fibre[23]) in those cases.
3. Linked to the previous point, Art. 16 mandates that NRAs encourage or even oblige the SMP operator to install sufficient capacity for other operators when building civil engineering infrastructure. Again, the Recommendation makes no reference to how to optimise usage of existing ducts, but instead it makes provisions for the construction of new ducts.

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21 Although initially according to National Law.

22 Specific access obligations should be imposed for the infrastructures between the MDF and the primary network segment (generally starting from the chamber outside the central office), and for the infrastructures from the last distribution point at the end of the secondary network segments and the in building wiring (generally the infrastructure composed by the last chamber on public land until the infrastructure inside the building).

23 Mentioned only in the case of FTTN backhaul.

The space requirements for the different cables types (fibre and coax, along with the existent copper cable) are rather different and may lead to limitations, as space in ducts is a scarce resource. Incumbents claim that in most cases ducts are already occupied to a large extent by the copper cable. However the obligation needs to be designed in such a way that no strategic withholding of capacity is possible. One way of doing this is placing the burden of proof on the incumbent. Another way is to impose dark fibre access only, in case no duct space is available. Moreover, multiple-fibre deployments may also lead to overuse or lack of space in ducts.

In case the available space in a determined path is limited, rules for allocating the limited space should be established. See the following sections on these subjects.

b) Costing and pricing issues

Several NRAs have imposed cost orientation on duct access, such as Denmark, France, Germany, Hungary, Italy[24], Lithuania, Norway, Portugal, Spain and the UK. The cost orientation obligation implies first the choice of an allocation rule of civil engineering costs between fibre-based network, copper-based network and eventually cable-based network and second the choice of a pricing scheme for the access product.

Allocation rule of civil engineering costs:

The NRA may consider several cost allocation rules between copper-based network, cable-based network and fibre-based network. They will depend inter alia on the way duct access is granted (access to full duct, to duct segment, to micro-ducts etc.).

Cost allocation can be based on different factors:

- degree to which the duct infrastructure is occupied, based on either
    - the space taken up *or*
    - number of cables
    - number of subscribers

24 Proposal under consultation

Space taken up

Cost allocation measured by the space taken up is applied in Germany, Italy and Spain [25]. This approach involves higher up-front cost at the start of deploying cables and decreasing average cost as the segments gets filled up with more cables.

Number of cables

Cost allocation measured by the number of cables deployed in the ducts by the operator concerned is applied in Portugal. This approach involves costs proportional to uptake and thereby involves lower costs at the start. With this rule, the costs are allocated to fibre-based network according to the volume or the length of the cables being deployed (in comparison with the copper cables).

Number of subscribers

In order to avoid higher up-front cost at the start of fibre deployment, the NRA might use a cost allocation rule based on the number of subscribers on copper-based network and fibre-based network (France). With this rule, the costs allocated to civil engineering are proportional to fibre subscriptions and enable lower costs at the start of deployments.

Pricing scheme:

The pricing scheme based on duct occupation is thus consistent with the cost drivers and provides incentives for the operators leading to an efficient cable occupation of the infrastructure. However, this can lead to differentiated costs per line in urban areas and in rural areas due to the amount of cables to deploy per household. To mitigate this issue, the NRA might consider the use of a pricing per line in a specific area. With this pricing scheme, there is no differentiation between rural and urban areas. Therefore, the NRA can use this scheme for shared deployments if its objective is to facilitate deployments in sparely dense areas.

c) Reference offer

According to the Annex II of the NGA-Recommendation, a civil engineering infrastructure reference offer, at a minimum, “should contain the relevant procedures and tools for retrieving civil engineering asset information; describe the access and usage conditions to the different elements which make up the civil engineering infrastructure; describe the procedures

25 Proposal under consultation

and tools for access ordering, provisioning and fault management; and fix target service levels and the penalties for breach of those service levels".

- Provision of information (maps, occupation of the ducts): see the following section B.6.

- Feasibility studies/infrastructure development

- Processes

    - Procedures and tools – ideally via "one-stop shop" - Information/electronic systems – necessary for ensuring efficient and timely access to the civil engineering infrastructure should be granted - including requests for information, end-to-end ordering, provisioning and fault management and de-congestioning (removal of old cables)[26].

    - Reducing the time to access and possible discrimination: the access seeker (after checking in the database for space availability for installation of its network), may directly submit a request to install (e.g. cables in a duct) without first submitting a request for feasibility analysis. A system requiring prior feasibility analysis may be acceptable if the SMP player itself has no sufficiently accurate data base.

    - Details about the engineering rules for sub-ducting, saturation, the amount of unoccupied space to keep, chambers and jointing closures use.

- Service level agreements (SLA)

    - To be defined and calculated for both internal use and alternative operators, including delays for replying to requests for information on availability/capacity/feasibility of infrastructure (e.g. ducts, manholes); delays on handling requests for access and use of infrastructure and delays on fault resolution processes.

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26 The electronic information systems of the SMP operator should keep track records to be available, on request, to the NRA.

- The calculation/assessment of the key performance indicators should be performed at regular, fixed intervals and submitted to the alternative operators and the NRA and should be equivalent to those delivered internally by the SMP operator[27].

Best practices / preliminary conclusions

- A mandated duct access product exists in 2 out of 3 countries. In those cases where such a product is mandated cost-orientation applies (except for 2 countries).

- The access obligation in the Recommendation is limited to civil engineering used for local loops cables and ducts needed for enabling backhaul. When there is no spare capacity, there is no mention in the Recommendation for other type of obligations. However, the access obligation should be defined - avoiding the possibility of the incumbent to strategically withhold capacity - either by placing the burden of the proof on the incumbent, or by imposing dark fibre access when no ducts are available. The definition of rules for allocating limited space can also help to optimize ducts use.

- When allocating costs for cost-oriented prices on ducts, several drivers can be considered as the degree of occupation (physical space or number of cables) or the number of subscribers. When physical space is used as allocation key, implying higher up-front costs and decreasing average cost as the number of cables grow, contrary to the case of the use of the number of cables as allocation key, which involves lower costs at the start. If the cost allocation rule is based on the number of fibre subscribers, costs are also lower at the start and proportional to fibre subscriptions. NRAs can also consider the use of a pricing per line in specific areas to facilitate shared deployments in rural areas.

- The reference offer for ducts should include procedures and tools ensuring efficient and timely non discriminatory access to ducts ideally based on one-stop shop IT systems, as well as details on engineering rules for space management. It may be important to define SLAs for both internal and external provision and fault management process, as well as KPIs that might be measured regularly and made public to the NRA and alternative operators.

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27 The SMP operator should commit to adequate compensation in case of failure to comply with target service levels agreed with alternative operator

B.6 Provision of information, database

The Recommendation is clear that information regarding the availability of existing and future civil engineering infrastructure and its use is necessary to ensure the efficient deployment of parallel fibre networks[28]. This is emphasised by several elements of the Framework, including Art. 12 (4) FD which states that: *"MS shall ensure that competent national authorities may require undertakings to provide the necessary information".* Annex II of the Recommendation is clear as to the application of the principle of equivalence for access to this infrastructure, and in particular states that SMP operator should provide the necessary tools (including databases and web portals) to ensure the proper information access for third-party access seekers.

In a similar vein, Art. 17 of the Recommendation states that "*NRAs should work with other authorities with a view to establishing a data-base containing information on geographical location, available capacity and other physical characteristics of all civil engineering infrastructure which could be used for the deployment of optical fibre networks in a given market or market segment. Such data-base should be accessible to all operators."*

The Recommendation is not specific as to which infrastructures (e.g. those belonging to SMP or alternative operators, and/or those outside the ECN framework) should be included in such a database.

BEREC agrees in general that as a minimum, a database containing information relating to the SMP operator's civil infrastructure is essential, and has already stated that *"wholesale customers should be able to obtain relevant information on roll-out of new infrastructure or technologies per geographical area. A reasonable window of announcement is necessary to create a level playing field on the retail market*"

BEREC has already set out (above in section B5, and also BoR (10) 08, section D1) those elements that should be included in a duct reference offer, including information resources for existing and planned facilities, including relevant geographical data and information regarding the occupation and availability of space in the desired ducts, manholes and associated infrastructure. The level of detail that required by the reference offer (and therefore database) may differ from NRA to NRA, depending on the expected demand in that Member State.

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28 Recital 12 of the Recommendation

Availability in practice:

Currently[29], in some countries data only from the SMP operator is collected following a regulatory obligation (Estonia, Italy[30], Portugal, Spain) and the database is run by the incumbent (also in Croatia and Switzerland [but without information about duct capacity]). In these cases, only other operators – the beneficiaries of the duct's access offer – are entitled to get access to the database, which is established and run by the SMP operator.

However, in other cases, the database also encompasses data of non-telcos (Germany[31]). In Germany data are not provided as an SMP obligation but on a voluntary basis. Transposition of the Art. 12 FD may allow to oblige infrastructure providers to provide information. Currrently, only administrative units are entitled to get access to the database[32]. They may also file information requests on behalf of operators. The database is established and run by the NRA (Germany) or the Ministry (Slovenia). In Portugal, aside from the database of ducts of the incumbent operator, it is expected that the implementation by the NRA of a national infrastructure database will also contain information of both telco and non-telco entities.

Segmentation of this database, with different levels of information accessible to different entities is not expected in any country.

In the UK, Ofcom have not required BT to provide a database. However, there is a requirement for BT to provide a range of information on BT's infrastructure (MDF locations, co-location availability, conditions for site access) to access seekers as part of the reference offer as specified in its SMP condition.

Database costs:

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29 From BoR (11) 06, Ch. 5: Several MS already have some sort of database containing information on civil engineering infrastructure (Denmark, Estonia, Germany, Italy, Lithuania, Portugal, Slovenia, Spain, Switzerland). and a few countries have plans to establish such a database or did not finally decide yet (Austria, Czech Republic, Malta, Romania).

30 Proposal in consultation

31 And, in the future, Italy and Portugal, as a separate (from the SMP operator's) database.

32 In the case of Germany data is provided on a voluntary basis. The data are not provided as an SMP obligation.

Where these databases are required as part of an SMP obligation, as previously stated[33], only those incremental costs arising as a result of the obligation imposed to develop a database to be accessed by the beneficiaries should be considered relevant. BEREC expects that the SMP-operator should have already built its database (and geo systems) for own use.

In Spain, the access price is included in the price per meter of duct used. In Portugal, both the principles of cost-orientation (yearly access price and geographic segmentation) and incremental costs (i.e. only those incremental costs resulting from the SMP obligation to develop a database are considered) apply[34]. In Italy the cost of the database will be included in the access fee to civil infrastructure and dark fibre.[35]

Content of the database:

Typically, these databases contain information on the location of ducts and associated infrastructure whereas information on empty capacity of ducts is provided in few countries only (Germany, Portugal). Alternatively, where duct capacity is not indicated due to global unavailability, a procedure to obtain such information for the infrastructure indicated in a specific request should be available. These duct capacity results are required before starting the deployment. Even more, in the event that the original demand cannot be fulfilled due to capacity restrictions, an alternative path should be delivered. That is the solution adopted for example in Spain.

In some countries databases not only encompass information on fixed network infrastructure but also on wireless infrastructure (Germany and, in the future, in Portugal) or provide information on joint digging efforts of other telecommunication companies (Denmark).

Best practices / preliminary conclusions

- At this stage a database exists in around one third of all countries. However, there are differences as to whether the database follows from a regulatory obligation (4 countries) or not, by whom it is run (e.g. incumbent or NRA/ministry), and whether it contains only data of telcos or also of non-telcos (see B.6 for details).

- BEREC is of the opinion (in agreement with the determinations of the Annex II of the NGA-Recommendation) that the SMP operator should build such a database, where available and feasible, of civil infrastructure, covering its organization (and technical characteristics of its different elements), their geographical location (ducts, poles, distribution

33 BoR (10) 08 footnote 62.

34 For example, costs of surveying are not included.

35 Proposal in consultation

points and any other physical asset), including available space in ducts. BEREC considers such remedy essential for the useage of access to civil infrastructure.

- Given the context of the Recommendation, where only obligations to be imposed on SMP operators are listed, and the scope of this particular access obligation – under "Access to civil engineering infrastructure of the SMP operator" and Market 4 obligations –, BEREC considers that this infrastructure database, as defined by the Recommendation, should at least contain all ducts of the SMP operator.

- BEREC is of the opinion that such a database is deemed necessary, but it is not enough to provide information regarding the location of the civil infrastructure of the SMP operator, but also information on the effective availability (or not) of space, e.g. in ducts, since this is necessary for the alternative operators to effectively deploy their (fibre) networks.

C Access to terminating segment in the case of FTTH

C.1 Relevant provisions of the NGA-Recommendation

Article 18[36] of the Recommendation mandates *NRAs to impose "access to the terminating segment of the* [FTTH] *access network of the SMP operator including* [fibre] *wiring inside building*", recognising (Recital 16) the cost and inefficiency of duplicating the terminating segment.

This access is deemed necessary to allow for sustainable infrastructure competition and be granted at a level (and with necessary interfaces) in the network of the SMP operator to enable entrants to achieve minimum efficient scale. Hence (Article 18), "*NRAs should determine where the distribution point*[37] *of the terminating segment*[38] *should be"*, taking into account

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36 *"(18) Where an SMP operator deploys FTTH, NRAs should* (…) *mandate access to the terminating segment of the access network of the SMP operator, including wiring inside buildings. For this purpose, NRAs should oblige the SMP operator to provide detailed information on its access network architecture and, following consultation with potential access seekers on viable access points, determine where the distribution point of the terminating segment of the access network should be for the purpose of mandating access* (…)*. In making such determination, NRAs should take into account the fact that any distribution point will need to host a sufficient number of end-users connections to be commercially viable for the access seeker*".

37 The 'distribution point' is defined in Art. 11 of the NGA-Recommendation as "*an intermediary node in an NGA network from where one or several fibre cables coming from the MPoP (the feeder segment) are split and distributed to connect to end-users' premises (the terminating or drop segment). A distribution point generally serves several buildings or houses. It can be located either at the base of a building (in case of multi-dwelling units), or in the street*".

the fact that this node will need to host a sufficient number of end-users' connections to be viable and "*in accordance with the principle of equivalence as set out in Annex II"* (Article 19)[39]*.*

As transparency and non-discrimination obligations are required to ensure the effectiveness of access to the terminating segment, the SMP operator, on request, should publish an adequate reference offer within a short timeframe (in less than 6 months) in order to allow access seekers to make investment choices (Recital 17). Moreover, the access to the terminating segment should be provided at cost oriented prices "*in accordance with Annex I*" (Article 20)[40].

Article 21 states that NRAs, if demanded, *"should encourage, or, where legally possible* (…)*, oblige the SMP operator to deploy multiple fibre in the terminating segment*", as these networks "*can be deployed at a marginally higher cost than single fibre networks, while allowing alternative operators each to control their own connection up to the end-user*" (Recital 19), promoting long-term sustainable competition.

On another stage, the Commission acknowledges – see Recital 13 and Article 7[41] – that obligations of reciprocal sharing of facilities at the terminating segments' level may be imposed, in accordance with Article 12 AD, as long as it is justified on the grounds that duplication of this infrastructure is economically inefficient or physically impracticable.

C.2 Availability in Practice

In MS where access to the terminating segment is mandated, it is either included in Market 4 (SMP obligation) or imposed via symmetric obligations.[42]

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38 'Terminating segment' is defined in Art. 11: *"The "terminating segment" means the segment of an NGA access network which connects an end-user's premises to the first distribution point. The terminatingsegment thus includes vertical in-building wiring and possibly horizontal wiring up to an optical splitter located in a building's basement or a nearby manhole."*

39 "*(19) The SMP operator should be obliged to provide access to the distribution points in accordance with the principle of equivalence as set out in Annex II. Where there is a request for a reference offer for access to the terminating segment, NRAs should mandate such offer as soon as possible. The reference offer should be in place not later than six months after such request has been made*".

40 "*(20) NRAs should ensure that access to the terminating segment is provided at cost oriented prices in accordance with Annex I*".

41 "*(7) When applying symmetric measures under Article 12 of Directive 2002/21/EC granting access to an undertaking's civil engineering infrastructure and terminating segment, NRAs should take implementing measures under Article 5 of Directive 2002/19/EC*".

42 See Annex "General table" and Table "D. FttH terminating"

Access to in-house wiring or equivalent is mandated (SMP-based) in some 6 MS (FYROMacedonia, Hungary, Italy, Lithuania, Poland, Slovenia). In Slovenia and in Italy it is under discussion[43]. In Germany it is not explicitly mandated, however implicitely encompassed by unbundling.

In Spain[44], France[45], Portugal[46] and in Croatia[47] access to the terminating segment, in case of FttH is mandated through symmetrical regulation.

The other MS do not currently apply obligations to provide access to the fibre terminating segment (including in-house wiring).

C.3 Commission's Comments

Since the enforcement of the NGA-Recommendation, the Commission issued comments only for the symmetric regulation of access to the terminating segment outside very-high density areas (case FR/2010/1144).

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43 Agcom proposed as obligation for the incumbent operator to provide access to its terminating segment independently if it is copper or fibre based.

44 Symmetrical measures were imposed February 2009 by CMT, aided to promote and facilitate sharing of fibre deployments within and near buildings, valid for buildings without Common Telecommunications Infrastructures (those built before 1998). These measures establish that operators that deploy in-building fibre wirings shall meet all reasonable access requests, and are obliged to agree with third parties procedures, technical constrains, prices and timings with regards to the provision of access to the fibre facilities installed

45 The "Law on the Modernisation of the Economy" ("Loi de Modernisation de l'Economie", LME) foresees an obligation to share in-building fibre wiring at reasonable, transparent and non-discriminatory economical and technical conditions, at a local connection point ("point de mutualisation") located outside the private property, unless decided otherwise by the NRA. It applies symmetrically to all operators. ARCEP implemented the law through decisions 2009-1106 and 2010-1312.

46 In Portugal, a 2009 Decree-Law imposes the set up of fibre optics in the scope of the infrastructures for telecommunications in buildings, by sharing of the new (or upgraded) infra-structure within the building. The first operator to reach a (already built) building has to install at least two fibres per flat and associated infra-structure to be shared by other operators (e.g. vertical infra-structure and ODF).

47 In Croatia, Ordinance on technical requirements and conditions of use of optical distribution networks (in force from 4Q 2010) stipulates the requirements which have to be fulfilled in developing, planning, designing, building, using and maintaining an optical fibre access network. The optical fiber network has to be build as an optical distribution network that is an important element of the electronic communication infrastructure. Optical distribution network is connecting end-user and the distribution point. The provisions of this Ordinance must be applied as fundamental requirements when planning and building a new optical distribution network, and in the reconstruction or up-grading of existing optical fibre networks. The network topology of the optical distribution network must be build based on the point-to-point architecture.

The Commission first commented on the fact that the notified decision gives only guiding principles that can lead to a lack of legal certainty. About the access to the concentration point and provision of backhaul, the Commission indicates that *"NRAs may mandate the sharing of civil engineering infrastructures and terminating segments where this is justified on the grounds that duplication of such infrastructure would be economically inefficient or physically impracticable"* and therefore *"should take into account the fact that any distribution point will need to host a sufficient number of end-user connections to be commercially viable for the access seekers".* As the notified decision imposes a backhaul obligation for small concentration/distribution points, the Commission *"recalls that such access and backhaul remedies should, in principle, be implemented by a NRA only after a market analysis and a finding of SMP and should address all necessary technical and pricing conditions".*

On consistency between symmetric and SMP regulation, the Commission *"invites ARCEP to closely monitor the development of NGA investment and competition both in the densely populated and in the less densely populated areas with view to evaluate whether the symmetric regulation scheme remains sufficient to ensure competition"*.

C.4 Product Description

Access to the terminating segment[48] in a FttH scenario is a wholesale product related to the access/sharing of the fibre (sub)loop/fibre drop cable (including vertical in-house wiring), provided by the SMP operator, a "building operator" (or by the condominium in some cases).

An operator reaching the building accesses the terminating segment at the concentration/distribution point and connects this optical fibre to his own fibre[49], which runs up to a MPoP (where the ODF is located)[50]. Hence, this access product is a pure passive – layer 1 – product, allowing the access seekers to fully control and manage their fibre infra-structure and services end-to-end, in a similar manner to fibre unbundling[51].

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48 In the NGA-Recommendation, 'terminating segment' represents "*the segment of an NGA access network which connects an end-user's premises to the first distribution point. The terminating segment thus includes vertical in-building wiring and possibly horizontal wiring up to an optical splitter located in a building's basement or a nearby manhole*".

49 Within a building, in-house wiring is deployed between e.g. the basement and each flat, normally inside dedicated cable trays. In a "mono fibre" scenario, when an operator reaches a building, it rolls-out point-to-point fibre in the cable trays so as to connect each of the flats with an individual optical loop.

50 This fibre, from the distribution point to the ODF, might make use of another wholesale like "duct access" in order to be laid down.

51 It is worth noting that access to the terminating segment implies a point-to-point structure from the end-user to the distribution point , but the "outside-plant" architecture of the operators making use of this wholesale

Although this product typically provides access to the vertical fibre infrastructure within buildings in higher density areas, with the access/distribution point typically located in the basement of the building (Portugal, Spain, France in very-high density areas, Italy) this might not be always the case. According to a criteria of efficiency, the access point can be located at a concentration/distribution point outside and close to the building (e.g. at the facade, manhole/pole or in a street cabinet)[52], especially in less dense areas (Italy, France outside very-high density areas, Spain).

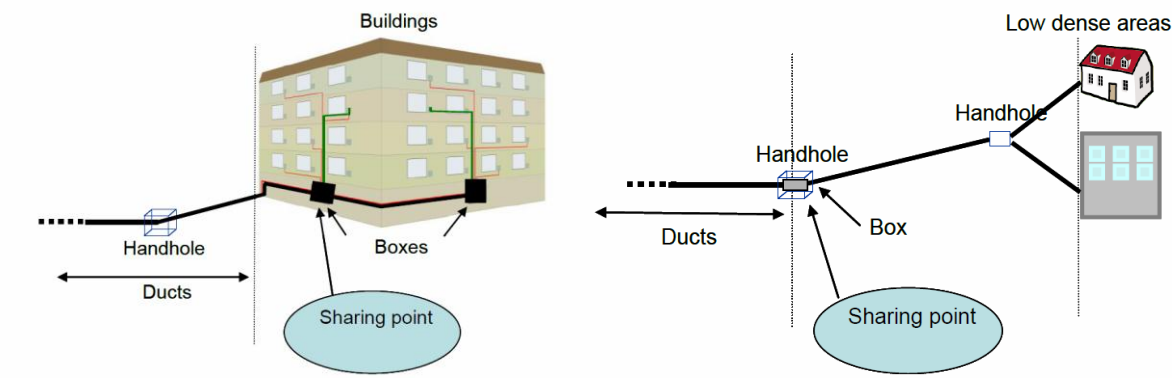

Figure 2: Terminating segment

In any case, the fibre wiring architecture might be single- or multifibre (several fibres per home/end-user).

C.5 Implementation Issues

A "vertical barrier" was identified by the ERG (e.g. CP NGA) as one of the key potential issues that operators deploying an NGA would have to face. In fact, on the basis that, typically, only one 'optical in-house wiring' could be rolled out[53], the terminating segment may represent a structural barrier for all competitors, incumbent included, insofar as there would be a risk that the (incumbent and/or the) first operator who reaches a building preempts this facility, thus preventing its competitors from having access to the end-users in that building. Moreover, several in-house wiring deployments may lead to significant annoyance to building's inhabitants.

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product can be either point-to-point or point-to-multipoint, the latter being the case when several fibres of multiple end users in the same distribution point are connected to one single fibre through an optical splitter.

52 The distribution/sharing point corresponds to the location of the 'optical termination boxes' and may be placed in the building itself or in the public domain. See, e.g., sections C1 and C.2 of BoR(10)08.

53 Either by economical or technical reasons (considering the cable trays could be already occupied or non-existing, e.g. in old buildings.

In connection with the above a competitive problem could arise in areas where the terminating segment has not yet been fully built. If the deploying operator has established a fibre network to the street level but the drop cable from the street to the customer's property still needs to be built, the deploying operator could gain a first-mover advantage on the alternative operators. As the deploying operator decides when to install the drop cable, the deploying operator would – in these areas – always be the first operator to offer retail broadband products based on the access to the terminating segment. Thus, the only way alternative operators could acquire retail customers in these areas is to persuade them to switch from the deploying operator.

a) Access obligation

To overcome this vertical barrier, BEREC supports that access be granted to the SMP operator's terminating segment (including fibre in-house wiring), as recommended by the Commission in Article 18 of the NGA-Recommendation.

There are MS where in-house wiring is owned by the property-owner (Norway, Sweden) and not included in Market 4. This also applies for Portugal for new buildings (constructed after 2005), or for Spain for buildings constructed after 1998. In other MS, it is unclear whether it is owned by the operator (typically the incumbent/SMP operator) or house owners. In any case, the incumbent might however be in a more advantageous position than its competitors, insofar as it can have privileged relationships with (co-) ownership property representatives due to its former copper local loop monopoly status as would the electricity company. Property thus plays a role in this wholesale access product, because access to the terminating segment at a (distribution) point located within the building could imply access to an infrastructure which is not property of the SMP operator. However, it must be noted that access to the fibre at a higher point in the network, like the ODF (or man-hole), is not impacted by property of the terminating segment, as the obligation is imposed on the SMP operator, which owns the fibre connecting down to the terminating segment.

The first-mover issue arising in situations where the drop cable of the deploying operator's network is yet to be built, could be addressed by imposing an access remedy on the deploying operator to build this part of the terminating segment when alternative operators request it in order to provide retail broadband services to the relevant end user. Such an approach would secure equal and non-discriminatory access to the terminating segment and eliminate the first-mover advantage otherwise held by the deploying operator. Also in the context of co-investment in the terminating segment, the deploying operator could be mandated to let another co-investing operator build the drop cable for its own customers to simplify the connection process. Most notably, access to the terminating segment can also be imposed as a symmetrical obligation, i.e., not based on SMP findings and obligations. This is the case currently in France, Portugal and Spain.

In these countries, the legal basis has been, up to now, a national law. However, with the adoption of the EU electronic communications reform package in November 2009, there exists now the possibility of imposing symmetrical access based on Article 12 FD (Directive 2002/21/EC). In this case, access can be provided through the rental/share of the facility or through co-investment with the (first) operator installing the terminating segment.

This sharing principle would consider that any operator reaching a building (or the property owner) grants and shares access for all (its) competitors at the distribution/sharing point – consisting of a kind of optical distribution frame –, at which level every end-user is connected by a point-to-point fibre. In this sense, the access conditions on in-building operators should apply not only to electronic communications operators (including the incumbent) but also to any undertaking having established or operating an in-building optical fibre line, since they control access to the end-users.

When symmetrical access is imposed based on Art. 12 FD, the considerations made above about property of the terminating segment might not be applicable. Paragraph 1 of the mentioned article states that "*Where an undertaking providing electronic communications networks has the right under national legislation to install facilities on, over or under public or private property, or may take a vantage of a procedure for the expropriation or use of property, national regulatory authorities shall, taking full account of the principle of proportionality, be able to impose the sharing of such facilities or property, including buildings, entries to buildings, building wiring, masts, antennae, towers and other supporting constructions, ducts, conduits, manholes, cabinets*". Accordingly, it is the right to install facilities (in this case, optical infrastructure for the terminating segment) that is relevant for the obligation, not the property of the facility itself.

As long as it is considered that the duplication of in-house wiring infrastructure is economically inefficient or physically impracticable, the imposition of facility-sharing – symmetrical regulation – is in line with the NGA-Recommendation (Article 7) and the AD.

b) Distribution/sharing point

An important issue to be considered when imposing access to terminating segments is the determination (of the 'convenient' location, Art. 18) of a distribution point for access to the terminating segment (including in-house wiring) of the SMP operator (or the 'first operator' in case of symmetrical access).

In GPON implementations – the network topology already chosen by several incumbents and alternative operators in some MS –, the distribution/concentration point may be located within the building (in very dense areas[54]) or very close to the building, precisely where the last splitter is located and several (up to 32 per splitter, normally) end-users can be connected through point-to-point fibre. Currently, there is no technical solution to access a terminating segment in a GPON network at a point before this last splitter.

Such a distribution/concentration implies less favourable scales compared to the one achieved with fibre local loop unbundling at the MPoP (ODF). The number of distribution/concentration points will be much higher than the number of street cabinets and its size (users connected) normally much lower. However, in sparsely dense areas, the distribution/concentration point can group a larger number of lines depending on local geographic issues and economic considerations.

When several operators deploy fibre terminating segment at the same time in specific areas, the NRA might recommend rules in order to avoid either portions of uncovered areas or overlap of deployments (instead of multiple fibre deployments)[55]. These rules could include the definition of an elementary zone for the deployment of terminating segments and the obligation to consult the other operators involved in FttH deployments before to start the installation of the terminating segment in the area.

In summary, the relevant location of the point of access depends essentially on one hand on the architecture chosen by the SMP (/first) operator reaching the area, on the other hand on economic facts, considering namely the population density of the area.

In any case, BEREC recommends that NRAs oblige the SMP operator and/or in-building (terminating segments') operators to meet reasonable requests for passive access to its fibre (sub)loops at a close distribution/sharing point and to the required associated facilities at reasonable and non-discriminatory conditions. This distribution/concentration point could be located either at the base of the building (in case of big buildings), or in the street, at a higher network level so as to aggregate several buildings or houses. For GPON implementations it must be where the last splitter is. However it may have to be acknowledged that the determination of the concentration point is a challenging task in practice.

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54 For example, in France both incumbent and competitors focus on FttH roll-out in bigger cities.

55 I.e., a multiple fibre deployment should be preferable to several deployments of single fibre.

In France, the NRA set different rules for the location of the distribution point to access the terminating segment according to the area density. In very-high density areas[56], the distribution/concentration point can be located at the base of the large buildings (with 12 or more households).[57] These decisions are designed to reflect the general case. However, to cope with the diversity of particular local cases in term of geographical topology, the operators can make different choices if they can justify them.

In Portugal, the distribution/concentration point is in the (basement of the) building. In Spain, the distribution/concentration point (optical termination box) may be placed in the building itself or in the public domain, according to criteria of efficiency of the first operator. In these cases, the determination of the distribution/concentration point is based on symmetrical regulation only.

c) Mono or multi fibre terminating segment architecture

The Commission encourages the deployment of multiple fibres and in Switzerland and France, multi-fibre solutions are under discussion for an easier access by competitors to the fibre terminating segment.

However, in case several operators want to reach the same building, some problems may arise with parallel in-house wirings, not only because of possible lack of space (or even lack of dedicated cable trays), but especially because co-ownership property representatives could refuse the roll-out of more than one in-house optical wiring (e.g. if it is not done at the same time). To ensure that multi-fibres terminating segment deployments are installed once, the NRA could recommend a notification process between the operators. In such scheme, the first operator notifies the other operators which can ask for a dedicated fibre. Then, the first operator installs as many fibres per household as required by all the operators.

In (less dense) areas where the terminating segment can include civil engineering in the horizontal deployments, or in areas where space in ducts is scarce, the use of multi-fibre architecture can lead to cost inefficiencies. In this case, mono-fibre architecture may be preferred. Moreover, as the multiplication of the fibre infrastructure is economically inefficient or physically impracticable, obligations of symmetric sharing of facilities at the terminating segments' level may be imposed.

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56 ARCEP - Décision 2009-1106

57 For smaller buildings, this point can be deployed in the street. Outside very-high density areas, the distribution point should aggregate at least 1000 lines in order to provide sufficient economies of scale for a competitive connection of that point. ARCEP - Décision 2010-1312

In any case, a particular technical solution for the sharing of elements is not imposed, as there is not a single optimum scenario, technological neutrality must be preserved and the mentioned elements are subject to rapid evolution. The provisions must allow operators (SMP and/or first operators) to choose either a point-to-multipoint (PON) or a point-to-point (P2P) network architecture (technology neutrality).

d) Reference offer

Access to the fibre terminating segment should be provided under transparent and non-discriminatory conditions (in conformity with the NGA-Recommendation, Art. 19), through a reference offer when there is a request for it (from an operator).

To this end, the SMP operator is required to publish, within a short period of time – no longer than 6 months –, a (reference) access offer containing the conditions for the access to dedicated or shared fibre lines and to associated resources (distribution panels/ODF, cable trays, etc.). Such (reference) offers must then foresee the establishment of procedures, technical implementations and timing so that other operators can share fibre resources under reasonable conditions in terms of operation or costs. In addition, to avoid that third operators encounter entry barriers such as property access negatives or lack of space for additional fibre deployments, the SMP operator deploying fibre within buildings should be the sole responsible for the management of the network resources and interaction with the property owners[58].

It should be noted that the NGA-Recommendation is addressing the remedies to be mandated to SMP operators. As mentioned before, an alternative means is the imposition of symmetrical obligations. However, it is unclear how the provisions contained in the NGA-Recommendation (in this case: Articles 18-21) apply in such a case. Symmetric obligations usually impose access in a generic obligation, and do not, for example, include specific regulated prices. Also, the reference offer would, if imposed, apply to all operators, and all reference offers should be, if not the same, at least very similar to avoid incompatibilities and discriminations. This scenario has therefore a much higher complexity to manage than the SMP-based obligations.

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58 Moreover, the SMP/first operator's offer could provide third parties with information needed to plan their access requests, such where optical cabling has been laid, type of deployment, characteristics of the distribution points and of the vertical cabling, available space in vertical ducts for additional fibres, etc.

e) Costing and pricing issues

NGA-Recommendation foresees (in Annex I) that "*NRAs should set prices for access to the distribution point consistently with the methodology used for pricing access to the unbundled local copper loop*[59]".

BEREC is of the opinion that access pricing conditions must follow the principles of non-discrimination, objectivity, pertinence and efficiency of investment. The offered prices cannot be excessive and cannot represent a barrier to entry[60]. They must allow the first operator (even if it is the SMP operator) to recover the incremental costs associated with the access/sharing. This is valid both for SMP and symmetric regulated access.

Although some MS have imposed cost oriented prices on the SMP operator's terminating segment offers (FYROMacedonia, Hungary, Italy, Lithuania, Poland, Slovenia), others, namely France and Spain, request that access prices are reasonable, under a symmetrical regulation scenario. In Portugal, the costs must be fully shared by all the operators rolling out to the building, sharing fibre resources.

However, one should consider the cases where access seekers request access to the distribution/concentration point prior to the roll-out of fibre into the building or, instead, where operators access the distribution/concentration point after the roll-out. In some cases (if not under co-investment or if there are no firm access requests from operators), it could be reasonable to allow the SMP/first operator to require a financial participation and that the price includes a rate of return on capital that takes account of the initial investment risk and attributes a premium to that operator.

It must also be considered that in-house fibre wiring is possibly not deployed for all tenants in a building at once, for cost reasons, but rather on a demand basis (so that a new customer always implies a new fibre deployment from a junction box). Therefore, a new customer has an associated deployment cost to the operator related to the laying-down of optical fibre within the flat.

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59 "*NRAs should ensure that access prices reflect the costs effectively borne by the SMP operator, including, where appropriate, a higher risk premium to reflect any additional and quantifiable risk incurred by the SMP operator*".

60 Although, in any case, for a FttH scenario, next to the horizontal costs (civil infrastructure and fibre roll-out , which are by far the most significant cost component), the cost associated with the vertical roll-out (for in-house wiring) may be also very significant, even more so if there is limited space for (new) in-house wiring, aggravating fibre roll-out to the end-users.

Best practices / preliminary conclusions

- In almost one out of 3 countries access to the terminating segment is mandated, either as an SMP obligation in Market 4 (6 countries) or imposed via symmetric obligations (4 countries).

- The access/distribution point typically is located in the basement of the building (Portugal, Spain, France in very-high density areas, Italy), which implies that the terminating segment refers to in-house cabling.

- However the access point can also be located at a concentration/distribution point outside or close to the building (e.g. at the facade, manhole/pole or in a street cabinet)[61], especially in less dense areas (Italy, France outside very-high density areas, Spain).

- There seems to be agreement across MS that in-house cabling can be considered as economically difficult to duplicate. In such cases, symmetric regulation may be generally appropriate. In many countries in-house cabling is also subject to civil law which can restrict the applicability of regulation.

- Ten countries have imposed either FTTH unbundling or access to the terminating segment. Five countries have imposed both remedies simultaneously.

D Unbundled access to the fibre loop in the case of FTTH

D.1 Relevant provisions of the NGA-Recommendation

Where SMP is found within market 4 an appropriate set of remedies should be applied (Art 11). According to Article 22 where the SMP operator deploys FttH, NRA's should in principle (if SMP is found on the relevant market) mandate unbundled access to the fibre loop. Access should be given at the most appropriate point in the network (MPoP). The imposition of unbundled access should be accompanied by appropriate measure assuring co-location and backhaul.

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61 The distribution/sharing point corresponds to the location of the 'optical termination boxes' and may be placed in the building itself or in the public domain. See, e.g., sections C1 and C.2 of BoR(10)08.

Where unbundled access to the fibre loop is mandated, the existing LLU reference offer should be amended to include all relevant access conditions including financial conditions relative to the unbundling of the fibre loop, according to Annex II of Directive 2002/19/EC, which contains a minimum list of conditions (Art 22). The reference offer should be in place as soon as possible and in any case not later than six months after an NRA imposed the obligation to grant access (Art. 24).

The price of access to the fibre loop should be cost oriented (Art. 25). The deployment of FttH will normally entail considerable risks (e.g. uncertainty about the demand for enhanced services and the take up of FttH). That's why the cost of capital of the SMP operator for the purpose of setting access prices should reflect the higher risk of investment relative to the investment into current networks (Risk premium) (Art. 23).

Risk sharing may lead to a more timely and more efficient deployment of NGA networks. That is why NRA's should asses and under certain conditions[62] facilitate pricing schemes, like upfront commitments on long-term or volume contracts, proposed by the SMP operator to diversify the risk of the investment. However NRA's should ensure that pricing arrangements do not lead to a margin squeeze preventing efficient market entry (Art. 24-26).

Co-investment into NGA networks may reduce both the cost and the risk incurred by an undertaking investing in FttH roll-out and can thus lead to a more extensive deployment of FttH (Art. 27). Arrangements for co-investment in FttH based on multiple fibre lines may in certain conditions also lead to a situation of effective competition in the geographical areas covered by the co-investment (Art. 28). In such a situation and under certain conditions the definition of a separate market could be justified as competitive conditions between different geographical areas can substantially and objectively differ (Art. 28).

D.2 Availability in Practice

In several countries (Croatia, Finland, Germany, Hungary, Lithuania, Netherlands, Poland, Slovenia, Sweden) regulated unbundled access to the fibre loop (ODF access) is available (BoR 11 (06), paragraph 3.4).[63] In Slovakia FttH unbundling (point-to-multipoint) is proposed (under consultation).

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62 See section on pricing and risk.

63 See Annex "General table" and Table "E. FttH unbundling"

In some countries fibre is included in Market 4, however unbundling it is not imposed: Czech Republic, France, FYROMacedonia, Ireland, Malta, Norway, Portugal, Romania, Switzerland, United Kingdom. In other countries fibre is not included in Market 4: Austria, Belgium, Denmark, Greece and Spain.

In all countries where ODF unbundling is imposed NRAs typically impose an access obligation, transparency, non-discrimination and a reference offer as foreseen in the NGA-Recommendation. In Germany the obligation to provide a reference offer contains an abstract obligation to encompass all forms of access. The actual provision by the incumbent of a formulated reference offer for FttH depends on sufficient general demand. In several member states the reference offer should be available within six months (Sweden – within three months).

There are no member states where unbundled access to the fiber loop of the SMP operator is only available in certain geographical areas (BoR 11 (06), paragraph 3.4). Although in Poland access to fibre loops is only granted if no access to ducts or dark fibres is possible in a given local loop (BoR 11 (06)b, p. 227). Some NRA's allow geographical differentiated price differences to create neutral investment signals (e.g. Sweden, Netherlands).

Member states typically apply cost-orientation. An LRIC approach is applied in Hungary, Italy[64], Slovenia, and Sweden. Poland implements a cost oriented model according to Art 13. AD. In Germany prices are subject to ex post rate regulation, but an ex-ante margin squeeze serves as a peg to ensure cost-oriented prices for FTTH access. Price regulation in the Netherlands is based on a Discounted Cash Flow (DCF) model. In Croatia prices do not have to be cost-oriented, but only reasonable. In Finland cost orientation is not applied. Some countries accompany cost-orientation with a margin-squeeze test (e.g. Netherlands, Poland, Slovenia) while others do not (e.g. Lithuania, Sweden).

An explicit risk premium is applied for FTTH unbundling in two out of eleven countries, in Lithuania and the Netherlands[65].The application of a risk premium in case of newly built infrastructure is under consultation in Italy. This implies that a number of countries did not consider a higher interest rate appropriate. However other NRAs have taken account of risk by carefully assessing the factors of uncertainty mentioned in Annex I Section 6 of the NGA Recommendation (e.g. by considering moderate demand figure etc).

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64 Proposal in consultation

65 Only in the case of overpermance to compensate for asymmetrical risk. See D.6.

Long-term access pricing schemes are currently not applied in member states. Volumes discounts are allowed in e.g. Netherland and Sweden. In the Netherlands volumes discounts are available to all access seekers based on the total market volume. In Sweden discounts are allowed as long as the incumbent can prove that the discount is non-discriminatory and based on actual cost savings due to variables such as volumes or commitment.

Fibre unbundling is not imposed in a number of MS with different reasoning and due to different circumstances such as:

- Fibre is not included in the market (e.g. Austria, Belgium, Denmark and Spain)
- Fibre unbundling in a GPON architecture at the passive optical splitter at a distribution point between the street cabinet and the end user premises was considered likely to be costly and impractical, given the large number of passive splitter locations and the switching process for disconnecting/reconnecting end user fibres requiring significant manual intervention (e.g. UK).
- Fibre unbundling is not considered imperatively necessary in view of symmetric measures (e.g. France). It is considered that access to the terminating segment in less dense areas comes close to unbundling.

Co-invest in FttH based on multiple fibre lines on the basis of co-investment contracts, which regulate rights and duties of the partners regarding NGAN construction and access are only available in Switzerland. In France a similar letter of intent has recently been concluded however not based on multiple fibre lines.

D.3 Relevant Commission comments

The Commission has, in preparing the NGA-Recommendation and after its adoption, stressed the importance of fibre unbundling as a principle where FTTH is being rolled out. The Commission is positive to unbundling remedies irrespective of network architecture.

In France access to civil engineering infrastructure complemented by symmetric measures was not considered sufficient and the Commission asked ARCEP to impose additional SMP remedies as necessary.

However in some cases the Commission did not strictly require fibre unbundling for different reasons In the UK VULA was accepted as a transitional remedy until WDM unbundling technology is available in practice. In relation to Ofcom's consultation proposals not to impose

fiber unbundling, the Commission stated that it did not challenge Ofcom's finding that fibre unbundling would not be justified and proportionate today. However, it invited Ofcom to reassess the case for fibre unbundling once it is technically feasible - if necessary, within the four-year forward look period that was used in the market review.

The Commission also considered that NRAs should allow fibre unbundling as a matter of principle, regardless of the type of network architecture deployed. Related to this, it invited Ofcom to assess whether over the forward look period of the review, it could be cost effective for CPs to unbundle BT's GPON network; particularly if BT undertakes selective deployment in densely populated areas where more services could be aggregated.

In Italy e2e service (for more detail see Section on Italy below) has been accepted as a transitional remedy only until fibre unbundling (WDM) will be available. However since, the obligation to provide the e2e-service encompasses a buildout obligation the Commission considers that it may only be justified as a proportionate access remedy in the absence of the availability of access to the fibre already built out by TI. The Commission considered in this case that *access to passive infrastructure and VULA over optical fibres would not be sufficient to safeguard effective competition.*

However the Commission has in a number of notifications commented on fibre unbundling being mandated only in the lack of access to civil engineering such as ducts. For example in the Lithuanian notification (Case LT/2011/1197), the Commission is of the view that both access to civil engineering and fully unbundled access to fibre loops shall be obliged in parallel, and the latter should not be conditional depending on the lack of access to civil engineering.

Moreover, the Commission has commented on the lack of price regulation, and more specific, cost orientation when mandating unbundled fibre, examples are case SK/2011/1210 and SK/2011/1211,[66] December 17th 2009, and DE/2011/1177, February 24th 2011. With regard to DE/2011/1177 the Commission holds the view that application of a margin squeeze test does not normally result in cost-oriented prices and that the approach taken may hamper investment by alternative operators. As a principle, the SMP operator should be obliged to provide the unbundled fibre at a cost oriented price appropriately adjusted for investment risks ideally based on a transparent cost model.

Furthermore regarding Case SK/2011/1210 and SK/2011/1211 the Commission welcomed TUSR decision to mandate unbundling of the SMP oerparo's GPON network. Regarding the upcoming specification on the details of unbundling the Commission reminded TUSR that access should typically be provided at the Metropolitan Point of Presence.

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66 In Slovakia FttH access remedies will be imposed (currently under national consultation).

Summarizing the comments from the Commission on notifications regarding market 4 in connection with the adoption of the NGA-Recommendation, the Commission is strict in its view that as a principle, fibre unbundling shall be mandated, not only second to other remedies such as access to civil engineering.

Considering the comments of the Commission on both unbundled fibre and civil engineering, the conclusion is that the Commission seems to be of the opinion that access on several levels of the value chain is necessary simultaneously.

D.4 Product Definition

FttH networks exist either as point to point architecture or as point-to-multipoint architecture, (BoR (10) 08 C.4 ODF unbundling).

In a point-to-point (P-t-P) FttH architecture a dedicated fibre (or fibres) is available from the ODF to every single end-user. This topology is similar to a traditional copper-based distribution network, where the MDF is replaced by the ODF (at the same or at another location).

In a Point-to-Multipoint FttH architecture, there is no dedicated fibre for each end-user at the ODF. Instead, a single fibre line at the ODF is shared by several end-users. This fibre line is connected to a passive optical splitter, which splits the incoming light over several (outgoing) fibres, each of which might again connect to other splitter(s). This architecture is known as PON (passive optical network). Therefore, only the part of the fibre path that is situated between the last optical splitter and the optical termination point in the end-user‘s home is dedicated, the fibres from that last splitter towards the ODF shares the traffic of all users served by that splitter.

D.5 Implementation Issues

a) Access obligation:

As with copper access unbundling the economies of scale play an important role in the business case of FttH unbundling. The closer the ODF is located to the end users the more equipment entrants have to install and the further operators have to roll out their networks to the concentration point/ODF. So access is only effective if it is granted at a level in the network where entrants are able to achieve a minimum scale and a business case is viable. Like with copper unbundling it may be necessary to supplement ODF unbundling with the obliga-

tion to provide backhaul from the concentration point/ODF to a higher point in the network. Also an obligation to provide co-location service may be a requirement.

b) Costing and pricing issues

See annex 1.

c) Reference offer:

In addition to what was mentioned as necessary elements of a reference offer in the document ERG (07) 53 and Annex II of Directive 2002/19/EC BoR (10) 08 emphasises the need to include in particular the provision of:

- Technical handbook, including type and characteristics of fibres (and/or copper in the case of access to in-house wiring), details of terminations in the concentration point and at end-user premises, types of concentration point (manhole or cabinet, pole, etc.) with description, physical characteristics and dimensions, any other physical implementations of splicing or connecting points. Environmental specifications might also be important;

- Operational handbook, including procedures for ordering and provisioning, procedures for service and maintenance, administration of physical infrastructure, identification etc.

- Information resources for existing and planned facilities, including location of concentration points (manhole, cabinet, other..), geographical area and buildings / customers (OTO) covered from each concentration point, length of fibre from concentration point to each customer, roll-out plans and availability of offer (present and covering plans for a clearly defined period).

According to the Recommendation a reference offer should be in place as soon as possible and at least within six months. Especially with a completely new wholesale product this can be challenging. To speed up the formation of the reference offer it could be an amendment of the current LLU copper reference offer. After the publication of an initial reference offer NRA's could facilitate or organise 'industry groups' where the SMP operator and entrants together can further discuss the elaboration of the reference offer.

D.6 Experiences

Germany

In its last Market 4 determination (March 2011) the Federal Network Agency included the fibre loop for the mass market and obliged Telekom Deutschland GmbH to grant fully unbundled access to the FTTH fibre loop[67].

The point of access for FttH-ULL is located where the customer can be accessed without using active network components of the incumbent. In case of TDM-PON, the access point is the last splitter before the customer. For WDM-PON, access from more remote points is possible.

The notified determination subjects the mass-market FttH local loop and co-location to *ex-post* rate regulation. The German Regulator found that substitutability of copper- and FTTH-ULL for customers and competitors that ex-ante regulated rates serve as a peg to ensure cost-oriented prices for FTTH access through margin-squeeze tests. Furthermore, accounting separation was newly imposed as a consequence of this ex-post regulation.

Besides that, the Federal Network Agency mandated the following obligations: non-discrimination, an obligation to present access agreements to the Federal Network Agency and the obligation to provide a reference offer which contains an abstract obligation to encompass all forms of access. The actual provision by the incumbent of a formulated reference offer for FttH depends on sufficient general demand.

Sweden

The Swedish 2nd generation decision on market 4 was adopted May 24th 2010, preceding the NGA-Recommendation of the Commission from September 20th 2010. Fibre access is cost oriented according to LRIC and the incumbent has an obligation to consider substantial cost differences in different geographical areas.[68] This obligation is intended to prevent the incumbent from distorting competition on local and regional level through means of cross-

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67 http://www.bundesnetzagentur.de/cln_1912/SharedDocs/Pressemitteilungen/EN/2011/110331NewRatesLastMile.html?nn=48242

68 There is no corresponding obligation for LLU and so the SMP may apply a national price based average costs.

subsidising nationally. Sweden has more than 100 fibre network owners, of which most are active in a limited geographical area, such as a municipality.[69] Since the cost of deploying access networks vary depending on geographical and geological conditions and subscribers density, PTS in the decision for market 4 deemed it necessary to impose a geographically differentiated price regulation to create neutral investment signals.

Italy

The incumbent operator will adopt FTTH connections, mainly a GPON network with more than one splitting level; the last splitter is in general installed at the base of the building due to the general predominance in Italy of flats respect to others kind of houses. For this reason unbundling of the fibre loop is substantially equivalent to an access to the terminating segment or in building wiring. Agcom has considered proportionate to mandate access in the form of unbundling from the central office in a technological neutral way. To this aim, Agcom proposed an *end to end* service which provides access to dark fibre from the ODF in the central office where the OAO is collocated until the customer premise equipment. The imposition of the e2e wholesale access service is considered to be the only access solution which is both technically viable and equivalent to the traditional copper unbundling service at the local exchange given that TI deploys a GPON network. The pricing mechanism is composed by a one off fee and a monthly rental fee. Agcom proposed to impose cost oriented prices through a BU-LRIC model. Agcom also proposed a "planning mechanism" for wholesale products: TI is obliged to publish a public announcement 9 months before starting to build its NGA network and to collect pre-ordering of wholesale products available in market 4 ("planning mechanism") from OAO.

AGCOM will consider further solutions for fibre unbundling in GPON networks such as unbundling of fibre based on WDM technologies.

Best practices / preliminary conclusions

- In 10 countries regulated unbundled access to the fibre loop (ODF access) is imposed. In all these countries except for one cost-orientation applies, sometimes accompanied by a margin squeeze test..
- In general, if FttH is included in the relevant market, the incumbent rolls out an FttH network and FttH unbundling is feasible, FttH unbundled access is imposed by NRAs.
- FttH is sometimes not imposed if other (symmetric) passive remedies are imposed already (e.g duct access) that are considered to ensure sufficient competition (in the respective geographical area) or unbundling is not considered feasible. At this points sever-

69 In October 2010, 34 % of the Swedish population had access to fibre

al NRA received comments from the Commission as the Commission seems of the opinion that FttH unbundling should in principle be applied.

- In a GPON architecture imposing unbundling in the form of access at the splitter may turn out to be very similar to imposing access to the terminating segment. The viability of these remedies may depend on the location of the splitter (splitter in the basement of the house, splitter located at the cabinet or some other concentration point between basement and MDF) and how easily this access point can be reached. Therefore supplementing remedies to reach the access point like remedy duct access, dark fibre and/or Ethernet backhaul (right hand side of the ladder) may be needed. Availability of access to sewage system at low cost may also play a role.

- Ten countries have imposed either FTTH unbundling (Croatia, Germany, Netherlands, Slowak Republic, Sweden) or access to the terminating segment (FYROMacedonia, France, Italy, Portugal, Spain). Five countries have imposed both remedies simultaneously (Finland, Hungary, Lithuania, Poland, Slovenia).

- In a GPON architecture unbundling still represents a challenge to regulators. Currently unbundling is technically feasible at the last splitter only. It is uncertain if and at what price alternative technologies like WDM-unbundling allowing unbundling at the MPoP become available. NRAs have proposed different combinations of wholesale remedies to alleviate this situation. It remains to be seen which solution is technically and commercially viable in the long run leading to a competitive market.

- The Commission has rightly recognized that differences in national circumstances may justify different combinations of remedies (Recital 3)

E Access obligations in the case of FTTN

E.1 Relevant provisions of the NGA-Recommendation

Art. 29 foresees that "*NRAs should impose an obligation of unbundled access to the copper sub-loop*".

Such an obligation should be "supplemented by backhaul measures … and by ancillary remedies". Recital 30 mentions as possible backhaul measures[70] "dark fibre (and where relevant copper), Ethernet backhaul or duct access" and points out that *"access seekers should be able to select the solution best fitting their requirements.* Second, an SLU-obligation should be supplemented by "ancillary remedies … such as non-discriminatory access to facilities for co-location, or in their absence, equivalent co-location".

Art. 30 prescribes that *"price of access to all items should be cost-oriented in accordance with Annex I"*.[71] More particular, Recital 32 calls for *"consistent with the pricing of local loop*

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70 Note: Art. 29 does not explicitly mention duct access as Recital 30. However, the wording of Art. 29 *"including fibre and Ethernet backhaul"* implies that it is not exhaustive and that a backhaul measure may also encompass duct access as explicitly mentioned in Rec. 30.

71 Similar, also Recital 32 refers to *"all items necessary for the provision of sub-loop unbundling"*.

unbundling" and Annex I points out *"that NRAs may considers to evaluate these costs using bottom-up modelling or benchmarks, where available"*.

Recital 29 set out that, *"NRAs should, where appropriate, organise a prior consultation of alternative operators potentially interested in sharing street cabinets, and on this basis determine where street cabinets should be adapted and how costs should be allocated"*.

To make an FTTN access obligation become effective in practice Art. 29 points out that *"the reference offer should be in place as soon as possible and in any case not later than six months after an NRA has imposed the obligation to grant access"*.

Furthermore, Recital 31 stresses the importance of transparency and therefore requires the Reference Offer to encompass *"all items … including backhaul and ancillary services"* and to *"incorporate all pricing conditions to allow entrants to calculate the business case for sub-loop unbundling"*.

E.2 Availability in Practice

In two out of three countries cabinet unbundling is available on a mandated basis (Austria, Croatia, Denmark, Finland, France, Germany, Greece, Hungary, Italy under consultation, Lithuania, Malta, Netherlands, Norway, Poland, Romania, Spain, Sweden, Switzerland, United Kingdom).[72] It is provided on a voluntary basis in Estonia.[73]

Cabinet unbundling is included in all countries in Market 4.

It should be noted that, while being available based on a regulatory obligation, in several countries cabinet unbundling is not widely or hardly used at all (e.g. Austria, Denmark, Italy, Norway, UK, Netherlands). Belgium withdrew its cabinet unbundling obligation to remove barriers to future network evolution with vectoring technology.

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72 See „General table" and Table „F. FttN"

73 BoR (11) 06, Chapter. 3.3., for a more detailed overview see BoR (11) 06c

E.3 Commission's Comments

The Commission has not provided comments on FTTN, except for the Belgian decision to withdraw SLU-unbundling: The Commission recalls that, whenever SMP is found in the WPNIA (market 4) market, NRAs should, as a matter of principle, impose an appropriate set of remedies which includes, in case of FTTC deployment, unbundled access to the copper sub-loop. The Commission acknowledges, however, that in the Belgian case 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.

E.4 Product Description

Typically, cabinet unbundling is defined as providing access to the street cabinet. A more general understanding is used e.g. in Denmark, Norway or Slovenia, the latter defining sub-loops as connecting the network termination point to a concentration point or intermediate access point.

Technically, unbundling at the cabinet applies at the physical layer. It should be noted that co-existence with services provided from MDF-based DSLAM may – depending on the distance between MDF and cabinet – require e.g. spectrum shaping at the cabinet-based DSLAM in order to prevent signal deterioration due to cross talk.[74]

E.5 Implementation Issues

a) Access obligation:

In Croatia, sub-loop unbundling has to be provided upon reasonable request (within 90 days from that request). In those location where the incumbent has installed its outside cabinet he has to ensure space for access at the sub-loop and he must also allow the competitor to install a street cabinet at some point of the incumbent's access network.[75] However, despite the regulation of SLU, there is *"no demand"* for this product in practice.

In Denmark for example, based on the current Market 4 decision from 2009, the incumbent has to grant access to collocation in the street cabinets. If there is not sufficient space in the existing street cabinet to collocate the alternative operator TDC has to provide virtual colloca-

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74 Spectral interference between services provided from different locations (e.g. MDF and SDF) in general is an issue not only for ADSL but for all xDSL technologies.

tion. NITA has described that this could be provided by establishing a separate cabinet just beside TDC's street cabinet. TDC then has to pay for the cable connecting their own and the alternative operator's cabinet.[76] However, despite the regulation of SLU, there is *"no demand"* for this product in practice.

In Belgium, due to technical incompatibility with "vectoring" technology, the obligation to provide access to the subloop unbundling was dropped to provide certainty for investing in vectoring (no risk that further demand of SLU in a street cabinet will hamper the investment made in this street cabinet). Due to a lack of usage of SLU, a lack of project to climb the ladder of investment at this level and a lack of existing viable business plan for such investment, the NRA reasoned that there is more benefits for competition and consumers with a bitstream with enhanced performances by vectoring than with an unused possibility to climb the ladder of investment (in particular in the context of platform competition with cable technology Eurodocsiss 3 and the absence of duct to the end user permitting quick and cheaper FTTH deployment). Since this removal is closely related to business plans by the SMP operator to invest in vectoring, the NRA will monitor whether the benefits will indeed occur. The decision contains some conditions that may justify the reintroduction of an obligation to provide SLU:

- Belgacom does not implement vectoring in a reasonable timeframe after commercial availability of vectoring on their existing DSLAM type
- Technological evolution of vectoring allows to use these functionalities also with several DSLAMs on the same subloop
- Technological evolution of vectoring giving similar performances without the need to monitor all VDSL lines in the subloop
- Technological evolution replacing vectoring which may provide a similar performance
- Demand to use SLU using a technology that does not conflict with vectoring

In France the regulated SLU offer shall includes collocation and fiber backhaul.[77]

In Germany a ruling chamber decision as of March 21 2011 requires the incumbent to provide – next to access to the street cabinet – also duct access and, where duct access is not

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75 BoR (10) 08b, Chapter A.3.1

76 BoR (10) 08b, Chapter A.3.2

77 Note: these obligation apply to the „mono-injection" case, where *all the lines are activated near the cabinet impacted*

possible due to capacity reasons, access to dark fibre.[78] Co-location at the cabinet constitutes annex services for unbundling at a street cabinet. The incumbent is required to provide virtual co-location by establishing a separate cabinet (connected via a patch cable) in those cases where access to the existing street cabinet is not possible. The cabinets have sufficient space for up to four further DSLAMs.

In Italy SLU has been confirmed as remedy at the end of the second market analysis and it is extended in case incumbent operator will decide to build up an FTTN architecture. The service is offered with an ancillary service, such as collocation in a separate cabinet built up behind TI's cabinet and technical parameter assessment for the maximum xDSL speed on the copper pair. At the moment there are no volumes sold for this service even if it is available from 2006. The SMP operator asked to Agcom in the last public consultation on NGA remedies for a specific regulatory rule in case "vectoring" technology (actually not installed) will be deployed in the network.

In the UK sub loop unbundling is mainly seen as using separate cabinets, although the formal obligation allows for other variants if requested.[79] In practice, SLU is not used on a large scale and SLU is mainly kept for State Aid cases.

b) Costing and pricing issues:

Regarding the provision of Art. 30 prescribing cost-oriented prices, the situation in MS is as follows: An LR(A)IC cost standard is applied by several MS (e.g. Denmark, Hungary, Italy, Romania, Romania and Slovenia, while in the UK a LRIC+ cost standard is applied. In Italia an LRIC cost standard is under discussion. Spain and Portugal apply cost-orientation. In Poland cost models are used. Germany uses CCA cost statements with cost-allocation based on LRAIC. Norway applies historical costs.

c) Reference offer:

In accordance with the NGA-Recommendation the MS typically impose a reference offer. A reference offer is already available for example in Austria, Italy and the Netherlands.

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78 The obligation to provide access to dark fibre, which was originally also foreseen in the previous decision and, was overruled by a court decision in January 2010, was reimposed with this decision.

79 BoR (11) 06b, p. 342.

In Croatia, the Reference Offer has to be established upon reasonable request (within 90 days from that request).

In Denmark, the Reference Offer has to be established two months after publication of decision. However, the incumbent can gain additional time if it chooses to involve alternative operators in the process establishing the reference offer. The additional time is decided by NITA (three months in relation to latest M4 decision) NITA has received very positive feedback from both sides on this process. Also the subsequent work to validate the reference offer has been reduced/eased.

In Germany, although a reference offer is not yet available, the obligations imposed in individual cases serve as a reference offer in practice because interested parties can apply for similar rulings which can be granted within ten weeks.[80]

In Poland the Reference Offer has to be submitted to approval 3 months after the decision is issued.[81]

In the UK, SLU is an existing and operating Remedy with a reference offer in place.

Best practices / preliminary conclusions

- In the two out of three countries cabinet unbundling is available on a mandated basis. It is provided on a voluntary basis in one country.

- Overall, while SLU is available on a mandated basis in the majority of countries, it is not widely used in practice. Thus, in many instances it may not provide a positive business case for operators. This may be particularly due to unfavourable economies of scale. However in some MS (UK, Germany) SLU plays a role as a complementary remedy for the roll-out of DSL in rural areas.

- Discontinuation of SLU due to the introduction of vectoring implies dismantling of collocation sites and facilities at the street cabinet unless it is used there as a concentration point for the terminating segment and/or unbundling of the splitter in a PON scenario. This requires clear migation rules.

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80 BoR (11) 06b, p. 95

81 BoR (11) 06b, p. 225

- Depending on the status of fibre unbundling different situations may arise in practice: In case of unbundling at the level of the street cabinet operators may be “pushed” to discontinue unbundling in the future and use enhanced bitstream at the MPoP instead. This may occur if there is no option to directly migrate to a fibre unbundling product at this level or at the ODF. Switching to new fibre unbundling technologies at a later stage (i.e. once the operator has de-installed his collocation facilities at the street cabinet) may constitute a significant barrier for the operator if he has to re-install the collocation facilities[82].

- Therefore the regulator might be faced with a dilemma in that he may want to support investment increasing the performance of the VDSL network on the one hand while at the same time allowing competitors to climb the ladder of investment. Such a decision requires a careful evaluation of the trade-offs taking account of the specific circumstances (e.g. are more future proof alternatives available that do not hamper passive wholesale products, the degree of platform competition, demand for unbundling).

F Backhaul Dark fibre

F.1 Relevant provisions of the NGA-Recommendation

The NGA-Recommendation addresses fibre in the chapter *Access to wholesale physical network infrastructure (Market 4)* under the sub-chapter *Access obligations in the case of FTTN*. Backhaul dark fibre is mentioned in recitals 29 and 30:

According to Recital 29 NRAs should impose an obligation of unbundled access to the copper sub-loop. A copper sub-loop unbundling remedy should be supplemented by backhaul measures, including fibre and Ethernet backhaul where appropriate, and by ancillary remedies ensuring its effectiveness and viability, such as non-discriminatory access to facilities for co-location, or in their absence, equivalent co-location. The reference offer should be in place as soon as possible and in any case not later than 6 months after an NRA has imposed the obligation to grant access.

According to Recital 30 when NRAs impose copper sub-loop unbundling, the SMP operator should be required to complement the existing LLU reference offer with all necessary items. The price of access to all items should be cost-oriented in accordance with Annex I.

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82 See ERG (07) 16rev2, p. 50 for a similar argument.

F.2 Availability in Practice

As explained in BoR (11) 06, Ch. 2.2 backhaul dark fibre products are available in a large number of countries throughout Europe.

In the following countries, access to dark fibre is mandated:[83]

- Austria

  Dark fibre backhauling mandated for SMP operator to be available subsidiary to duct access in whole access network (not restricted to NGA areas), i.e. dark fibre has to be made available in the case of duct access not to be available or not to be usable from a commercial point of view; access points at major concentration points, i.e. MDF, street cabinet, remote access unit.

- Denmark

  Dark fibre backhauling to be provided by the SMP operator as an ancillary service in market 4. Backhaul is regulated from the street cabinet up to a higher point in the network.

- Croatia

  Dark fibre backhauling between MDF and street cabinet (access to the sub-loop) has to be offered on a non-discriminatory base. Dark fibre is mandated for SMP operator in the case of no space being available in ducts. Currently not used in practice.

- Germany

  In Germany, dark fibre is mandated on a conditional basis as an ancillary service to SLU. This means that access to dark fibre is only granted if free duct capacities are not available.

- Hungary

  about to be notified

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83 See „General table“ and Table „H. WBA”

- Italy

  Dark fibre backhauling consisting in the provision and maintenance of continuous sections of fibre belonging to the SMP operator's access and backhauling network. Reference offer already published by SMP operator. The dark fibre will be provided from the central office where the operator is co-located to the point of separation between the primary optical network and the secondary optical network segments (this is the point where the street cabinet or the first splitter of a GPON architecture are located) and from this point to the base of the building, where the terminating segment starts. The mandated access of dark fibre has been imposed independently of the availability of space in duct and independently from the availability. Dark fibre is intended to be used both for backhauling to the fibre or copper terminating segment (FTTH, FTTB) as well as backhauling for the sub loop unbundling in FTTN scenario.

- Lithuania

  Dark fibre backhauling mandated for the SMP operator

- Netherlands

  Dark fibre backhauling to be provided by SMP operator as an ancillary service in market 4. Furthermore, dark fibre backhaul services on FTTH/FTTO are offered as dark fibre services. Backhaul is regulated from the street cabinet up to a higher point in the network (MDF or other aggregation point in the incumbents NGN network). A transparency and reference offer, non-discrimination obligation (including a rule to prevent margin squeeze) and cost-orientation (EDC) apply. The Netherlands are the only country so far to explicitly mention FTTH scenarios within the context of dark fibre backhauling.

- Norway

  Dark fibre backhauling available as part of the incumbent's leased lines offer. Dark fibre is used as backhaul service, but also for other purposes.

- Poland

  Dark fibre backhauling mandated for the SMP operator.

- Slovenia

  Dark fibre backhauling to be made available for the needs of operators for construction of their own network and access to the sub-loop.

- Spain

  Dark fibre backhauling mandated for the SMP operator in the case of no space being available in ducts. Currently not used in practice.

- Sweden

  Dark fibre backhauling mandated for the SMP operator. Dark fibre to be made available up to a maximum length of 50 km.

In Estonia and Portugal the product is available on a voluntary basis.

In the UK, Ofcom have not imposed an access obligation on backhaul dark fibre because alternative effective backhaul solutions are available, in support of both LLU and SLU remedies (wholesale leased lines product) . .

F.3 Commission's Comments

Germany: Com requires to impose dark fibre in parallel with duct access and not conditional on non-availability of free duct capacity.

F.4 Product Description

As explained in BoR (10) 08, D.1.II, dark fibre is a wholesale passive access product (unlit optical fibre) and can be used by operators to connect their equipment in their core networks to access points. As with ducts, dark fibre products could exist at the core or access network levels. However, there is more flexibility in this product (than with ducts), i.e., the installation of new fibre cables is not a costly and prolonged process (although in some cases it may not be feasible due to technical constraints, e.g., no capacity available in ducts). Fibre is a Layer 1 product but supports several Layer 2/transport technologies, as WDM, Ethernet, SDH, etc.

As mentioned in BoR (10) 08 D.2.I, apart from using backhaul dark fibre for connecting FTTN locations to a point deeper in the network, that wholesale product can also be used in FTTH deployment scenarios. While the former is associated with copper sub-loop unbundling, the latter is associated with fibre unbundling. Two scenarios can be differentiated:

- Point-to-point
  Dark fibre backhauling from an optical distribution frame (ODF) location in a Point-to-point scenario (fibre loop unbundling) connecting that ODF location with a point of interconnection deeper in the network (MPoP).

- PON
  Dark fibre backhauling from a splitter location in a PON scenario which would mean, that customer-individual fibres between splitter and customer premises are unbundled (fibre sub-loop unbundling) and connected by means of dark fibre backhauling to a point of interconnection deeper in the network (MPoP).

F.5 Implementation Issues

a) Access obligations:

From BoR (11) 06, Ch. 2.2c): Dark fibre is included in Market 4, sometimes as an ancillary service (e.g. Austria, Netherlands).

From BoR (11) 06, Ch. 2.2g): Sweden refers to the obligation to provide co-locating operators access to co-location space with own or other operators fibre.

b) Costing and pricing issues:

Cost-orientation is applied in Netherlands [EDC] and Poland. An LR(A)IC cost standard is applied by Denmark, Hungary [about to be notified], Slovenia and Sweden. In Italy cost orientation based on BU-LRIC approach is proposed by Agcom in the framework of NGA remedies. Germany uses CCA cost statements with cost-allocation based on LRAIC.

c) Reference offer

As further described in BoR (10) 08, D.1.III, the reference offer for backhaul dark fibre should contain a detailed description of the offering for both access and ancillary facilities as well as conditions for granting regulated access. Especially the following should be included:

- Technical handbook, including type and characteristics of the fibre and the technical description of the ODF where the optical interconnection is taking place.

- Operational handbook, including procedures for ordering and provisioning, procedures for service and maintenance, administration of physical infrastructure, identification, etc.

- Information resources for existing and planned facilities, including geographical data – The definition of specific rules for the provision of dark fibre requires information, by the SMP-operator, on the actual occupation of the ducts as well as the effective use (date of installation and commencement of use) of the installed fibre.

Best practices / preliminary conclusions

- Backhaul dark fibre products are mandated in about 40 % of the countries and in 2 countries it is available on a voluntary basis. (Almost) all NRA's have imposed a supplementing backhaul remedy in the case of sub-loop unbundling. Since sub-loop unbundling is however used to a limited extent only backhaul dark fiber isn't used frequently either.

- The Recommendation specifically refers to backhaul dark fiber in the context of subloop unbundling. Although not explicitly mentioned there, BEREC assumes that fibre in this context means dark fibre, i.e. passive fibre infrastructure without any active equipment attached.

- Furthermore BEREC assumes that dark fibre is *primarily* seen as a possible ancillary remedy in the case of FTTN (i.e. FTTC and FTTB) accompanying sub-loop unbundling of traditional copper lines allowing alternative operators to connect remote units placed at e.g. street cabinets (FTTC) or basement locations (FTTB) to a point deeper in the network (MPoP). Therefore BEREC speaks of *Backhaul* dark fibre in this context. Backhaul dark fibre often is accompanied by other backhaul remedies like backhaul ducts (passive) or backhaul layer 2 Ethernet services (active).

- However BEREC is of the opinion that backhaul dark fiber can be a relevant regulated wholesale product also in combination with other access products (see ladder of investment) as it is used to reached the PoP of an alternative operator deeper in the network. NRAs also imposed backhaul remedies in a scenario of FttH unbundling (e.g Netherlands) and a scenario of terminating access in the case of a PON architecture. In the latter scenario some NRAs also regard access to the terminating segment/in-house wiring in a bundle or unbundled with dark fiber access (from the splitter to a concentration point deeper in the network (e.g. the MDF)) as in an end to end access product' (e.g. Italy). Whether a backhaul dark fiber remedy is proportionate depends on the economics of a specific NGA scenario.

G Wholesale Broadband Access

G.1 Relevant provisions of the NGA-Recommendation

Active access remedies in Market 5

Art. 31- 38: Wholesale broadband access (Market 5)

31. Where SMP is found on Market 5, wholesale broadband access remedies should be maintained or amended for existing services and their chain substitutes. NRAs should consider wholesale broadband access over VDSL as a chain substitute to existing wholesale broadband access over copper-only loops.

32. NRAs should oblige the SMP operator to make new wholesale broadband access products available in principle at least 6 months before the SMP operator or its retail subsidiary markets its own corresponding NGA retail services, unless there are other effective safeguards to guarantee non-discrimination.

33. NRAs should mandate the provision of different wholesale products that best reflect in terms of bandwidth and quality the technological capabilities inherent in the NGA infra- structure so as to enable alternative operators to compete effectively, including for business grade services.

34. NRAs should cooperate with each other in order to define appropriate technical specifications for wholesale broadband access products provided over NGAs and provide information to international standards bodies in order to facilitate the development of relevant industry standards.

35. NRAs should in principle impose cost orientation on mandated wholesale broadband access products in accordance with Annex I, taking into account differences in bandwidth and quality of the various wholesale offers.

36. NRAs should analyse whether an obligation of cost orien tation on mandated wholesale broadband access is necessary to achieve effective competition in case functional separation or other forms of separation have proved effectively to guarantee equivalence of access. In the absence of cost orientation NRAs should monitor the SMP operator's pricing behaviour by applying a properly specified margin-squeeze test.

37. Where NRAs consider that, in a given geographic area, there is effective access to the unbundled fibre loop of the SMP operator's network and that such access is likely to result in effective competition on the downstream level, NRAs should consider removing the obligation of wholesale bitstream access in the area concerned.

38. In examining whether SMP is present NRAs should, in the case of co-investment, be guided by the principles set out in paragraph 28.[84]

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84 The conditions referred to in paragraph 28 of the Recommendation include the number of operators involved, the structure of the jointly controlled network and other arrangements between the co-investors which aim at ensuring effective competition on the downstream market.

Active access remedies in Market 4

There are provisions in the Recommendation for the use of alternative access remedies as a substitute for physical unbundling in Market 4 as a transitional measure. This also refers to active remedies.

Recital 21: “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, provided that these are accompanied by the most appropriate safeguards to ensure equivalence of access and effective competition.”

A ‘raw’ active access product may offer many of the benefits of physical access, such that a wholesale purchaser would not regard WBA products as a good substitute for it. Under Recital 21, such a product could be regarded as falling within market 4 and consequently a remedy for SMP in this market could be based on it for a transitional period.

G.2 Availability in Practice

In many countries enhanced bitstream products are available on a mandated basis (Belgium, Croatia, Denmark, Estonia, Germany, Hungary [about to be notified], Italy, Norway, Poland, Portugal (copper/DSL), Slovenia, Spain, Sweden, The Netherlands [regional PoI], United Kingdom).[85] In other countries such products are provided on a voluntary basis (Lithuania, Switzerland).

G.3 Comments from the Commission

The Commission welcomes the inclusion of fibre access and networks and fibre-based services in both relevant markets (cases NL/2008/0827, SE/2010/1062, UK/2010/1064).

In five cases (PT/2008/0851, DK/2008/0862, FR/2011/1214, IT/2011/1230 and IT/2011/1231) the Commission invites the NRAs to impose remedies on wholesale fibre access products.

In Case DE/2010/1116 the Commission invites BNetzA to clarify that the incumbent should be obliged to up-date its Bitstream offer in time (6 months) before the launch of a new retail service based on fibre.

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85 See BoR (11) 06, Section 3.5

Concerning passive infrastructure, VULA or virtual unbundling products ("vULL") the Commission accepted VULA or vULL as transitory measures in two cases (UK/2010/1064 and AT/2010/1084). But in the Italian cases (IT/2011/1230 and IT/2011/1231) the Commission regarded access to passive infrastructure and VULA over optical fibres as not sufficient to safeguard effective competition.

Furthermore in Italian cases (IT/2011/1230 and IT/2011/1231) the Commission commented that cost orientation can be removed only in case the NRA is in a position to conclude on the existence of sufficient competitive constraints on the SMP operator's downstream arm.

In the Polish case (PL/2011/1184) the Commission asked UKE to adapt the currently used margin squeeze text, which only relates to copper-based access products, with the relevant cost data for fibre-based products. Further guidance in the context of the NGA roll-out was considered necessary in three cases (DK/2008/0862, SE/2010/1062, UK/2010/1064).

G.4 Product Description

- Brief description

Active access products permit a wide spectrum of potential technical characteristics. The selection of these characteristics influences the role that the product can play in the market, the degree of innovation they allow and the type of investment. Article 33 also specifies the need to for WBA products to 'best reflect in terms of bandwidth and quality the technological capabilities inherent in the NGA'. In this respect, active remedies can be designed to be more or less aggregated and include other features of the technology deployed, such as multicast and allocated VLANs.

Decisions regarding WBA product characteristics also influences the role that the product may play in the 'ladder of investment'; they can vary from highly aggregated products that allow market entry with low levels of network investment through to disaggregated products that require substantial network investment and local interconnection. They can also vary in terms of the ability for wholesale customers to define the technical and performance characteristics of the service, varying from a highly flexible service that approximates the degree of control that a network operator would possess, through to more narrowly defined service that permits the wholesale purchaser limited control and scope for differentiation on the basis of the wholesale offering.

The product characteristics of an active access regulated product can therefore vary depending on the regulatory aims, conditions of the market, and the intended relationship with other remedies in place.

It should be noted that in this document we are considering those remedies that have been implemented with the intention that they will apply to the NGA deployed in each country. This means that, in some countries, there are existing WBA remedies that have not been considered here (e.g. in the UK a WBA remedy exists in market 5 that in practice it would apply only in geographic areas that would not have NGA deployment within the current market review period.)

- Product Characteristics:

Requirements of BEREC Wholesale Report:[86]

An Ethernet bitstream offer is typically considered to need the following elements to be fit for purpose:

– Flexible allocation of VLANs (in network trunks) to allow maximum potential for service differentiation. In some countries the view has been taken that some business clients would prefer their own private network with dedicated VLANs. In these cases, the inclusion of allocated VLANs within the Reference Offer has been considered important to allow competition across all business customers. In other countries, shared VLANs have been seen as sufficient to support competition, particularly in the instance that no demand for dedicated VLANs has been expressed by operators and end users.

– Control of customers' service speeds and service symmetry: business traffic is generally symmetric, while mass markets usually demand asymmetry - more download than upload.

– Security enabling: security is enabled by separation of traffic streams and allowing wholesale-users to implement their own security measures.

- Ability to support different QoS levels[87]: Competing operators need to have the ability to control QoS parameters in order to supply differentiated retail products and also to

86 See BoR (10) 08, p. 38 ff

respond to the requirements of end-users. The ability to distinguish between high priority and low priority traffic is needed, because for example TV & voice services are more sensitive to delays than data services. Control messages need the highest priority because they are vital for keeping the network and services up and running.

- Flexible interconnection and aggregation at regional & local level: interconnection at different levels in the network is needed to give alternative operators the possibility to lower their backhaul costs and invest in their own backhaul infrastructure when they have critical mass or to give them the opportunity to keep using their existing backhaul infrastructure in an NGA environment.

- Flexible choice of customer premises equipment (CPE's) from different vendors: Interoperability between DSLAM/MSAN/OLT and modems from different vendors is needed to prevent a vendor monopoly. Alternative operators don't have the same scale advantages as the incumbent to get the same price, particularly where there is only one supplier of the product

- Support for multicast functionality allows alternative operators to compete effectively for IP-TV customers (broadcasting functionality) and to provide triple-play offers because this drives the economic distribution of audio-visual content. In some countries the provision of multicast, within the bitstream reference offer, has been imposed by considering multicast as a Layer 2 network functionality. A critical issue is the quantity of bandwidth that has to be allocated to provide IPTV. In fact, price test of bundled services, which include IPTV, have to take into account the average transport cost to provide triple play. Thus, knowledge of the amount of bandwidth required allows the regulator to correctly evaluate the network costs incurred by the alternative operators. In some countries although multi-casting isn't implemented within the WBA product, the service may still support transmission of multicast frames by the access seeker.

Where bitstream is implemented under Market 4 as an interim measure, consistent with recital 21, it is important that the parameters of the wholesale product match those of the nearest substitute physical product as closely as possible. Ofcom in the UK implemented an active product as a Virtual Unbundled Local Loop (VULA) and identified the following defining characteristics for this product.

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87 Ethernet protocol provides 8 QoS classes. Current networks generally still use a subset of these Classes: The lowest QoS (0 & 1) are used for best effort traffic, while the higher QoS for real time services and more important traffic streams (2-5). The highest QoS (6 & 7) are used for control signals.

(1) Local access: Interconnection, by the access seeker, should occur locally; that is at the first technically feasibly aggregation point. In practice this is likely to be in the local serving exchange where the first Ethernet switch is located (NGA exchange). This means that CPs only purchase the access connection, allowing competing CPs to arrange (or build) their own backhaul and core networks, maximising CPs control. Local interconnection also provides foundations which support some of the other key characteristics, for example uncontended access becomes more difficult as the point of interconnection moves deeper into the backhaul/core network.

(2) Service agnostic access: The product should be a generic access product. That is, it should provide service agnostic connectivity, replicating one of the key features of LLU.

(3) Uncontended access: The connection, or capacity, between the consumers' premises and the local serving exchange where interconnection takes place should be dedicated to the end user, i.e., the connection should be uncontended. The availability of an uncontended access connection, alongside the control options discussed below, would ensure that the full innovation benefits can be realised.

(4) Control of access: Given the aim of realising competition benefits by allowing CPs maximum flexibility in their ability to offer differentiated products to consumers it is necessary for the bitstream product to provide a high degree of access control to the interconnecting CP. CPs would need freedom of control in order to provide different types of service and, potentially, also vary the QoS parameters in delivering those services to enable them to effectively compete with other providers. It is possible that some control of the underlying technical elements would need to remain with the access provider (BT) to maintain network stability. However, allowing CPs the greatest freedom possible to alter certain control parameters, where possible, is critical to ensure that CPs are able to determine and control the type and level of service they provide.

(5) Control of customer premises equipment (CPE): Similar to the control characteristic described above, allowing competing CPs the ability to control CPE is crucial in ensuring that the potential benefits of Ethernet are realised. Allowing CPs the freedom to choose CPE provides the flexibility needed to ensure CPs are able to differentiate how they deliver services to their customers. Unnecessarily preventing, or limiting, the control CPs have over CPE risks undermining some of the benefits to consumers that Ethernet may provide. Restricting the type of CPE (other than in accordance with generally recognised and accepted standards) would limit CPs ability to offer different and innovative products. However, as with other aspects of the key characteristics supporting bitstream, some restrictions may be necessary in order to protect network security and integrity. However the principle that should apply is that maximum control of CPE should be afforded to competing CPs, and control should not be subject to undue restrictions by the access provider.

The table below shows product characteristics of enhanced active remedies implemented in different member states:

	Austria	Belgium	Croatia	Germany[88]	Italy	Spain	UK
Technology	VDSL2	VDSL2 Ethernet	Ethernet (ADSL2+, VDSL2, FTTH)	VDSL2 Ethernet	Ethernet (Independently from architecture FTTx)	Ethernet (ADSL2+, VDSL2, FTTH)	Ethernet
Level of interconnection	local MDF, other on commercial basis	local MDF, regional PoP, not national	Regional PoP	local MDF, parent PoP	i) local OLT multiplex over FTTx (VULA), ii) parent and distant Ethernet node iii) IP level interconnection	regional PoP	local
QoS levels	two classes with each two subclasses	4 levels + control level	TBD	four classes downstream two classes upstream	High level of configurability	three levels	greatest freedom
allocation VLANs		dedicated & shared	Dedicated	dedicated	dedicated & shared	dedicated	
Service speeds & symmetry	different profiles defined by TA	retail profiles + own symmetric profile	Retail profiles	profiles negociated between access seeker and network operator	at least same profiles as TI retail (profiles still to be defined)	retail profiles + own profiles + on request	profiles defined by access seeker
CPE	white list maintained by TA	free in future, Belgacom provides now	free in future, SMP provides now	access seeker free	Free as possible (in respect of compliance to standard)	access seeker free (VDSL2 CPE and ONT can temporarily be provided on request by SMP)	free in future, BT provides now
multicast	no	yes	Yes	yes	yes	no	yes
Price control	retail minus, FL_LRAIC	CO, BU-LRIC	Retail minus,	pre-notification & margin squeeze	Not discrimination (in competitive area) CO, BU-LRIC (in not competitive area)	CO, BU-LRAIC	
Market	4	5	5	5	5	5	4
Status	Imposed	Imposed	Proposed (consultation)	Imposed	Proposed (consultation)	Imposed	Imposed

88 The described solution has been agreed by the NGA-Forum, an industry group chaired by BNetzA. It does not refer to a reference offer. See NGA-Forum, Technische und operationelle Aspekte des Zugangs zu Glasfasernetzen und anderen NGA-Netzen.

Table 1: Product characteristics of enhanced active remedies implemented in different member states

G.5 Implementation Issues

a) Access obligation:

Regarding the launch of new wholesale broadband access products due to technological evolutions, the NGA-Recommendation has foreseen in point 32 :

"NRAs should oblige the SMP operator to make new wholesale broadband access products available in principle at least six months before the SMP operator or its retail subsidiary markets its own corresponding NGA retail services, unless there are other effective safeguards to guarantee non-discrimination."

This leaves room for interpretation regarding what should be ready six months before the retail launch: a draft document, the NRA decision regarding the draft document or an implemented wholesale offer. Consideration 33 of the NGA-Recommendation is very helpful in trying to understand the purpose of this point:

"NRAs should apply non-discrimination principles in order to avoid any timing advantage for the retail arm of the SMP operator. The latter should be obliged to update its wholesale bitstream offer before it launches new retail services based on fibre to allow competing operators enjoying access a reasonable period to react to the launch of such products. Six months is considered a reasonable period to make the necessary adjustments, unless other effective safeguards exist which guarantee non-discrimination."

Basically the EC wants to avoid giving the incumbent first mover advantage in the launch of new products or the adaptation of products based on technological evolutions because this would lead to competition distortion on the retail market. In order to guarantee non-discrimination between incumbent and alternative operator, both products should be able to launch on the same date. This is only possible if the alternative operators get access to all the necessary information six months before the launch in order to adapt their internal operational processes and develop their communication strategy for the new product.

It is up to the NRA to foresee in its market analysis decision how this new product information should be treated, how much time is necessary for the NRA to make a decision about the new product and how long the alternative operators need in order to adapt their processes. (e.g. The Belgian regulator has foreseen an additional three months to consult and de-

cide on the draft reference offer before the six months start taking effect. The operators considered that six months was necessary at least to adapt their processes.)

This timing is not disproportionate because the introduction of new technologies and the consequent launch of new products are prepared long before the retail launch and certainly more than a year when it is a totally new retail product. By taking the development of the wholesale equivalent into account from the start and discussing the needs of the alternative operators in parallel with the needs of its own retail arm, an efficient incumbent can ensure that the final technical specifications and other relevant information will be available six months before the retail launch and that the launch by all parties on the same date is guaranteed. However it should be a possibility for NRAs to decide whether the introduction of a new NGA product is a crucial new launch significantly affecting OLOs or if it is just an upgrade easily integrated in existing processes of OLOs. In the latter case a shorter time frame than six months may be applicable.

There might be a conflict of interest when other players which have access to the consumer through their own infrastructure (e.g. cable, utility companies through fiber) as well through the wholesale broadband access offer get access to confidential information that would harm the competition on the retail market. In that case a NRA might foresee that crucial data (e.g. launch date, bandwidth specifications of the retail product,) of the wholesale offer is only shared with alternative operators that don't dispose of such an own infrastructure after they have signed a Non-Disclosure Agreement. The infrastructure operators do get the necessary information to adapt their processes and be ready at the same time but the confidential elements are only shared just before the retail launch when the incumbent goes public with his new product.

b) Costing and pricing issues:

Regarding the price of wholesale broadband access the NGA-Recommendation has foreseen in Article 35 a cost oriented approach:

> *"NRAs should in principle impose cost-orientation …taking into account differences in bandwidth and quality of the various wholesale offers"*

The differences in bandwidth and quality can be accounted for in the following way:

- Cost increases when more bandwidth is consumed. Cost Orientation model reflects this because transport network is scaled on the needed capacity. (e.g. Denmark, Belgium, Poland, Portugal, Spain)

- Quality factor is taken into account in tariffs to avoid that everyone takes the highest quality for all their services.

Different approaches are applied in different member states:

Cost-orientation/LR(A)IC is applied in several countries (e.g. Belgium[89], Denmark, Hungary [about to be notified], Italy (currently under public consultation), the Netherlands[90], Poland, Portugal, Spain, Sweden) and cost models are used in e.g. in Belgium or Poland.[91] The concept of retail-minus is used by Portugal (for specific cases) and Slovenia. Norway applies historical costs in the accounting separation reporting and price-cap is used in Estonia. Germany has imposed ex-post regulation.

United Kingdom:

Ofcom has not applied cost orientation to VULA but it will closely monitor specific pricing approaches adopted to prevent anticompetitive outcomes. This approach was based on a number of factors.

- First, Ofcom considered that there is significant uncertainty over both the cost and revenues associated with this type of investment. Thus, determining what a cost oriented charge is would be very difficult. The risk of setting the charge either too low or too high could stifle investment when too low or reduce potential consumer benefits from NGA when too high.

- Second, Ofcom considered that current generation services (CGA) would act as a constraint on the price of NGA services. Ofcom's view was that, over the next few years, there would be a single market for all broadband speeds, including super-fast broadband.

- Third Ofcom noted that BT is required to comply with its other SMP obligations (e.g. non-discrimination and price squeeze) and general competition law requirements, limiting its ability to act in an anti-competitive way given its position in the market.

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89 For VDSL2 bitstream access an additional mark-up is applied to obtain reasonable pricing.

90 Cost orientation is applied (EDC) only for high quality wholesale bitstream access.

91 See BoR (11) 06, Section 3.5

Italy:

Agcom proposes to differentiate remedies in market 5 proposing two geographically different price controls between two areas (competitive and not competitive). Agcom proposes a cost orientation based on a BU-LRIC approach in not competitive areas and a not discriminatory pricing in competitive areas, with the objective of giving the right signals to encourage efficient investment, where sustainable, and considering the availability of other access remedies in market 4. Agcom will define – in a new proceeding – these areas with a forward looking approach, considering the presence of alternative infrastructures and, inter alia, the competition level, the deployment cost for new infrastructures and the demand and offer levels for new services.

Article 36 of NGA-Recommendation foresees a margin squeeze test in the absence of cost orientation.

d) multicast

Multicast is a NGA functionality that can, among other things, support TV retail product through triple-play solution. Such products are an increasingly significant part of the broadband market. Thus, it is considered by many NRAs that it is important for the alternative operators to gain access to functionalities such as multicast, in order to be able to offer such solutions. In these cases, multicast functions are specified as part of the imposed WBA remedy

In February 2011 the Danish regulator NITA notified an LRAIC price decision where also multicast prices where calculated. In its letter from March 2011[92] the Commission commented on NITA's treatment of multicast and asked NITA to carefully substantiate the proportionality of the measure .

“In view of the limited demand for bundled offers including IP-TV, the Commission notes that competition on the retail broadband market does not seem to critically depend on access to the multicast functionality. Moreover, it is not clear whether a bitstream-based alternative operator could profitably self-supply the multicast functionality by investing in the core network. Finally the obligation to provide access to the multicast functionality may not be in line with the principle of technological neutrality as the access network technologies would be subject to different access obligations. In this regard, this asymmetry in remedies could artifi-

92 DK-2011-1180

cially incentivise access to copper and fibre networks to the detriment of the cable network, especially if IP-TV becomes a more important driver for the demand for broadband connections."

In its final price decision from April 2011 NITA maintained the multicast price regulation:

It is NITA's assessment that the multicast functionality is important in relation to broadband competition. This was evident from the market 5 decision from 2009 where it was stated that "It should be noted that, among other things, TV through triple-play solutions is an increasingly significant part of the broadband market. Thus, it is important for the alternative operators to gain access to functionalities such as multicast, in order to be able to offer such solutions.".

The importance of IP-TV and thus access to the underlying wholesale service has most recently been confirmed in NITA's analysis of the wholesale regulation of the broadband market from December 2010. Finally, it should be mentioned that NITA has received several complaints from broadband operators regarding TDC's pricing of multicast. This also underpins the fact that the service is essential for alternative providers.

In Austria, the equipment currently used by the incumbent operator for VULL does not support multicast natively. However, VULL allows transparent transport of multicast protocols configured by OLOs between nodes in their network and the CPE.

Similarly, in Spain NEBA allows transparent transport of multicast protocols configured by OLOs between nodes in their network and the CPE.

The Belgian regulator BIPT added multicast as functionality to the regulated bitstream product because the bitstream services currently offered do not allow alternative operators to offer competitive multiple play offers. Furthermore in a scenario where LLU services - which enable the use of the multicast functionality - are developed to a very limited extent and where there are no prospects of further LLU deployment due to the on-going dismantling of local exchanges, the imposition of a multicast functionality is essential in order to ensure that alternative DSL operators can effectively compete in the retail broadband market. The commission made no comment regarding this argumentation.

The Croatian regulator HAKOM obliged in market 5 its incumbent Hrvatski Telekom d.d. to ensure technical conditions for providing the service of a separate virtual channel (PVC or VLAN) for VoIP and IPTV (including functionality for multicast distributed replication), as well

as technical conditions for additional two private virtual channels which are not explicitly related to a certain service at cost oriented prices and non-discriminatory basis in order to enable competitors to provide the whole range of services to the end users.

The Swedish regulator PTS obliged in market 5 its incumbent TeliaSonera to offer access for TV and functionality for multicast distributed replication at cost oriented prices and non discriminatory basis (on a reasonable request and within areas/places where TS produces IP TV to its own customers). As far as PTS knows, no operator has asked for a concrete multicast offer from TeliaSonera.

The Italian regulator AGCOM imposed bitstream access on fiber network giving access to all specifications, configurations and functionalities supported by Telecom Italia network, including multicast functionality.

e) Standardisation bodies

In accordance with Article 34, many NRAs have been active in different stages and different depths in considering technical specifications with industry groups. For example in Germany BNetzA have initiated an NGA-Forum with operators, that works on interoperability regarding broadband specifications, and in the UK Ofcom initially worked with the broadband forum to consider how Active Line Access (ALA) could best facilitate competition in downstream markets. In Spain, CMT established an operator forum in order to discuss the implementation of NEBA. In some cases this has encouraged the development of standard approaches to product specification. This is often a precursor to developing a reference offer, and once a reference offer is in place for an active product, the reference offer may become the *de facto* industry standard.

Best practices / preliminary conclusions

- In every second country enhanced bitstream products are available on a mandated basis and in 2 countries they are provided on a voluntary basis.

- In line with the Recommendation all NRAs seem to be implementing an active remedy. Two NRAs have implemented an active product in market 4 as a transitional remedy (consistent with Recital 21) to support competition where further upstream remedies are not seen as currently feasible.

- The wholesale active product characteristics required by NRAs reflect the bandwidth and quality the technological capabilities inherent in the NGA infrastructure (in line with Art. 33), as well as the regulatory aims, conditions of the market, and the intended relationship with other remedies in place.

- Industry discussion generally preceeds the development of a Reference Offer due to the complexity of active bitstream products and the need for interoperability.

H Migration

H.1 Relevant provisions of the Recommendation

First, Art. 39. of the Recommendation states that unless an agreement is reached on an appropriate migration path between the SMP operator and operators currently enjoying access to the SMP operator's network, NRAs should ensure that alternative operators are informed no less than five years, …., before any de-commissioning of points interconnection. This period may be less than five years if fully equivalent access is provided ….[93] [94]"

Second, NRA's have to put in place a transparent framework for the migration from copper to fiber-based networks. NRA's should ensure that the systems and procedures put in place by the SMP operator, …, are designed as to facilitate the switching of alternative providers to NGA-based access products" (Art. 40)

Third, "NRAs should use their powers und Art. 5 of Directive 2002/21/EC to obtain information from the SMP operator concerning any network modification plans …." And should under Article 9 (1) of Directive 2002/19/EC ensure that undertakings enjoying access to the SMP operators's network receive all necessary information, ……, to adjust their own networks….." (Art. 41).

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93 See also BoR (10) 08 section E.1 p. 58

94 See BoR (10) 08 p. 9 the "Best practice for NGA wholesale products as of Dec. 2009": " …wholesale customers should *obtain relevant information on roll-out of new infrastructure or technologies per geographical area. A reasonable window of announcement is necessary to create a level playing field on the retail market; Information on phasing out of legacy wholesale services should also be announced a reasonable period in advance to avoid discriminatory situations."*

H.2 Availability in practice[95]

A framework for migration from current to next generation access products is envisaged in eleven countries (Austria, Belgium, Croatia, Denmark, Hungary, Italy, The Netherlands, Portugal, Romania, Slovenia, Spain). In Ireland migration remedies are currently under consultation.

In almost half of the countries the incumbent is obliged to provide information on network modifications, including the roll-out of new infrastructures. There is a variety of notice periods in different member states typically ranging from 1 to 5 years. Some NRA's allow for shorter periods if agreed upon by the operators involved. In some countries the decommissioning of MDF's is explicitly guided by the aim of ensuring the availability of equivalent alternatives, whereas other countries do not make the approval of decommissioning contingent on any conditions as long as the notice periods are adhered to[96].

In several countries a framework for migration is already in place and in almost half of the countries the incumbent is obliged to provide information on network modifications, including the roll-out of new infrastructures. Notification periods typically lie in the range between 4 and 12 months[97].

In Germany and the UK a migration path has not been imposed. No decommissioning of copper networks is expected at least during the review period and current obligations are considered sufficient (LLU reference offer excludes copper MDF decommissioning in Germany, appropriate level of detail on major changes, including relevant information about planned changes to the SMP provider's network, to be given to other providers with sufficient notice.and furthermore agreed exchange closure procedure in place between industry and the UK).

H.3 Relevant Commission comments

In the Austrian case (AT/2010/1084) the Commission while accepting the proposed rules for migration to NGA, expressed concerns about the competitors not having appropriate time to prepare for changes that affect their investments and business cases.

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95 See Annex Table "I. Migration" and BoR (11) 06, p.13.

96 BoR (11 (06) p. 14-15.

97 BoR (11) 06, p. 15.

In the Polish case (PL/2010/1137, October 29th 2010) the EC commented on the requirement by UKE to TP to maintain previously granted or requested access to copper loops and sub-loops for as long as alternative operators require so and irrespective of whether parallel networks are available. The Commission states that it welcomes UKE´s proposed measures which ensure that operators currently enjoying access to the SMP operator's network are not left stranded and are given the means to prepare for network changes that can substantially affect their investments and their business case. The Commission notes, however, that UKE has not established a specific time limit for copper based access to be maintained by TP and that the latter may eventually be obliged indefinitely to maintain access to two parallel infrastructures in a given location.

In the Lithuania case (LT/2011/1197, May 6th 2011) the EC comments that RRT has not considered in its notification detailed obligations relating to the migration process from copper to fibre loops. The Commission draws the attention of RRT to the fact that migration from copper to fibre loops and the dismantling of exchanges substantially affects the business case for alternative operators and states that it is critical that NRAs obtain all relevant information from the SMP operator concerning any network modification plans where the SMP operator envisages replacing parts of its existing copper access network with fibre, and plans to de-commission currently used points of interconnection.

The Commission recalls in this case that existing SMP obligations in relation to market 4 should continue to remain in force and should not be rendered invalid by changes to the existing network architecture and technology, unless agreement is reached on an appropriate migration path between the SMP operator and operators currently enjoying access to the SMP operator's network. In line with NGA-Recommendation

Regarding the United Kingdom case the Commission notes that Ofcom's notification has not considered detailed obligations relating to the migration from copper to fibre loops, in particular in the context of the lower number of main distribution frames (MDFs) required to provide broadband services. The Commission would recall that migration from copper to fibre loops and the dismantling of exchanges could substantially affect the business case for alternative operators. It is therefore critical that CPs obtain all relevant information from the SMP operator concerning any planned alterations to the network, particularly when the SMP operator envisages replacing part of its existing copper access network with fibre and plans to de-commission currently used interconnection points. The Commission therefore invites Ofcom to include, as part of the transparency obligation, a requirement for BT to put forward a migration procedure for alternative operators in the event of planned changes in BT's network topology.

H.4 Implementation issues

a) Notice periods[98]

Most member states have a notice period foreseen up to 5 years.

In setting a notice period BEREC considers it reasonable that member states take into account the usual investments periods of the different elements (e.g. DSLAM) and whether the alternative operator at the time of investment could know that the economic lifespan of the investment would be shorter than the technical lifespan of the investment.

A shorter notice period than 5 years may be appropriate when all investments by alternative operators are already written off and/or alternative operators already knew at the time of investment that assets were planned to be phased out within 5 years. A shorter notice period may also be reasonable if stranded investments will be compensated by the incumbent.

An important condition for the phasing out of legacy network elements is the availability of an alternative regulated wholesale product (under equivalent/non-discriminatory conditions) which allows for the continuation of sustainable competition. If such a product is already available, assets have been written off or stranded assets will be compensated, and an appropriate migration path is put in place to facilitate switching a period of less than five years may be appropriate. This also seems reasonable if shorter periods are agreed upon by the operators involved.

In any circumstance it is important here that NRAs strike a balance between the importance of facilitating innovation and investment by the incumbent and creating a level playing field between the incumbent and competitors to sustain competition.

b) Framework for migration

The Commission Recommendation clearly states that existing SMP obligations in relation to market 4 should continue to remain in force and should not be rendered invalid by changes to the existing network architecture and technology, unless agreement is reached on an appropriate migration path.

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98 See also ERG (09) 17 D.6 “Procedural issues during the migration period”.

A migration path is in place in many countries. BEREC considers it important that an efficient procedure is put in place beforehand, to ensure that migration is carried out in an efficient and non-anti-competitive way, enabling wholesale customers to migrate in an orderly and timely fashion, and minimising the level of disruption to customers. BEREC also considers it important that migration is performed in a non-discriminatory way between the retail arm of the incumbent and alternative operators and that this relates to quality aspects of migration and to time periods. This also implies that the assets can only be phased out of the incumbent does no longer use the assets itself.

The new NGA product should be an alternative with (as much as possible) comparable quality diversifications and comparable functionality options to approach the same level of product competition in an NGA world. Different levels to connect with the Ethernet network give the alternative operators the possibility to use their existing infrastructure investments in a fiber network for collection and transport of backhaul traffic.

Other relevant implementation issues regarding migration may be[99]:

- Enabling migration in an earlier stage if the NGA network infrastructure and the legacy infrastructure still co-exist may facilitate a level playing field.[100]

- Payment of migration costs. It is important that it is clear which (direct) costs of migration, such as time wages, penalties actually paid out to customers of alternative operators in accordance with contractual obligations, administration costs and IT and network reconfiguration costs are reimbursed by the incumbent and which costs will have to be paid by alternative operators. (E.g. in Belgium for the migration from bitstream ATM products to bitstream Ethernet products, the following actions are not billed: de-connecting ATM access; configuration of shared LAN of same quality as existing VP; configuration of dedicated LAN of same quality as existing VC; reconfiguration of end-users to VLAN with same quality; commencement of new configuration).

- Compensation payment in the case of stranded assets. It is important that compensation payments do not include business risks that are not related to the phasing out of assets (e.g. risk of economic downturn, technological developments, changes in demand patterns, changes in retail prices). Such inevitable business risks should be borne by each operator for its own investment.

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99 See also BoR (10) 08, p. 57-59.

100 In Italy Agcom proposed to impose TI to set the interconnection points for fibre Ethernet bitstream taking into account the investment already made by OAO to interconnect to copper bitstream network and reducing as much as possible the migration costs to the new infrastructure.

c) Information on network modifications

It is important that competitors receive on a non-discriminatory base all relevant information regarding network modifications. This includes among other things information on:

- Planned changes to the current wholesale access points
- Decommissioning of any current points where wholesale access is provided
- Availability of new points where wholesale access will be provided
- Relevant technological changes in the network

Also this information should be made available to competitors at the same time as it is available to the retail arm of the incumbent and should be accompanied by a planned time schedule (globally and per access point). Updates should be available frequently (e.g every three months). A notice period and an implementation period are relevant.

Best practices / preliminary conclusions

- A framework for migration exists in more than one third of countries. More than every second country foresees certain provisions for decommissioning MDFs. In almost half of the countries the incumbent is obliged to provide information on network modifications, including the roll-out of new infrastructures. Notification periods typically lie in the range between 4 and 12 months.
- In line with the Recommendation all NRA's seem to allow the phasing out of legacy networks and seem to keep the existing obligations in place until a certain migration path is agreed and followed.
- Where the NRA allows incumbents to phase out legacy networks - leading to a faster end of parallel running of networks – this may increase the viability of FttH deployments.
- Several NRA, have already imposed remedies that should facilitate the migration from access seekers from legacy to NGA infrastructure. As the Recommendation prescribes these remedies often include a notice period, a framework for migration and an obligation to the incumbent to provide all relevant information on network modifications.
- Regarding the notice period not all NRA's consider that a five year notice period is proportional. Some NRA's consider a shorter period appropriate.

- It is also important to note that fibre roll-outs may significantly change the competitive landscape, especially if MDFs will be closed down. Even as early as in the phase of announcements and planning, these developments may be liable for halting competitive tendencies.[101]

I "Pricing principles and Risk" (Annex I of the NGA-Recommendation)

I.1 Risk Premium

I.1.1 Relevant provisions of the Recommendation

NGA-Recommendation, Annex I.6:

Investment risk should be rewarded by means of a risk premium incorporated in the cost of capital. …. NRAs should, where justified, include over the pay-back period of the investment a supplement reflecting the risk of the investment in the WACC calculation currently performed for setting the price of access to the unbundled copper loop. …

NRAs should estimate investment risk *inter alia* by taking into account the following factors of uncertainty: (i) uncertainty relating to retail and wholesale demand; (ii) uncertainty relating to the costs of deployment, civil engineering works and managerial execution; (iii) uncertainty relating to technological progress; (iv) uncertainty relating to market dynamics and the evolving competitive situation, such as the degree of infrastructure-based and/or cable competition; and (v) macro-economic uncertainty.

Investment into FTTN, which is a partial upgrade of an existing access network (such as for example VDSL), normally has a significantly lower risk profile than investment into FTTH, at least in densely populated areas. In particular, there is less uncertainty involved about the demand for bandwidth to be delivered via FTTN/VDSL, and overall capital requirements are lower. Therefore, while regulated prices for WBA based on FTTN/VDSL should take account of any investment risk involved, such risk should not be presumed to be of a similar magnitude as the risk attaching to FTTH based wholesale access products. When setting risk premia for WBA based on FTTN/VDSL, NRAs should give due consideration to these factors, and should not in principle approve the pricing schemes set out in sections 7 and 8 below. NRAs should publicly consult on their methodology to determine the risk premium.

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101 This is especially relevant e.g. in the Portuguese situation where the competitiveness of the retail broadband market and the WBA market are – to a large extent – conditioned by the availability of sufficient inputs in the LLU market.

I.1.2 Availability in practice

An explicit risk premium is applied in two out of eleven countries, in Lithuania and the Netherlands[102].The application of a risk premium in case of newly built infrastructure is under consultation in Italy. However other NRAs have appropriately taken account of risk by carefully assessing the factors of uncertainty mentioned in Annex I Section 6 of the NGA Recommendation.

I.1.3 Commission comments

In the Dutch case the Commission was worried that OPTA estimated the risk of the investment too high, whereas the main concern regarding the Swedish notification questioned related to the consistency of de-averaging of prices. they were worried about deaveraged pricing

The Netherlands (Case NL/2009/0868: Wholesale access to the local loop – price control obligation)

The starting point of OPTA's cost model is the business plan of the Reggefiber Group. The parameters used in this business plan reflect expectations and assumptions of a private investor and is therefore in OPTA's view a good 'proxy' to assess the risk of fibre infrastructure roll-out by a new entrant in a competitive environment. The commission comments that this risk is however lower for an incumbent benefiting from a large customer base that it can migrate to the new fibre network, thus saving operating expenses when decommissioning the copper loops concerned. The joint venture is now partly owned by KPN (41%), which has a call option to raise its stake to 100 %. The investment risk is now shared between the investors and the incumbent operator and according to the Commission the basic assumptions used by OPTA could therefore over-estimate the risk of the relevant investment, in particular regarding the following parameters. i) The Internal rate of return may be too high if KPN will gain full control over Reggefiber and ii) the payback period of the relevant investment (25 years) may be too short.

Sweden (SE/2011/1205 notification of price control):

The Commission, in its comments on the Swedish notification of further details on price control remedies, Case SE/2011/1205, commented on the de-averaging of fibre prices while still

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102 Only in the case of overperformance to compensate for asymmetrical risk. See D.6.

applying averaged copper prices, which the Commission worried, would distort investment incentives. Furthermore, the commission commented on the transparency in the estimation of costs, including risk, for fibre to detached houses. While acknowledging that the Swedish market situation did not justify for an overall risk premium, the Commission was not fully satisfied with the explanations given regarding the approach chosen regarding pricing of fibre to detached houses. More details of the Commissions comments can be found in the Experience Section on Sweden.

I.1.4 Implementation Issues

When addressing risk issues it should be considered that any investment – whether regulated or not – entails a degree of risk. Given this, regulation cannot (and should not) shield the investor from normal commercial risks as this would distort the investment decision.[103]

Generally, the concept of a "risk premium", which is part of the rate of return (cost of capital) is related to a regulated access price and thus an SMP remedy according to Art. 12 and 13 of the AD.

BEREC considers that assessing the investment risk by taking account of the various factors of uncertainty (see. J.1.1 above), rather than making an a priori classification of risk, is appropriate in order to calculate a risk-reflective premium of NGA roll-out that provides the necessary investment incentives. This approach implicitly generates distinctions in the risk assessment between different roll-out scenarios on a case by case basis by NRAs.[104]

More specifically, BEREC points out that a higher risk premium does not apply only because new infrastructure is rolled-out or because it is a large investment. Fibre in itself does not presume a greater risk, rather it is the uncertainties as outlined above. In some cases fibre investment can be an upgrade of existing networks.

Thus, such a case-by-case approach is required as these factors of uncertainty will take different values in different countries and the overall effect will vary across countries depending on the market situation. Moreover, risks will not only *vary considerably across Europe and even within Member States.*[105]

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103 ERG (09) 17, Chapter D.3.2.

104 BoR (10) 25Rev1 (Recital 10)

105 ERG (09) 17, Chapter D.3.2.

Ideally an assessment of risk has to start with an evaluation of the different factors of uncertaintly (demand, cost etc) as spelled out in the Recommendation at the suggestion of BEREC that yield the appropriate rate of return properly reflecting the investment risk .

When using the CAPM methodology for the calculation of risk the fibre risk assessment is difficult to implement in practice due to the lack of comparable fibre companies when calculating the beta (risk) for the WACC. There are no listed fibre (or even broadband)-only companies. Therefore the beta needs to be determined by a peer group consisting of companies that include other business areas or are present in other markets than the European (see Germany). Alternatively, potential NGA-specific risk will have to be accounted for in other ways than merely through the WACC (See Denmark).

In the case of the Netherlands the regulator exceptionally had access to data on the business case of a fibre only company which could be used for estimating the business case parameter (relating to demand, cost etc.) resulting in the internal rate of return used for the price cap calculation.

More details on the experiences can be found in the section below.

I.1.5 Experiences

Denmark[106]

NITA was unable to find comparable fibre-only companies suitable for assessing a WACC based risk premium. Thus, NITA decided to model a risk premium through conservative demand profiles. This was ensured by the following factors:

- Limited migration from copper to fibre during the first years, especially in rural areas.

- Only 75 % of copper customers end up migrating to fibre, others might choose coax, LTE or WIMAX.

106 NITA slides (Jonas Østrup) from BAKOM Workshop, Biel, 5/6 May 2011

- Saturation not reached until approximately 20-25 years after fibre deployment in an area is initiated.

- In the end, fibre customers will start migrating to a future (unknown) technology.

Since actual demand was considered the most important risk factor, the risk premium is only incorporated through demand profiles. It was reasoned that the Danish incumbent, TDC, may limit most other risk factors, e.g. by cherry-picking.

Germany

Expert study:

In 2010 BNetzA had commissioned an expert study which applies a CAPM / WACC approach to determine a broadband specific risk.[107],[108] The study recommends to calculate the interest rate for FTTH/FTTB roll-out by using the methodology for the calculation of the regular interest rate however modified by a broadband-specific risk premium. Overall, it was considered a difficult challenge to assess the broadband specific risk.

Determination of Beta:

A broadband-specific Beta estimation requires the existence of stock exchange listed operators that concentrate their activities on broadband. No such operators exist either within the OECD or in the EU. Therefore the risk was best approximated by using Betas of a peer group of high technology companies that operate in emerging markets. The study assumed that operators associated with broadband-specific activities would have a Beta above 1,0 reflecting the average market risk. Finance values had been excluded because they currently show the highest Betas due to the financial crisis. 45 of the HDAX 110 values have been identified that have Betas above this average value: 11 of the DAX 30 companies[109]; 22 of

107 http://www.bundesnetzagentur.de/cae/servlet/contentblob/194320/publicationFile/9936/GutachtenProfStehle241110pdf.pdf

108 Note: This study was not applied by the Federal Network Agency for its latest Market 4 determination (see Chapter E.5).

109 On October 4 2010 Telekom had a Beta of 0.71 (according to “Börsen-Zeitung”)

the MDAX 50 and 12 of the TecDax 30 companies. The Beta of these operators range from 1,0 to 1,6. The arithmetic average of these two values was used to calculate the broadband-specific Beta of 1,3.

The study suggests to reduce the Beta value estimation by 0,03 per year, leading to a value of 1.0 within 10 years. There is a tendency that Betas move towards 1,0 over time. The estimation will be revised within the next two years to get a more specific picture.

Implications derived in the study:

In the short and medium term the incumbent faces rather a revenue risk than a demand risk because he can migrate copper customer to fibre networks. Profitability of fibre investment rises with the speed and percentage of the final penetration rate. In comparison to FTTN (VDSL), FTTH and FTTB have relatively high initial expenses, mainly driven by high civil engineering cost. Low cost of fibre loops can only be achieved if enough buildings within a fibre deployment area are contracted to the service. It is uncertain at which point of time prospective users in fibre deployment areas are contracted – if at all (take-up risk). The broadband-specific interest rate could be applied for ex-ante or ex-post regulated fibre loops (FTTH, FTTB).

Sweden:[110]

The LRIC model:

The model is built with point-to-point FTTH, fibre pairs and cost allocation according to assumptions of how many households/subscribers which are connected by, and currently active on the network.

110 See Chapter E.5 for a description of the Swedish decision on Market 4.

Fibre as Modern Equivalent Asset (MEA)

PTS has considered modern equivalent assets to be fibre and wireless. The latter is only deployed in areas where the incumbent only offers telephony services and is therefore not influencing the cost calculation for fibre access and broadband products.

The reason for the choice of MEA is that these are the infrastructures currently being rolled out and invested in Sweden. The costs of all regulated accesses are hence calculated according to current cost accounting with fibre and wireless constructing the replacement cost.

The pricing methodology:

The pricing methodology specifies principles that the incumbent must conform to when setting the prices for the regulated access (based on the cost results from the model). There are some generic principles in the pricing methodology, such as that the incumbent is not allowed to price in a way which distorts competition.

Regarding fibre, the pricing methodology addresses geographical issues, discounts and pricing of fibre to single and multi dwelling units.[111]

Risk and new investments:

PTS has not, as will be further explained, included any additional premium in the cost of capital (besides the parameters included in the CAPM framework) due to the risk of investing in NGA. That said, there are some actions that are taken to ensure the incumbent some flexibility when it comes to NGA investments. These actions take the form of increased flexibility for the SMP-operator when setting prices on NGA-based access.

WACC:

In the process of revising the LRIC model, the cost of capital through the WACC has also been revised. PTS calculates WACC in accordance with CAPM. The WACC (pre-tax) is set to 8,8 % (8,2 %).

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111 These related issues are further specified in the Swedish country case in Chapter J.1.3.

Altogether, there are a number of reasons why PTS determined not to incorporate an extra risk premium in the calculation of cost of capital through the CAPM framework:

- The Swedish market condition is characterised by selective and specific case-by-case investments rather than large scale roll out of fibre networks. Fibre investments are only materialized when the SMP-operator has ensured a sufficient percentage of penetration in a particular area.

- Moreover, the SMP-operator is not only pursuing a selective investment regime but is also using one-time charges (or set up fees of ~EUR 1000 and upwards) as a condition to connect new fibre subscribers.

- A risk premium would result in higher overall prices which in turn would suppress demand and halter NGA investments. PTS therefore considered it more suitable to take account for any potential extra risk in specific cases by adjusting the pricing methodology.

- PTS did not find any relevant companies for comparison as there are no pure fibre operators to establish a fibre peer group, nor any objective data implying a diverse risk between investments in access and core networks.

- The relevant risk is accounted for in the Beta since the change of the stock over time is dependent on future expectations. Moreover, PTS has applied an asset Beta of 0,54 for the WACC calculation which implies that it covers a broader risk profile compared to pure fixed line operators like KPN which has a beta of 0,19, Deutsche Telekom and France Telecom which both have assets betas of 0,21, while Telefónica has an asset Beta of 0,41.

Geographical pricing

The geographical cost results shall be the basis of the pricing of fibre in the respective areas.

The incumbent has an obligation to differentiate the pricing in accordance with costs in various geographical areas. This in order to avoid distorting competition which is mainly made up of local municipality networks. In their comments[112] on the notification, the Commission expressed concerns that this de-averaging of fibre prices which is not matched by a similar obligation for the incumbent to de-average copper prices could risk distorting investments incentives. Following these comments, PTS conducted an impact assessment which concluded that it would not at present have any distortive effects on investments in the Swedish

112 SE/2011/1205

markets. As this may change, PTS plans to re-investigate the issue in the next round of market analysis.

Pricing of fibre to multi dwelling units/building blocks

The average cost of a fibre access to a multi dwelling unit is the cost of one connection/household multiplied with the average of active numbers of connections in the geotype. The pricing methodology stipulates that the incumbent may vary the pricing in order to differentiate between smaller and larger multi dwelling units, as long as the average still is cost oriented.

Pricing of fibre to single dwelling units/ detached houses

Deployment of new fibre to single dwelling units within a residential district is at present the only investment scenario where PTS has recognised a potential extra “risk” for the incumbent when investing. The risk identified is explained by the cost occurred by an initial lower take up of customers in a greenfield area, not matching the cost of deploying fibre to the whole area. In the LRIC-model, this will be recouped over a longer time period. The LRIC-method ensures return on the investments over time but the penetration in the model is rather high compared to real penetration during the initial period in a specific greenfield area.

Given that the NGA-Recommendation advocates risk compensation in order to stimulate fibre investments, PTS has decided upon a transitional price incorporating this asymmetry between the real uptake and the volumes bearing the cost in the model. The result is that the price for a single dwelling unit in geotype 3 will serve as the national price for deployment of fibre to detached houses since the cost of fibre in geotype 3 most accurate reflects the cost deploying fibre in a greenfield area. The geotype 3 cost is higher than the costs in geotypes 1 and 2, hence compensating the incumbent for the asymmetry between the penetration in the model versus real penetration.

The Commission acknowledged that the particular features of roll-out in Sweden did not justify incorporating a risk premium in the WACC leading to a supplement compared to copper roll-out. Regarding the risk-awarding methodology chosen, the Commission invited PTS to better justify the adequacy and better substantiate the assumption of reduced fibre uptake in detached housing areas and its compatibility with the “single model approach”. In its final measure, PTS revised the pricing methodology to better reflect the analysis and calculations supporting the applied risk adjustment.

Netherlands

In its last market decision regarding market 4, OPTA included access to the fibre loop in residential areas (FttH) in the relevant market. Based on the applied obligations KPN/Reggefiber is obliged to grant unbundled access to the local loop (ODF-access).

FttH access prices in The Netherlands depend on the actual CAPEX per line in a 'connected area' area (called 'aansluitgebied'). Depending on the characteristics of the area (dense or more rural) a different tariff applies. These tariffs range from 12 – 17 Euro per line/per month (without discount) and 100 Euro installation fee.

OPTA sets a price-cap which is stable and predictable over a long period (price indexation is allowed) including a reasonable rate of return. OPTA checks the actual returns every new regulatory period (3 years) and compares the actual return with the allowed reasonable rate of return over performance ('excessive return') leads to a downward adjustment of the price cap. In this periodical check, OPTA allows some extra return to limit the asymmetric regulatory risk, which is the risk that the regulator skims off positive returns while negative returns are for the risk of the investor. Under performance does not lead to an upward adjustment of the price cap. Under performance is for the risk of Reggefiber.

Tariff regulation by OPTA also contains risk sharing elements (an investment-contribution per line), volumes discounts based on total market volume to stimulate penetration and allowed regional price difference (based on actual CAPEX/line) facilitating investment incentives. Based on the principles OPTA has set a tariff ceiling for ODF Access, Collocation and Backhaul Services.

Best practices / preliminary conclusions

- An explicit risk premium is applied for FTTH unbundling in two out of eleven countries, in Lithuania and the Netherlands[113].The application of a risk premium in case of newly built infrastructure is under consultation in Italy. This implies that a number of countries did not consider a higher interest rate appropriate. However other NRAs have taken account of risk by carefully assessing the factors of uncertainty mentioned in the Annex I Section 6 of the NGA Recommendation (e.g. by considering moderate demand figure etc).

- Ideally an assessment of risk has to start with an evaluation of the different factors of uncertainty (demand, cost etc) as spelled out in the Recommendation at the suggestion of BEREC that yield the appropriate rate of return properly reflecting the investment risk.

113 Only in the case of overpermance to compensate for asymmetrical risk. See D.6.

This has been carried out by NRAs in line with and based on commercial data (reflecting an actual business case),, if possible (see Netherlands).

- When using the CAPM methodology for the calculation of risk the fibre risk assessment is difficult to implement in practice due to the lack of comparable fibre companies when calculating the beta (risk) for the WACC. There are no listed fibre (or even broadband)-only companies. Therefore the beta needs to be determined by a peer group consisting of companies that include other business areas or are present in other markets than the European (see Germany). Alternatively, potential NGA-specific risk will have to be accounted for by using appropriate values for the crucial factors of uncertainty (See Denmark).

- When assessing the risk in NGA deployment, NRAs have found that many of the parameters making up the risk relates to the uncertainty of customer demand and small willingness to pay, both impacting on the ARPU and take-up. These are factors which NRAs have taken into account and which have affected the calculations of access prices.

I.2 Criteria to assess long-term access pricing in case of FttH

I.2.1 Relevant provisions of the Recommendation

NRA's should assess pricing schemes proposed by the SMP operator like upfront commitments on long-term or volume contracts (Art. 25).

(Annex I.7). Long-term access contracts would be priced at a lower level per access line than short term access contracts. Long-term access pricing may however be abused by the SMP operator over time to sell its retail services at prices lower than those for its regulated wholesale services. Furthermore, alternative providers with smaller customer bases and unclear business perspectives face higher levels of risk. They might be unable to commit to purchasing over a long period.

For these reasons, long-term access pricing would be acceptable only if NRAs ensure that the following conditions are met.

(a) long-term commitment prices only reflect the reduction of risk for the investor; and

(b) over an appropriate timeframe there is a sufficient margin between wholesale and retail prices to allow for market entry by an efficient competitor in the downstream market."

I.2.2 Availability in practice

In Sweden discounts are allowed as long as the incumbent can prove that the discount is non-discriminatory and based on actual cost savings due to variables such as commitment.[114]

I.2.3 Implementation issues

Long-term up-front commitments by buyers of NGA access are intended to reduce the risk of the investor by transferring part of the risk from the investor to other operators ('risk diversification'). There is however a trade-off between lowering the overall risk of the investor, which may lead to a higher level of investment) and possible negative effects on competition and investment of competitors who cannot commit to purchasing over a long period.

That's why NRAs have to strike a balance. NRAs should assess pricing schemes proposed by the investor, but price differences should only reflect differences in risk for the investor and must not lead to a margin squeeze.

In practice it will be very difficult to assess the impact of long-term commitment prices on risk in order to be able to determine separate access prices per line for short term and long term access contracts.

NRAs also have to verify that the proposed pricing scheme ensures that a sufficient margin remains. This margin squeeze test has to make sure that there is a sufficient margin between wholesale and retail prices to allow for market entry by an efficient competitor in the downstream market. "NRAs should specify in advance the methodology they will follow for identifying the imputation test, the parameters for the margin-squeeze test and the remedial mechanism in case of established margin-squeeze (Rec 27)."

I.2.4 Experiences

The Netherlands

In the Netherlands operators cannot choose between signing a long-term or a short-term contract. Although operators do not get the opportunity to make an explicit choice for signing a long-term contract, each operator implicitly commits for a longer time, because the tariffs for access services for local fibre loops consist of both one-off fees and periodic fees.

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114 For an overview see Annex Table *"Annex I pricing"*

By giving the investor the choice to recoup fixed costs via a one-off fee or periodic fees, the investor can affect his own investment risk and the entrants risk ('risk sharing'). The advantage of recoupment via a one-off fee is that the investor recoups some of its investment in the early phase of the economic life of the network. This early recoupment of part of the investment translates into a lower capital requirement over time, a decrease in the investment risk and an increase in the investor's willingness to invest.

OPTA allows the investor to charge a relatively small amount of the cost via a one-off tariff because it should not create a barrier to entry.

Sweden

Discounts are allowed as long as the incumbent can prove that the discount is non-discriminatory and based on actual cost savings due to variables such as volumes or commitment.

Best practices / preliminary conclusions

- Long-term access schemes are rarely offered and/or accepted by NRAs. They are allowed in one country and under consultation in another.

I.3 Criteria to assess volume discounts in case of FttH

I.3.1 Relevant provisions of the Recommendation

(Annex I.8). Investment risk is closely tied to the number of fibre loops which remain unused. Access prices could therefore vary in accordance with the volume purchased.

A volume discount should only be accepted by NRAs provided the following conditions are met:

(a) a single level volume discount is calculated per area as appropriately sized by the NRA taking account of national circumstances and network architecture, and applies equally to all access seekers which, in the area concerned, are willing to purchase at least the volume of lines giving access to the discount; and

(b) the volume discount only reflects the reduction of risk for the investor; and

(c) over an appropriate timeframe there is a sufficient margin between wholesale and retail prices to allow for market entry by an efficient competitor."

I.3.2 Availability in practice

In the Netherlands volumes discounts are available to all access seekers based on the total market volume.[115] In Sweden discounts are allowed as long as the incumbent can prove that the discount is non-discriminatory and based on actual cost savings due to variables such as volumes or commitment.

I.3.3 Implementation issues

BEREC considers that the main objective of volume discounts is not to reduce the risk of the investment as in the case of upfront commitments, but to stimulate network penetration rate and lower unit costs per end user. The reduction in unit costs occurs because in network industries there is a negative relationship between market penetration and the cost per connection: the higher the penetration, the lower the cost per connection. This means that, in order to minimise cost per connection, a supplier of NGA access will want to expand the network volume by encouraging buyers to purchase more lines. The introduction of volume discounts schemes is one way of incentivising buyers, whereby part of the achievable benefits of scale of the investor is shared with the operators purchasing access. However, this reasoning does not only apply to FttH as stated in Annex I.

In BEREC's view, the level of investment risk is only impacted to a limited extent, if any, by the presence of volume discount schemes to the extent that the investment has already taken place prior to the volumes being purchased. Potentially there could be an indirect impact on investment risk to the extent that an investor has certainty prior to the investment taking place that volume discounts will be allowed in principle, whereby the investor could expect that network penetration rates and total turnover will be higher than in the case when such discounts are ex ante prohibited.

It must be borne in mind that the threshold of the minimum efficient scale may curtail competition and foreclose the market, because in a number of circumstances the minimum efficient scale may not allow more than one additional competitor beside the SMP operator to be eligible for the discount.

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115 For an overview see Annex Table *"Annex I pricing"*

I.3.4 Experiences

The Netherlands

For FttH unbundling OPTA does not allow discount schemes if they lead to different tariffs for different buyers in the same area. However, OPTA allows discount schemes in which all buyers profit from the offered discount as the discount is applied to the total market volume.

In the Netherlands the introduction of a discount scheme based on total market volumes leads to relatively higher base access prices. However, the prices with discount will be relatively lower in case the actual penetration rate is higher than expected. The net effect of the introduction of the discount scheme is that total turnover and consequently the rate of return becomes less sensitive for the sales volume or the penetration rate. This reduced sensitivity of the rate of return for the penetration rate reduces the risks of the investor. By giving the investor the choice to introduce a discount scheme as described, the investor can transfer some of his own investment risk to the buyers of unbundled fibre access ('risk sharing').

Sweden

Discounts are allowed as long as the incumbent can prove that the discount is non-discriminatory and based on actual cost savings due to variables such as volumes or commitment.

Best practices / preliminary conclusions

- Volume discount schemes are rarely offered and/or accepted by NRAs. They are allowed in one country and under consultation in another.

J Preliminary Conclusions/Dilemmas

BEREC believes that regulatory certainty and consistency are crucial in order to foster a competitive environment for long-term investment in NGA. Thus BEREC shares the goal of the Commission's Recommendation on NGA to complement and enhance the NRAs ability to follow due process and create a regulatory environment that applies appropriate and con-

sidered measures which promote both investment and competition. In this regard the NGA-Recommendation has come timely to ensure the roll-out and deployment of NGA across Europe while recognizing that Member States are in different stages of NGA roll-out and deployment.

Since it came into force in September 2010 thirteen MS notified remedies in Market 4 and ten MS notified in market 5.

As stated in previous BEREC reports and confirmed by the data collection performed for this report operators in different MS do follow different NGA deployment strategies involving different degrees of using own infrastructure or focus on using active resp. passive wholesale products etc.) due to a number of factors and characteristics:

- The business case for NGA roll-out is driven by resp. influenced by inter alia the following factors
    - population density, geographies etc.;
    - costs of deployment influenced inter alia by factors such as availability of ducts, access to sewage system;
    - (lack of) demand;
    - willingness to pay for higher bandwidth/ARPU,
    - competitive conditions regarding inter platform competition, more specifically the presence of cable networks and intra platform competition;
    - penetration achievable for NGA networks;
    - speed of migration towards NGA networks

- In some MS incumbents tend to invest heavily in NGA roll-out, however focusing on different architectures and technologies.

- The current state of deployment in each MS also reflects the “history” with regard to both market developments and current generation remedies. This may impact on the migration towards NGA and NGA remedies. Some important factors are listed hereafter:
    - “path dependence” in the sense that LLU countries are more likely to want to continue with this approach ;

- costs of NGA deployment vs cost of current generation deployment (opportunity costs of no longer paying for LLU as a driver) impacts on the roll-out incentives of both incumbents and competitive operators;
- current generation price is generally geographically averaged; In case next generation access prices are geographically deaveraged (e.g. dens/non-dense) it is a challenge to ensure consistency of wholesale access prices across the value chain and conduct margin squeeze tests;

Differences in national circumstances may justify different combinations of remedies that are tailor-made for the national market a fact that the Commission has reflected in Recital 3 of the Recommendation ("….aimed at preventing inappropriate divergence of regulatory approaches, while allowing NRAs to take proper account of national circumstances when designing appropriate remedies".).

The Commission itself followed a wide interpretation of the application of the NGA recommendation to mandate access to specific wholesale products reflecting the variety in national circumstances and acknowledging that these circumstances vary too much to be treated in a completely identical manner.

Since regulation of NGA networks is still in its early stages there is up to now little experience on the effects of certain sets of remedies on investment incentives and competition. More specifically it is an issue whether either LLU unbundling and/or duct access will be a success or more active type remedies or a combination of both are necessary to maintain competition in an NGA environment. This implies that it is currently difficult to already find best regulatory practices.

A number of preliminary conclusions have been identified for the specific wholesale products discussed in the section B to I in the report. Furthermore some observations of a more general nature regarding increased complexity, variety of local market conditions and typical combinations of access obligations.

J.1 Preliminary conclusions regarding specific wholesale products

Access to Civil engineering infrastructure /ducts of SMP operators (Chapter B)

- A mandated duct access product exists in 2 out of 3 countries. In those cases where such a product is mandated cost-orientation applies (except for 2 countries).

- The access obligation in the Recommendation is limited to civil engineering used for local loops cables and ducts needed for enabling backhaul. When there is no spare capacity, there is no mention in the Recommendation for other type of obligations. However, the access obligation should be defined - avoiding the possibility of the incumbent to strategically withhold capacity - either by placing the burden of proof on the incumbent, or by imposing dark fibre access when no ducts are available. The definition of rules for allocating limited space can also help to optimize ducts use.

- When allocating costs for cost-oriented prices on ducts, several drivers can be considered as the degree of occupation (physical space or number of cables) or the number of subscribers. When physical space is used as allocation key, implying higher up-front costs and decreasing average cost as the number of cables grow, contrary to the case of the use of the number of cables as allocation key, which involves lower costs at the start. If the cost allocation rule is based on the number of fibre subscribers, costs are also lower at the start and proportional to fibre subscriptions. NRAs can also consider the use of a pricing per line in specific areas to facilitate shared deployments in rural areas.

- The reference offer for ducts should include procedures and tools ensuring efficient and timely non discriminatory access to ducts ideally based on one-stop shop IT systems, as well as details on engineering rules for space management. It may be important to define SLAs for both internal and external provision and fault management process, as well as KPIs that might be measured regularly and made public to the NRA and alternative operators.

Database

- At this stage a database exists in around one third of all countries. However, there are differences as to whether the database follows from a regulatory obligation (4 countries) or not, by whom it is run (e.g. incumbent or NRA/ministry), and whether it contains only data of telcos or also of non-telcos.

- BEREC is of the opinion (in agreement with the determinations of the Annex II of the NGA-Recommendation) that where feasible the SMP operator should build such a database of civil infrastructure, covering its organization (and technical characteristics of its different elements), their geographical location (ducts, poles, distribution points and any other physical asset), including available space in ducts. BEREC considers such remedy essential for the usage of access to civil infrastructure.

- Given the context of the Recommendation, where only obligations to be imposed on SMP operators are listed, and the scope of this particular access obligation – under "Access to civil engineering infrastructure of the SMP operator" and Market 4 obligations –, BEREC considers that this infrastructure database, as defined by the Recommendation, should at least contain all ducts of the SMP operator.

- BEREC is of the opinion that such a database is deemed necessary, but it is not enough to provide information regarding the location of the civil infrastructure of the SMP operator, but also information on the effective availability (or not) of space, e.g. in ducts, since this is necessary for the alternative operators to effectively deploy their (fibre) networks.

Access to terminating segment in the case of FTTH (Chapter C)

- In almost one out of 3 countries access to the terminating segment is mandated, either as an SMP obligation in Market 4 (6 countries) or imposed via symmetric obligations (4 countries).

- The access/distribution point typically is located in the basement of the building (Portugal, Spain, France in very-high density areas, Italy), which implies that the terminating segment refers to in-house cabling.

- However the access point can also be located at a concentration/distribution point outside or close to the building (e.g. at the facade, manhole/pole or in a street cabinet)[116], especially in less dense areas (Italy, France outside very-high density areas, Spain).

- There seems to be agreement across MS that in-house cabling can be considered as economically difficult to duplicate. In such cases, symmetric regulation may be generally appropriate. In many countries in-house cabling is also subject to civil law which can restrict the applicability of regulation.

- Ten countries have imposed either FTTH unbundling or access to the terminating segment. Five countries have imposed both remedies simultaneously.

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116 The distribution/sharing point corresponds to the location of the 'optical termination boxes' and may be placed in the building itself or in the public domain. See, e.g., sections C1 and C.2 of BoR(10)08.

Unbundled access to the fibre loop in the case of FTTH (Chapter D)

- In 10 countries regulated unbundled access to the fibre loop (ODF access) exists. In all these countries except for one cost-orientation applies, sometimes accompanied by a margin squeeze test

- In general, if FttH is included in the relevant market, the incumbent rolls out an FttH network and FttH unbundling is feasible, FttH unbundled access is imposed by NRAs.

- FttH is sometimes not imposed if other (symmetric) passive remedies are imposed already (e.g duct access) that ensure sufficient competition (in the respective geographical area). At this point several NRA received comments from the Commission as the Commission seems of the opinion that FttH unbundling should in principle be applied.

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- In a GPON architecture imposing unbundling in the form of access at the splitter may turn out to be very similar to imposing access to the terminating segment. The viability of these remedies may depend on the location of the splitter (splitter in the basement of the house, splitter located at the cabinet or some other concentration point between basement and MDF) and how easily this access point can be reached. Therefore supplementing remedies to reach the access point like remedy duct access, dark fibre and/or Ethernet backhaul (right hand side of the ladder) may be needed. Availability of access to sewage system at low cost may also play a role.

- Ten countries have imposed either FTTH unbundling (Croatia, Germany, Netherlands, Slowak Republic, Sweden) or access to the terminating segment (FYROMacedonia, France, Italy, Portugal, Spain). Five countries have imposed both remedies simultaneously (Finland, Hungary, Lithuania, Poland, Slovenia).

- In a GPON architecture unbundling still represents a challenge to regulators. Currently unbundling is technically feasible at the last splitter only. It is uncertain if and at what price alternative technologies like WDM-unbundling allowing unbundling at the MPoP become available. NRAs have proposed different combinations of wholesale remedies to alleviate this situation. It remains to be seen which solution is technically and commercially viable in the long run leading to a competitive market.

- The Commission has rightly recognized that differences in national circumstances may justify different combinations of remedies (Recital 3)

Access obligations in the case of FTTN (Chapter E)

- In the two out of three countries cabinet unbundling is available on a mandated basis. It is provided on a voluntary basis in one country.

- Overall, while SLU is available on a mandated basis in the majority of countries, it is not widely used in practice. Thus, in many instances it may not provide a positive business case for operators. This may be particularly due to unfavourable economies of scale. However in some MS (UK, Germany) SLU plays a role as a complementary remedy for the roll-out of DSL in rural areas.

- Discontinuation of SLU due to the introduction of vectoring implies dismantling of collocation sites and facilities at the street cabinet unless it is used there as a concentration point for the terminating segment and/or unbundling of the splitter in a PON scenario. This requires clear migarion rules.

- Depending on the status of fibre unbundling different situations may arise in practice: In case of unbundling at the level of the street cabinet operators may be "pushed" to discontinue unbundling in the future and use enhanced bitstream at the MPoP instead. This may occur if there is no option to directly migrate to a fibre unbundling product at this level or at the ODF. Switching to new fibre unbundling technologies at a later stage (i.e. once the operator has de-installed his collocation facilities at the street cabinet) may constitute a significant barrier for the operator if he has to re-install the collocation facilities[117].

- Therefore the regulator might be faced with a dilemma in that he may want to support investment increasing the performance of the VDSL network on the one hand while at the same time allowing competitors to climb the ladder of investment. Such a decision requires a careful evaluation of the trade-offs taking account of the specific circumstances (e.g. are more future proof alternatives available that do not hamper passive wholesale products, the degree of platform competition, demand for unbundling).

Backhaul Dark fibre (Chapter F)

- Backhaul dark fibre products are mandated in about 40 % of the countries and in 2 countries it is available on a voluntary basis. (Almost) all NRA's have imposed a supplementing backhaul remedy in the case of sub-loop unbundling. Since sub-loop unbundling is however used to a limited extent only backhaul dark fiber isn't used frequently either.

- The Recommendation specifically refers to backhaul dark fiber in the context of subloop unbundling. Although not explicitly mentioned there, BEREC assumes that fibre in this context means dark fibre, i.e. passive fibre infrastructure without any active equipment attached.

- Furthermore BEREC assumes that dark fibre is *primarily* seen as a possible ancillary remedy in the case of FTTN (i.e. FTTC and FTTB) accompanying sub-loop unbundling of traditional copper lines allowing alternative operators to connect remote units placed at e.g. street cabinets (FTTC) or basement locations (FTTB) to a point deeper in the network (MPoP). Therefore BEREC speaks of *Backhaul* dark fibre in this context. Backhaul dark fibre often is accompanied by other backhaul remedies like backhaul ducts (passive) or backhaul layer 2 Ethernet services (active).

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117 See ERG (07) 16rev2, p. 50 for a similar argument.

- However BEREC is of the opinion that backhaul dark fiber can be a relevant regulated wholesale product also in combination with other access products (see ladder of investment) as it is used to reached the PoP of an alternative operator deeper in the network. NRAs also imposed backhaul remedies in a scenario of FttH unbundling (e.g Netherlands) and a scenario of terminating access in the case of a PON architecture. In the latter scenario some NRAs also regard access to the terminating segment/in-house wiring in a bundle or unbundled with dark fiber access (from the splitter to a concentration point deeper in the network (e.g. the MDF)) as in an end to end access product' (e.g. Italy). Whether a backhaul dark fiber remedy is proportionate depends on the economics of a specific NGA scenario.

Wholesale Broadband Access (Chapter G)

- In every second country enhanced bitstream products are available on a mandated basis and in 2 countries they are provided on a voluntary basis.

- In line with the Recommendation all NRAs seem to be implementing an active remedy. Two NRAs have implemented an active product in market 4 as a transitional remedy (consistent with Recital 21) to support competition where further upstream remedies are not seen as currently feasible.

- The wholesale active product characteristics required by NRAs reflect the bandwidth and quality the technological capabilities inherent in the NGA infrastructure (in line with Art. 33), as well as the regulatory aims, conditions of the market, and the intended relationship with other remedies in place.

- Industry discussion generally preceeds the development of a Reference Offer due to the complexity of active bitstream products and the need for interoperability.

Migration (Chapter H)

- A framework for migration exists in more than one third of countries. More than every second country foresees certain provisions for decommissioning MDFs. In almost half of the countries the incumbent is obliged to provide information on network modifications, including the roll-out of new infrastructures. Notification periods typically lie in the range between 4 and 12 months.

- In line with the Recommendation all NRA's seem to allow the phasing out of legacy networks and seem to keep the existing obligations in place until a certain migration path is agreed and followed.

- Where the NRA allows incumbents to phase out legacy networks - leading to a faster end of parallel running of networks – this may increase the viability of FttH deployments.

- Several NRA, have already imposed remedies that should facilitate the migration from access seekers from legacy to NGA infrastructure. As the Recommendation prescribes these remedies often include a notice period, a framework for migration and an obligation to the incumbent to provide all relevant information on network modifications.

- Regarding the notice period not all NRA's consider that a five year notice period is proportional. Some NRA's consider a shorter period appropriate.

- It is also important to note that fibre roll-outs may significantly change the competitive landscape, especially if MDFs will be closed down. Even as early as in the phase of announcements and planning, these developments may be liable for halting competitive tendencies.

Pricing principles and Risk (Annex I of the NGA-Recommendation - Chapter I)

Risk Premium:

- An explicit risk premium is applied for FTTH unbundling in two out of eleven countries, in Lithuania and the Netherlands[118].The application of a risk premium in case of newly built infrastructure is under consultation in Italy. This implies that a number of countries did not consider a higher interest rate appropriate. However other NRAs have taken account of risk by carefully assessing the factors of uncertainty mentioned in Annex I Section 6 of the NGA Recommendation (e.g. by considering moderate demand figure etc).

- Ideally an assessment of risk has to start with an evaluation of the different factors of uncertainty (demand, cost etc) as spelled out in the Recommendation at the suggestion of BEREC that yield the appropriate rate of return properly reflecting the investment risk. This has been carried out by NRAs in line with and based on commercial data (reflecting an actual business case), if possible (see Netherlands).

- When using the CAPM methodology the fibre risk assessment is difficult due to the lack of comparable fibre companies when calculating the beta (risk) for the WACC. There are no listed fibre (or even broadband)-only companies. Therefore the beta needs to be determined by a peer group consisting of companies that include other business areas or are present in other markets than the European. Alternatively, potential NGA-specific risk will have to be accounted for by using appropriate values for the crucial factors of uncertainty.

- When assessing the risk in NGA deployment, NRAs have found that many of the parameters making up the risk relates to the uncertainty of customer demand and small willingness to pay, both impacting on the ARPU and take-up. These are factors which NRAs have taken into account and which have affected the calculations of access prices.

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118 Only in the case of overpermance to compensate for asymmetrical risk. See D.6.

Criteria to assess long-term access pricing and volume discounts in case of FttH:

- Long-term access schemes and volume discount schemes are rarely offered and/or accepted by NRAs. They are allowed in one country and under consultation in another.

J.2 General observations/dilemmas

Some more general observations can be identified pointing into the same direction across MS:

Increased complexity and uncertainty

- SMP regulation is becoming more complicated due to the fact that the wholesale access products need to be newly designed and adjusted to different NGA network architectures. While technological neutrality is endorsed as a principle the detailed specification and implementation of wholesale products such as fibre unbundling depend on the architecture chosen by the SMP operator (e.g. PON versus P2P).

- There also seems an agreement that in general NRAs prefer intervention at the deepest level possible as reflected in the NGA-Recommendation. Whether a business case based on passive remedies is considered feasible will however differ between geographical areas in Europe.

- Without any doubt it will be important to ensure that standards regarding further developments of fibre networks remain compatible with third party access, more particularly allow unbundling to ensure competition in the future. This applies specifically to the future generations of PON networks with regard to WDM unbundling.

- NGA roll out depends on a number of factors that are highly uncertain such as demand, willingness to pay, ARPU and penetration as well as technological developments impacting on costs. Therefore all actors in the market have to base their decisions on estimates which may later turn out to have been too high or too low.

- In some MS roll-out strategies seem to be frequently subject to change by the major investors (e.g. from VDSL to FTTH back to VDSL etc.). While informational transparency

could mitigate some of problems associated with it, strategy changes may change the parameters on which initial regulatory measures have been based. This may raise the question whether regulatory measures have to be adapted accordingly. However frequent change of regulatory decisions does conflict with the goal of long term regulatory certainty.

Variety of local market conditions

Another important common thread across MS is that markets are developing in an increasingly fragmented fashion:

- This variety of local market conditions is reflected in the fact that remedies are increasingly (explicitly or implicitly) differentiated between different geographical areas, most importantly between densely populated and less densely populated areas in terms of and access points and prices .
    - The determination of the concentration point is an exercise requiring a considerable degree of micro-management by the NRA (e.g. see France),
    - Pricing for NGA wholesale products may be differentiated across regions of differing population density (see pricing of the fibre loop in Sweden and the Netherlands, pricing of bitstream access prices in Italy[119]).
- Fragmentation of the market (and regulation) is also due to many other factors than density (number of actors, different technologies, etc.)
    - In most countries there will not be one uniform infrastructure rolled out by the incumbent.
    - Local fibre networks rolled out by municipalities/local authorities and/or utilities are gaining importance (see France, Sweden, Germany, Switzerland), and these may have different business cases.[120]

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119 Agcom proposed to differentiate pricing for competitive and non competitive areas; such areas, to be identified by Agcom, will have different characteristics in terms, inter alia, of population density.

- This implies more potential actors at the wholesale level.

- There is a chance that the incumbent may also become a buyer of wholesale products, changing the wholesale market dynamics.

- Given the increased number of players at the wholesale level it is an open question whether there is a chance for wholesale access occurring on a voluntary basis or whether mandatory access will continue to be required?

  - A natural incentive for providing voluntary access should be the economies of scale inherent in fibre networks. Viability of fibre roll-out crucially hinges on achieving a high degree of capacity utilisation as quickly as possible.

  - An incentive for voluntary access may occur if access is required in a reciprocal fashion. This may be the case for national operators or players active in more than one regional market whereas local players may not need wholesale access elsewhere.

  - The incentive for voluntary access is also naturally encouraged if the provider of the access doesn't compete on the higher level services (nor does any partner cooperating with the provider), i.e. some form of vertical separation is established.[121]

  - Furthermore product specifications, e.g. for wholesale broadband products may need to be developed by market parties that are applicable nationwide to avoid transaction costs arising from a proliferation of different variants of wholesale products. Such a process may be of particular importance for smaller local players lacking the resources to develop such specifications themselves.

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120 Municipalities may take into consideration factors that do not play a role for telco investors such as opportunity cost of a loss in tax revenues if business users are moving away without fibre connections.

121 See "BEREC Open Access Report", Chapter "Voluntary Access").

- The CEO Roundtable initiated of Commissioner Kroes has revealed that it is difficult to get beyond statements of a general nature regarding the willingness to offer non-discriminatory access.[122]

- While some voluntary wholesale contracts are being concluded in some MS it remains an open question whether given the caveats mentioned above voluntary access can be thoroughly successful to safeguard competition.

- Mandatory wholesale access may also be imposed in those cases where state aid is granted.[123]

- Altogether variety of local market conditions and trends toward fragmentation lead to the question whether local "monopolies" will emerge in the future and how regulators may then have to respond. Possibly answers may lead to either more geographically differentiated markets or increasing application of symmetric regulation. Both measures are addressed in the Recommendation. Preventing local monopolies may require different forms of measures such as regulatory remedies both SMP and symmetric, State aid and competition law which need to be fitted together consistently.[124]

Summing up the Recommendation is now in force for about a year. A major contribution of the Recommendation was to enhance regulatory certainty and increase harmonization.

In BEREC's view it goes without saying that fulfilling the NGA Recommendation does not imply imposing all remedies in all MS. Rather in line with the ladder of investment principle NRAs have implemented those combinations of remedies in markets 4 and 5 that properly reflect their national circumstances and are proportionate to remedy the competition problems identified in the market analysis. While BEREC was able to identify a number of preliminary conclusions regarding specific wholesale products it is too early at this point to come to definite best practices.

Consistency and regulatory certainty require that NRAs continue to apply the Recommendation and gain more experience with the effects of certain sets of remedies on investment in-

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122 See also NGA-Forum, Interim Report, Dec 2010 (in German only)

123 See BEREC 11 05 on Open Access for an analysis of manadotry access in the context of the Broadband Guidelines and the relationship to regulated access acoording to the Commission.

124 See Open Access Report

centives and competition. BEREC is therefore committed to continue its analysis of proportionate remedies aiming at best practices in the light of the trends identified in this report including increased complexity and variety of local market conditions.

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