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**EU Guidelines for the application of State aid rules in relation to rapid deployment of
broadband networks**

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1. INTRODUCTION: THE SCOPE OF THIS IMPACT ASSESSMENT

The Commission has considerable experience with assessing State aid granted for the roll out of broadband networks. Since 2003, it has already taken more than 100 decisions in this sector¹. On the basis of this case experience, in 2009 the Commission adopted Guidelines for the assessment of State aid in broadband². The Guidelines do not formally expire on a certain date. However, in the light of rapid technological and regulatory change, they provide in paragraph (83) a review to be carried out within three years. The review process started in April 2011.

On the basis of the Commission's EU case practice and the existing Guidelines, the Impact Assessment explores the options for the review. It does not address wider sectorial issues which are, for instance, linked to the regulation of the electronic communications sector. Similarly, the review is considered within the framework of the objectives of the Digital Agenda for Europe ('DAE')³ which themselves are not subject to that Impact Assessment.

2. PROCEDURAL ISSUES AND CONSULTATION OF INTERESTED PARTIES

2.1. Context

Until 2009, when the State aid Broadband Guidelines were adopted, the financial support offered by Member States for the broadband development was assessed directly under the State aid rules of the Treaty on a case-by-case basis. In 2009 the State aid Broadband Guidelines were adopted codifying the well-established Commission's case practice concerning basic broadband networks and extrapolate the fundamental tenets and apply them to the new area of very high speed Next Generation Access (NGA) networks. Since then, the Broadband Guidelines form the fundamental reference for state aid assessment in this sector. Following the adoption of the Guidelines, Member States have started designing better aid schemes and the Commission was able to speed up its assessment, as the record number of decisions on state aid broadband measures since September 2009 shows.

Member States are asked to design their support schemes on the basis of the rules and conditions set out in the Broadband Guidelines. Other interested parties include the recipients of State aid, primarily telecommunication operators providing broadband services, their customers – other telecommunication companies providing retail services to end users, as well as their employees – and finally the end-customers obtaining broadband access.

¹ The list of Commission's broadband decisions is available here: http://ec.europa.eu/competition/sectors/telecommunications/broadband_decisions.pdf.

² Communication from the Commission — Community Guidelines for the application of State aid rules in relation to rapid deployment of broadband networks Text with EEA relevance, OJ C 235, 30.9.2009, p. 7–25: [http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52009XC0930\(02\):EN:NOT](http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52009XC0930(02):EN:NOT).

³ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, COM (2010) 245 final *A Digital Agenda for Europe*.

2.2. Organisation and timing

The review started on 19 April 2011 with the launch of the first of two rounds of public consultation. The first consultation included a questionnaire seeking views on the relevant issues. Based on the comments received and recommendations from a study, the Commission services published draft new Guidelines on 1 June 2012. The second round of consultations on this new draft ended on 3 September 2012. In the context of the two public consultations, DG Competition hosted multilateral meetings with Member States on 14 November 2011 and 13 September 2012.

The project has been led by Directorate General for Competition (DG Competition).

2.3. Previous steps in the revision process, including consultations

2.3.1. Member States and Stakeholder Consultations

On 19 April 2011 DG Competition launched a first public consultation, by publishing a detailed questionnaire to highlight the most important aspects of the revision exercise. These included, for instance, the technological and market development of very high speed broadband infrastructures, the best design of access conditions on subsidized next generation networks, enhancement of transparency of state aid broadband measures or the role of the National Regulatory Authorities (NRAs) in such projects.⁴ 120 contributions were received during the 4.5 month consultation period. They came mainly from Member States, public authorities, telecommunication operators, including fixed broadband, cable and satellite operators, mobile operators and associations of such companies.

On the basis of the results of the first public consultation, a draft text was prepared and a second round of public consultation started on the draft new Guidelines on 1 June 2012⁵. In this case, almost 100 contributions were received from a similar range of contributors. All contributions not having a character of confidentiality have been published on DG Competition's consultation page.

2.3.2. Meetings with interested parties

Apart from the multilateral meetings with Member States, the Commission services met notably with representatives from telecommunications incumbents and alternative operators, cable, mobile and satellite operators and service providers. In June 2012, it also presented and discussed the draft new Guidelines to the European sectoral social dialogue committee for telecommunications.

Two multilateral meetings were held with Member States, on 14 November 2011 and on 13 September 2012, showing an overall support by Member States as regards the issues to address in the revision exercise.

As regards other stakeholders, they also generally supported the Commission's approach but proposed also a number of more detailed comments, further discussed in Section 3 of this Report.

⁴ http://ec.europa.eu/competition/consultations/2011_broadband_guidelines/index_en.html.

⁵ http://ec.europa.eu/competition/consultations/2012_broadband_guidelines/index_en.html.

2.3.3. *External studies*

WIK Consult conducted a study for the Commission on the implementation of the existing Broadband Guidelines⁶. It looked at 10 case studies and provided recommendations on a number of technological and competition issues (the sample included 7 existing State aid measures). The study was published in December 2011.

3. THE PROBLEM AND THE POLICY CONTEXT

3.1. Broadband infrastructure is an important driver of economic development

The existence of a high performing broadband infrastructure is considered to be an important factor for economic development throughout the world. High speed internet access enables businesses, especially small ones, to remain competitive and it allows consumers to benefit from many advanced online services that improve their quality of life.

There exists ample literature discussing the positive spill-overs of the telecommunications (broadband) infrastructure for the economy as a whole. For 21 OECD countries the positive impact for economic development from investments into the telecommunications infrastructure was already found for the period 1970-1980s in an empirical research by Röller and Waverman (2001). More recently, using a similar approach for broadband technology, Czerich et al. (2009) show for the period from 1996 to 2007 that the development of such infrastructure led to a 2.7% to 3.9% higher per capita GNP for 25 OECD countries⁷. Such results could also be found for areas with low population density⁸.

3.2. The state of European Broadband markets and technological development

There exist a significant number of different broadband technologies. At this stage of development, different technological platforms have very different technological capabilities and therefore they cannot always be considered to be substitutes. In principle one can distinguish between fixed and mobile networks. As regards fixed networks, the Digital Subscriber Line (DSL) technology is based on the existing telecommunications infrastructure (copper cable). This infrastructure normally belongs to the incumbent telecommunications operators (like BT, France Telecom etc.). In addition, in the last few years the deployment of fibre optic networks has been undertaken. Fibre optic allows the rapid transfer of very large data files. This is one of the technologies which is being deployed for the Next Generation Networks (NGA). Fibre optic is deployed also for backbone and backhaul infrastructure. The connection of the end-user (the "last mile") with fibre optic technology however is very costly. As a result, today's fixed telecom networks consist mainly of a hybrid technology which combines copper based DSL and fibre optic.

Due to technological convergence, electronic communications signals can also be conveyed by cable (TV) networks. In many cases these cable networks are not operated by telecommunication operators. Therefore in several Member States they provide a separate and competing solution to the telecom incumbent.

While so far mobile networks mainly have been complementary to fixed telecommunications infrastructure, more recently, similarly to cable networks, due to technological progress wireless networks are evolving to offer an alternative for data transmission. Given the rapid evolution of technology, next generation fixed wireless access (e.g. based on point-to-

⁶ http://ec.europa.eu/competition/consultations/2011_broadband_guidelines/final_report_en.pdf.

⁷ Fornefeld, Delaunay and Elixman (2008) estimate that in the economically advanced countries 0.89% of economic growth can be attributed to the broadband sector.

⁸ Cf. for instance, The Economist 20 February 2010.

multipoint or tailored mobile broadband technology) are becoming already a viable alternative to wired NGA in the near future

As regards satellite networks, so far they have been mainly used for the transmission of TV signals. As for other technologies, technological progress has made this platform also suitable for broadband data services. As the satellite footprint covers the entire European territory, they seem to be particularly suitable to serve remote rural areas. However, for the time being, the risk of time lag and the slower "uplink" speed allow the use of satellite only for the transmission of basic broadband services and, generally, only in specific conditions.

Annex II to this Report provides a short description of the most important technologies.

Today, Internet access in the EU is mainly based on first generation broadband. Most people connect to the Internet over telephone copper and TV cable networks, both of which offer only limited speeds. Europe is lagging behind other parts of the world (USA, Japan, Korea) where heavy investments are made to foster the deployment of NGA networks that enable to access high-speed internet.

DSL technologies still dominate the EU markets with not too high broadband speeds. However, lines providing speeds of 10 Mbps and above increased by 9.5 percentage points year-on-year, representing 48.4% of the total market in January 2012. The proportion of intermediate speeds (above 2 Mbps and below 10 Mbps), which accounted for the largest share of lines in 2011 (47.8% out of the total), fell to 43.4% in January 2012. The range of speeds below 2 Mbps continued falling and represented only 8.2% of the total broadband market in January 2012.

While there is a clear trend towards delivering higher speeds using first generation broadband technologies, until January 2012 only 8.1% of the population in the EU subscribes to lines providing speeds equal to or higher than 30 Mbps. Most of these lines are for speeds above 30 Mbps and below 100 Mbps with just 1.3% of accesses in some EU countries providing speeds equal to or above 100 Mbps.⁹

The coverage of basic broadband (DSL) networks was 95% at the end of 2011.

Mobile broadband experienced a boost in 2011; and data traffic through wireless devices is growing exponentially. The penetration rate for all active subscribers jumped from 26.2% in 2011 to 43.1% in 2012 (i.e. a 17 percentage point year-on-year increase).

As regards fourth generation mobile broadband (LTE), spectrum auction already took place in a number of Member states and the technology is available in eight EU Member States. LTE may help mobile operators becoming not just complementary but competing with fixed broadband. This could change the competitive situation of the broadband market in the future.

3.3. Policy framework

In the context of the 2000 Lisbon Agenda the respective Presidency Conclusions¹⁰ of the European Council called in particular on the Community and the Member States *“to make available in all European countries low cost, high-speed interconnected networks for Internet access and foster the development of state-of-the-art information technology and other telecom networks as well as the content for those networks.”*

The 2005 Spring European Council, launching the partnership for growth and jobs as a new start for the Lisbon strategy, called knowledge and innovation the engines of sustainable

⁹ Source: Digital Agenda Scoreboard 2012.

¹⁰ See http://www.europarl.europa.eu/summits/lis1_en.htm.

growth and stated that it is essential to build a fully inclusive information society, based on the widespread use of information and communication technologies (ICT) in public services, SMEs and households. The rationale for this was in particular, that ICT are viewed as a powerful driver of growth and employment. Against this backdrop, the Commission proposed in 2005 the i2010 strategic framework, laying out broad policy orientations towards 2010. To create as Single European Information Space four main challenges were identified, one of which was: “*speed: faster broadband in Europe services to deliver rich content such as high definition video*”.

This general policy highlighted in the above statements has been further clarified by a number of regulatory initiatives by the Commission. First, in 2009, the Broadband Guidelines were adopted to contributing to the achievement of the policy objective of broadband coverage by appropriately directing public subsidies. In 2010, additional initiatives were undertaken, among which addressed the regulatory environment meant to encourage private investments, among which the NGA Recommendation¹¹.

Furthermore, the Commission clarified its vision for the future in its Digital Agenda for Europe (DAE), in which the Commission stressed that Europe needs widely available and competitively priced fast and ultra-fast Internet access. The DAE referred to the Europe 2020 Strategy¹² which underlined the importance of broadband deployment to promote social inclusion and competitiveness in the EU. The DAE restated the objective to bring basic broadband to all Europeans by 2013 and to ensure that, by 2020:

- all Europeans have access to much higher Internet speeds of above 30 Mbps, and
- 50% or more of European households subscribe to Internet connections above 100 Mbps.

The estimated costs of those objectives are estimated to be up to EUR 60 billion for the first stage and EUR 270 billion for the second. According to the DAE the Member States shall draw up national broadband strategies until 2012 that may contain funding instruments.

3.4. The underlying problem: the funding gap and the need to protect competition

While most of the necessary investments to achieve the goals of the DAE, as highlighted above, will be carried out by private companies¹³, there are areas in which market investment is not profitable.

Due to the economic characteristics of the industry, private investments alone will not suffice to attain such ambitious coverage goals and governments will have to step in with the smart (and pro-competitive) use of public funds to extend high-speed and very high speed, next generation access (“NGA”) network coverage to those areas in which market operators are unlikely to invest on commercial terms. As highlighted in Section 3.1 above, the importance of the internet means that the benefits for society as a whole are much greater than the private incentives to invest in faster networks. Therefore, to bridge the funding gap, public support for the non-profitable areas will be necessary.

Mobile and to a lesser extent also satellite technology have so far contributed to achieving the first DAE target to bring basic broadband services to all citizens in the EU by 2013. The other

¹¹ Commission Recommendation of 20 September 2010 on regulated access to Next Generation Access Networks (NGA), OJ L 108,24.4.2002, p.23.

¹² COM (2010)2020.

¹³ For example, all four major broadband provider in France (Orange, Illiad, SFR and Numericable) have constructed fiber optic networks in French cities. See ARCEP (2010).

two above-mentioned DAE targets, however, require extensive new investment in NGA networks. Today, fibre based, advanced upgraded cable and certain wireless access networks can guarantee speeds of above 30 Mb/s¹⁴.

Due to high investment costs for broadband and NGA rollout, many telecommunications operators do not see a business case to commit themselves to a wide broadband roll-out, and they are holding back investments into ultra-fast, NGA networks, which would be the key to achieve the DAE objectives¹⁵. This is due to several factors, in particular the high investment costs for ultra-fast (fibre based) broadband networks, besides the dire economic and financial climate since 2009. Even in countries where investments are progressing, commercial deployment of ultra-fast broadband networks are focused on a few major (capital) cities¹⁶.

Very different policies have been tried to pursue the goal of achieving ubiquitous high speed broadband coverage. The most radical approach was taken by Australia and New Zealand: in these cases the complete roll-out relies on public funds, forcing all operators to compete on this infrastructure. In South Korea and Japan, governments provide "soft loans"¹⁷ to create incentives to the incumbent operators to undertake such investment. In the US, a "regulatory holiday" is provided for the main providers: they do not have to provide access to any other operators on their networks. As a result, they often are expected to benefit from monopolistic rents which should encourage them to widen the roll-out of the infrastructure. In addition, in the US 7 billion dollars of public subsidies were provided in the 2008 stimulus package to support the roll-out of broadband networks.

In the EU, the policy foresees a mix of regulatory measures to stimulate private investments¹⁸ and use of targeted public subsidies (state aid) to extend the coverage of broadband networks to those areas where private companies do not invest.

However, it is important to underline that public funds have to be used cautiously in a sector such as the electronic communications which has already been fully liberalised, and in principle, should be complementary and not substitutes to the investments of private market players. State intervention should limit as much as possible the risk of crowding out private investments and of altering commercial investment incentives and should not therefore distort competition.

In other words, the goal of achieving ambitious infrastructure development targets needs to be qualified in the sense that effective competition shall also take place between and on these infrastructures. Effective competition will help to maximise "consumer welfare", in the form of lower prices and of better and more services for European citizens and companies. Several examples suggest that indeed, smartly used public funds can lead to wider coverage, increased competition, more investments and better end-user prices in this sector. Crowding out of

¹⁴ Mobile LTE networks can achieve such speeds as well. However, as they are a "shared" facility, the transmission speed declines the more users are connected to the network at the same time

¹⁵ In 2010, for instance, Deutsche Telekom announced to roll-out fibre to 10% of all German households by the end of 2012 which would have implied the number of 4 million homes passed. In the meantime, however, these plans have been reduced to 160,000 lines in 2011 and 100,000 lines in 2012. This would amount to just about 7% of the originally announced plans. Source: WIK Consult.

¹⁶ For instance, in Italy, Telecom Italia announced that only the 13 largest cities will be covered on market terms. From the bigger Member States, as of early 2012, Germany, Italy and Spain seem to be particularly lagging behind in terms of high speed broadband deployment, while investments are progressing better in the UK, France and the Netherlands due to stronger competitive pressure on the market (from cable companies) and/or more advanced regulatory framework.

¹⁷ i.e. loans without interest rates or with minimal interest rates.

¹⁸ Currently also under review.

private investments would not only lead to the waste of taxpayer's money¹⁹, it would also drive away private investors and therefore it could delay achieving the Digital Agenda objective itself.

Distortions of competition can also arise at other levels. For instance, when tendering out publicly funded projects, the tender procedure may be biased to a particular technology or a particular bidder. Further, the high level of fixed (and sunk) cost in many cases make it unlikely that competing infrastructure is put in place. Instead, competition between service providers can take place on the same infrastructure if proper access conditions are applied. To exclude such competition, the network operator may choose technological solutions which exclude granting effective access.

The 2009 Broadband Guidelines attempted to achieve the fine balance between fostering infrastructure rollout and preserving market competition in the way described in the following Section. The existing Guidelines already foresee the necessity of a review within 3 years to adapt to market, technological and regulatory developments. One such development emerged relatively soon, namely the adoption of the Digital Agenda setting specific targets for Member States. The DAE was adopted in 2010, i.e. after the State aid Guidelines and for this reason there have been instances of conflict between achieving the goals as set in the DAE and fulfilling the conditions for the application of the Broadband Guidelines.

3.5. The current policy approach

The Broadband Guidelines aim to contributing to the achievement of the policy objective of broadband coverage by appropriately directing public subsidies. The Guidelines are *complementary* to encouraging private investment via appropriate regulation and to undertake other actions to stimulate insufficient demand. Whenever the other regulatory policies will not succeed in stimulating private investment because of existence of a market failure, public authorities may decide to fund a broadband infrastructure with the aim to achieve the coverage objectives set at European level to spur economic growth and development. The goal the Guidelines want to achieve is to channel public investment in the most pro-competitive way.

The current Broadband Guidelines are based on a distinction between basic and NGA networks. The logic behind the distinction is that while the former is based on the existing legacy network (or other wireless technologies), NGAs represent new infrastructures with enhanced characteristics, not based on the legacy networks, and able to deliver advanced connectivity services (very high speeds, symmetry, etc.). At the time of entry into force of the 2009 Guidelines, NGA deployment was just starting and the Commission only had limited case practice.

In line with general State aid policy, the Guidelines first outline under what conditions government intervention does not constitute State aid. This is mainly limited to the application of the Market Economy Investor Principle (MEIP) and to public service compensation in case of Services of General Economic Interest (SGEI). If aid exists, such aid

¹⁹ To take an extreme example from the US where there does not exist State aid control: Eisenach and Caves (2011) report that a large part of the "Rural Utilities Service" (RUS) from the ARRA funded broadband initiative was invested in areas where a high proportion of households was already previously served by private providers. In the three projects examined only 452 new homes were connected to broadband infrastructure with a state subsidy of USD 232 million. According to the authors, this massive bad investments resulted from the fact that the ARRA left to the RUS substantial freedom while the latter had insufficient experience in the sector. As a result, mainly projects in the suburbs were funded. Eisenach and Cates (2011), p. 4 - 10.

needs to be notified to the Commission. The Guidelines set out the conditions under which such aid could be declared compatible.

Compatibility assessment under the balancing test

The objective of the balancing test is to assess whether an aid measure can be deemed compatible with the internal market. This is done by weighting the positive impact of the aid measure against its potential negative effects like distortion of competition or trade. On the positive side, the aid has to address a market failure (which has to be demonstrated by the Member State). In order to assess the existence of market failures, the Guidelines use the concept of white, black or grey areas (see Sections 2.3.2.1 to 2.3.2.3 of the Guidelines).

"White areas" are those where broadband services are currently not available and where no network expansion plans are pursued by private investors within the near future (specified as a period of 3 years). These areas are eligible for state aid. In contrast to that, no state intervention is needed in "black areas", since these are characterised by at least two broadband network providers and by the provision of broadband services under competitive market conditions (facilities-based competition). In "grey areas", considered as those with a de facto monopoly, State aid is permitted only under certain circumstances, so a more thorough assessment is needed. To justify the proposed categorisation of a particular region, the Member State has to provide detailed mapping information including coverage and market analysis.

The balancing test then sets out a number of principles to limit the distortion of competition to the minimum. First, it has to be demonstrated that, in order to address the market failure, there does not exist a better way of intervention (such as regulation). Moreover, the Guidelines indicate concrete conditions that have to be fulfilled for the intervention to be considered as not excessively distortive (see paragraph 51): an open tender process, the choice of the most economically advantageous offer, technological neutrality, use of existing infrastructure, wholesale third party access at prices derived from benchmarking and a claw-back mechanism to avoid over-compensation.

3.6. The application of the Broadband Guidelines

Member States provide substantial government funding for the roll-out of broadband infrastructure. The Commission approved 1.826 billion and 1.868 billion of broadband aid in 2010 and 2011, respectively²⁰ (3.05% in 2010 and 3.45% in 2011 of the total aid volume to services and industry, excluding crisis related measures). In addition to Member State financing, the EU also proposes to make significant funding available in the coming years. Under the proposed Connecting Europe Facility (CEF), at least €7 billion would be made available for investment in high-speed broadband infrastructure between 2014 and 2020.

In total, between 2003 and 2012 the Commission approved more than 110 State aid measures in the broadband sector²¹, authorising more than EUR 11 billion of State aid for broadband networks²². The importance of public funding has increased significantly since 2008, when national State aid measures for broadband roll-out were designed as an integral part of national broadband strategies. Therefore the amount of State aid dedicated to the broadband sector has risen sharply compared to the average in the period 2004 - 2008.

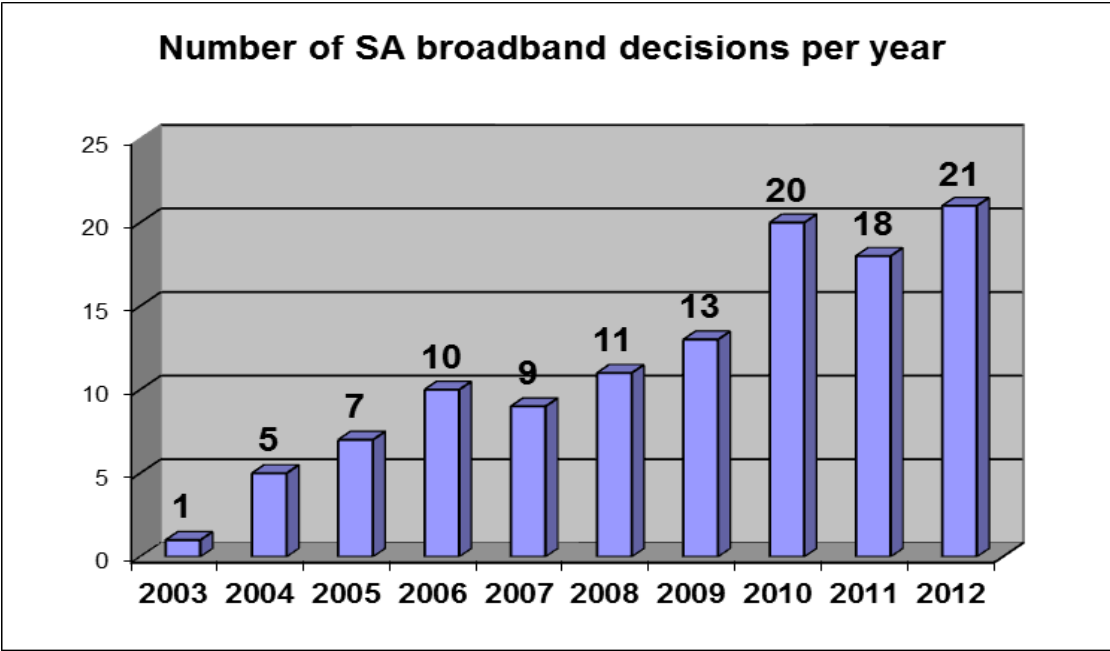
²⁰ Source: Digital Agenda Scoreboard 2012.

²¹ See http://ec.europa.eu/competition/sectors/telecommunications/broadband_decisions.pdf.

²² Commission's data based on the multi-annual aid budget for which authorisation was granted.

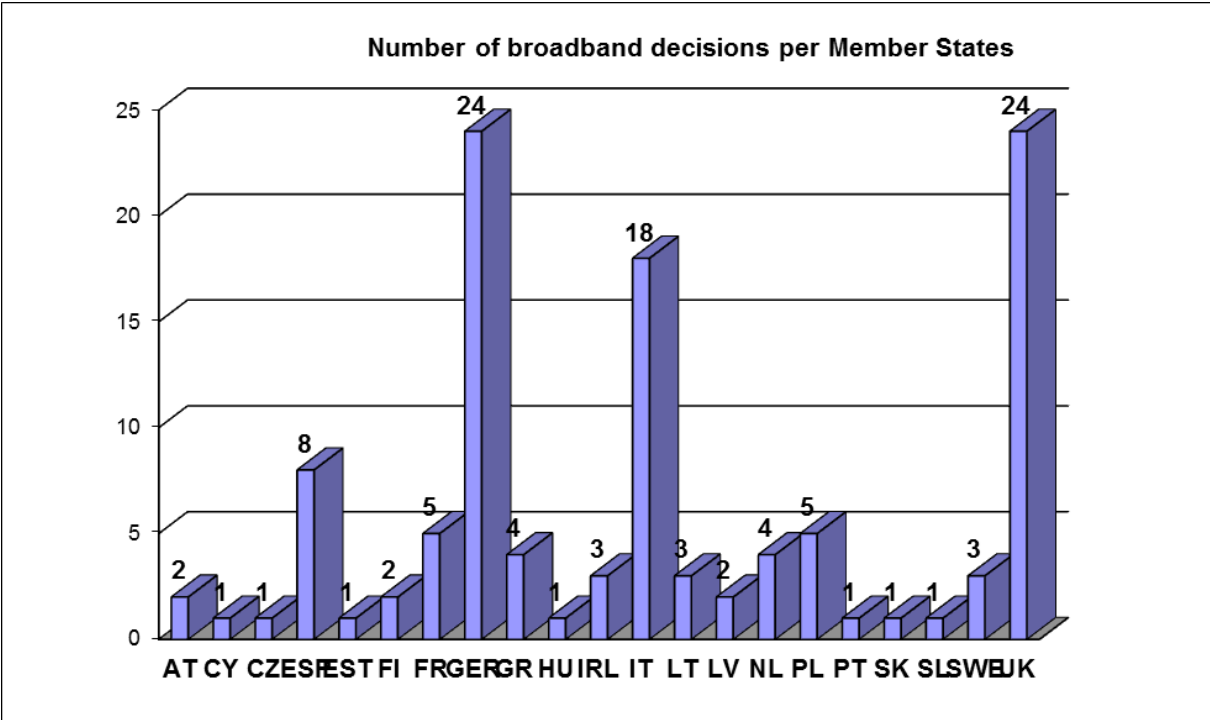
The implementation of the authorised aid schemes, however, seems to be delayed. According to the annual reports for the period 2006 - 2011, Member States indicated that only EUR 605 million of aid was actually spent for broadband networks. In that regard, one should take into account the "time-lag": state aid schemes have durations of 3-5 years, thus for instance a scheme that received state aid clearance in 2011 would trigger investments between 2012-2017.

Chart 1: Number of Commission State aid decisions on broadband per year



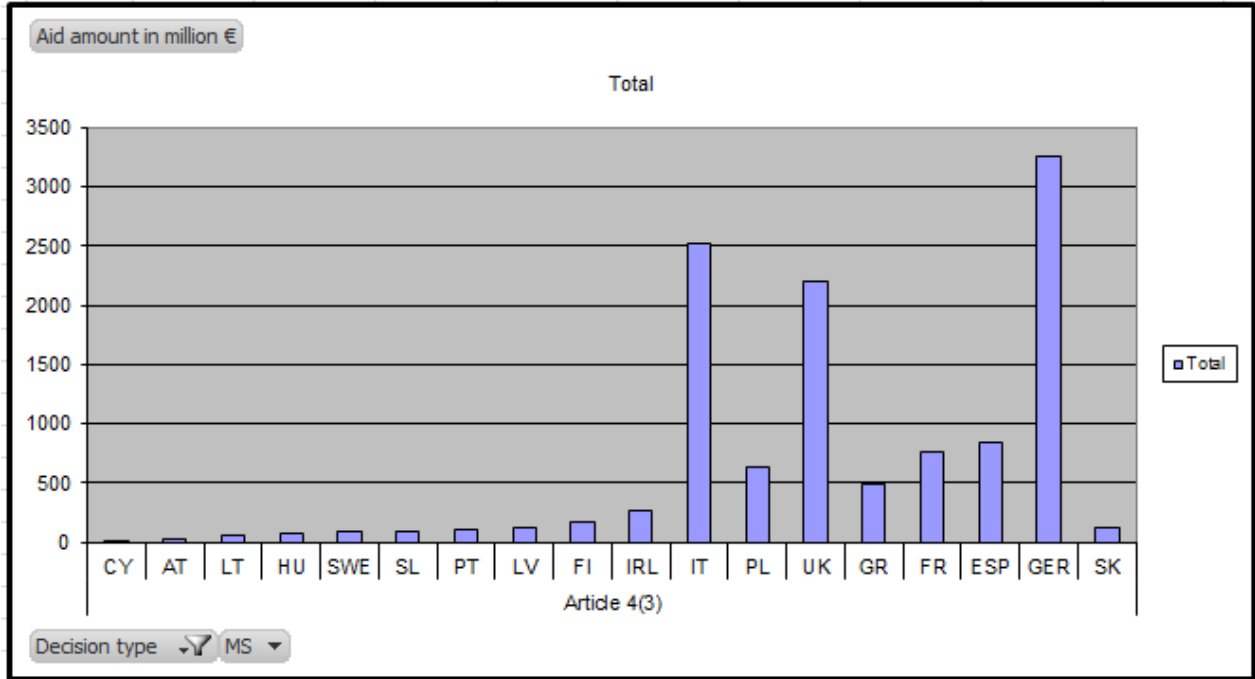
In the same period, for most countries there is only a small number of authorisation decisions. For the United Kingdom, Germany and Italy the number of decisions is very high with more than 10 decisions each. Generally, in these countries, regional schemes were often notified. As regards France, it is likely that most funding projects fell into the scope of the Services of General Economic Interest (SGEI) exemption and therefore authorisation by the Commission was not necessary. More recently, also Poland has begun to notify multiple regional and local schemes, hence the figure for Poland is likely to increase.

Chart 2 - Number of State aid decisions per Member States



As regards public funding, Italy, Germany and the UK earmarked the largest amount of State aid in this sector. Furthermore, certain measures are not covered in these figures, as they do not constitute State aid. France, for instance, has been financing broadband projects as SGEI, which are estimated in the neighbourhood of €2 billion of public funds.

Chart 3: Multiannual State aid budgets per member States (in million €)



In the vast majority of cases the European Commission did not have serious doubts that the notified measure was compatible with the internal market (“Article 4(3) decision”). In some cases the European Commission came to the conclusion that the notified measure does not constitute aid (“Article 4(2) decision”). Three times the European Commission decided to initiate a formal investigation procedure as there were doubts about the compatibility of the notified measure with the internal market (“Article 4(4) decision”). In one of these cases the European Commission decided that the notified measure did not constitute State aid (“Article 7(2) decision”), in another case the notified measure was considered not compatible with the internal market and thus could not be put into effect (“Article 7(5) decision”), the third case is still pending. The first two decisions were taken before the adoption of the Broadband guidelines in 2009.

3.7. Evaluation of the current policy

3.7.1. Evaluation Process

The Commission has built an extensive experience in its case practice with the assessment of broadband aid schemes. In particular, after the adoption of the Guidelines, the Commission had regular contacts with national and local authorities in the context of notification procedure of more than 60 cases from 16 different Member States. In order to carry out an evaluation of the current policy, the Commission complemented the case experience with a number of additional steps which have been already mentioned above in Section 2 of this Report.

A first fact-finding exercise has been launched in April 2011. It consisted in the publication of "issues lists" for comment, i.e. a detailed questionnaire to help to identify critical points in the application of the Commission's policy. These included, for instance, the technological and market development of very high speed broadband infrastructures, the appropriateness of the black/white/grey paradigm, the usefulness of the basic/NGA distinction, the adequacy of NGA definition, the best design of access conditions on subsidized next generation networks, enhancement of transparency of state aid broadband measures or the role of the National Regulatory Authorities (NRAs) in such projects, possible problems with the implementation of the compatibility conditions etc.²³ 120 contributions were received during the 4.5 month consultation period. The non confidential replies have been published on DG Competition's consultation page. The comments received came mainly from Member States, public authorities, telecommunication operators, including fixed broadband, cable and satellite operators, mobile operators and associations of such companies, national Regulatory authorities and BEREC.

Following the public consultation, a first draft of revised Guidelines was prepared. This revised draft text was the subject of public consultation launched on 1 June 2012²⁴ for 3 months. Almost 100 replies were received from a similar range of contributors as the previous one.

In addition to contributions in writing, the Commission had a number of meetings with different stakeholders in order to further discuss their views: with associations such as ETNO, ECTA, Cable Europe, ESOA, as well as their members individually, equipment vendors, local authorities.

²³ http://ec.europa.eu/competition/consultations/2011_broadband_guidelines/index_en.html.

²⁴ http://ec.europa.eu/competition/consultations/2012_broadband_guidelines/index_en.html.

Overall, the replies to the consultation were very constructive. The participants found the issues proposed to be relevant and exhaustive, additional comments and sometimes very detailed suggestions were made. Regarding the design of the future Broadband Guidelines, many Member States and stakeholders welcomed the transparency measures, such as ex post monitoring. Most comments received concerned the role of the NRAs, the definition of NGA networks as well as access and pricing obligations.

Stakeholders generally welcomed the proposed transparency measures. Several mobile operators, incumbents and alternative operators support that the aid granting authority should carry out a public consultation before launching a broadband project, and the request to establish a dedicated central website for tenders at national level. A central database of existing infrastructure has been welcomed in particular by alternative operators.

Two multilateral meetings have been organised to discuss with the representatives of the Member States their views. As a result, it emerged that overall Member States supported the revision, while at a general level, the importance of coherence between the Broadband Guidelines and the State Aid Modernisation²⁵ ("SAM") package and also with policy initiatives of other DGs (e.g. the DAE, the EU regulatory framework for electronic communications and the proposed Connecting Europe Facility (CEF)). Generally Member States were in favour of more transparency (central webpages for tender procedures and existing infrastructure) on a facultative basis, but some did not agree to introducing obligatory transparency measures. Numerous more detailed amendments were requested.

In addition to the public consultation, the Commission also procured a study carried out by WIK Consult in 2011 on the implementation of the Existing Broadband Guidelines²⁶. The study looked at 10 cases (the sample included 7 existing State aid measures approved by the Commission) and provided recommendations on technological and competition issues to be tackled for the review. The study was published in December 2011. Because of the inherent character of infrastructure funding projects, there is usually a delay in the implementation. Therefore for most projects it is too early to assess the concrete effects of our policy and this was the reason for concentrating the WIK study on 10 projects which were already at a relatively more advanced stage of implementation.

3.7.2. Evaluation results: specific issues arising from the review process

Both the first round of public consultation and the first Multilateral Meeting with the Member States demonstrated that there is a general support for the current Commission's policy in this area. Stakeholders highly appreciate the legal certainty as a result of the Guidelines. Besides the general support, the Commission received many suggestions for 'fine-tuning' of the existing text but also several calls for substantial policy changes.

Naturally, different interests influenced the stakeholders' positions on the review of the Guidelines, incumbent operators stressing the need to limit State aid to the extent possible, alternative operators encouraging the use of State aid even more boldly to promote competition, while Member States call for flexibility to be able to continue to implement their own broadband strategies - with local authorities voicing concerns about the administrative burden of obtaining State aid approval.

²⁵ See for the SAM Communication:
http://ec.europa.eu/competition/state_aid/modernisation/index_en.html

²⁶ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52012DC0209:EN:NOT>.
See http://ec.europa.eu/competition/consultations/2011_broadband_guidelines/final_report_en.pdf.

Several common elements emerged in stakeholders' responses. First, that different Commission's policy documents in this area should be aligned; that NRAs should have a more prominent role for State aid broadband schemes; the transparency of state aid schemes should be further increased (e.g. by publishing on a national website details about on-going State aid schemes, available infrastructures, and introducing ex post reporting to the Commission). There were also calls for other initiatives that fall outside the Broadband Guidelines' remit (e.g. provision of a legal basis for NRAs to intervene in State aid schemes, block exempt small, regional aid measures, etc.).

On the basis of the case experience, the public consultations of the stakeholders and the WIK study, the following issues came up as problems to be addressed:

Aligning the NGA definition with technological developments

The NGA definition of the 2009 Guidelines needs to be adapted to technological developments. In the 2009 Guidelines the present NGA definition was the same of the NGA Recommendation²⁷. The new Guidelines are expected to bring it in line with the broadband targets of the DAE and with the state of technological and market development.

Strictly speaking, any technology that is able to support the required NGA capabilities should be included in the NGA definition. On the other hand, to speed up the Commission's decision making and the tendering process, where possible the Guidelines already set out what options actually exist at the current state of technological development.

In the consultation, it has been argued that the capabilities of mobile (**LTE**) technology will be expanding over time. However, mobile technology is a "shared" infrastructure. Thus, when the number of users increases the available speed drops. While a network may be able to deliver very high speeds if the number of online users is small (for example at night), the actual speed may quickly go down significantly in busy periods. This, as well as the low upload speed, could be a major handicap if NGA infrastructure is meant to serve business customers. However, given the rapid evolution of advanced wireless technologies²⁸, next generation fixed wireless access could be a viable alternative to wired NGA under certain conditions.

In the second round of consultation, incumbents²⁹ argued that the "ultrafast" NGA definition would favour FTTH technology which is too expensive and discriminates against other technologies³⁰. To the contrary, the alternative operators' association ECTA argues that priority should be given to FTTH because that would allow unbundling and therefore competition.

The Body of European Regulators for Electronic Communications (BEREC) recognises that at the current time and with regard to NGA networks, the Guidelines are largely an aid instrument to facilitate the roll-out of wired networks. It proposes that using a fibre deployment in conjunction with a wireless technology would be compatible with the Guidelines.

²⁷ Commission Recommendation of 20 September 2010 on regulated access to Next Generation Access Networks (NGA), OJ L 108,24.4.2010, p.23.

²⁸ Such as LTE-Advanced or high-speed Wi-Fi and the intensifying market deployment of LTE or Wi-Fi.

²⁹ As for instance the incumbents' association ETNO.

³⁰ Like FTTC vectoring.

Directing State aid where it is needed: Detailed mapping and coverage analysis

The analysis of present and future broadband coverage imposes several challenges to the responsible authorities. The public consultation and the WIK study raised a number of them. Among the most important ones, is that public authorities have difficulties obtaining sound projections from private investors on their potential broadband or NGA roll-out activities in the near future. Relevant planning projections for a 3 year horizon are difficult to be formulated. Moreover, the survey of broadband providers is seen as a potential source for strategically influencing the local broadband undertakings. Negative responses may aim at taking subsidies, while positive responses may block the intended funding of public authorities. Second, a decentralised approach for the analysis leaves room for methodological differences which are not caused by regional dissimilarities, and it neglects the use of synergies between regions. Thirdly, authorities faced uncertainties regarding the distinction between grey and black areas if different broadband services within one region (e.g. based on DSL and on LTE) are offered by only one network operator. It is not clear enough how such an area has to be classified.

The 2009 Guidelines were also felt to be unclear in distinguishing grey from black areas: an area remains "grey" if the same company operates two (or more) broadband service offerings within that area or if there are only ULL operators.

In the second round of consultation, BEREC expressed doubts about the NRAs being involved in the design of target areas, as they often have no expertise in this respect. The appropriateness of NRA involvement therefore would depend on the national institutional context.

Aligning the Guidelines with the Digital Agenda for Europe (DAE)

To align the broadband Guidelines with the DAE objectives, the new draft Guidelines put in public consultation have proposed a new section on "ultra-fast" NGA. Under certain conditions, State aid to build such "ultra-fast" NGA networks may be allowed even in "black" NGA areas (e.g. urban areas).

Private investments are currently taking place to deploy certain technologies which exploit to the maximum the capabilities of existing networks and could deliver high speeds, without necessarily being future proof. If the market is evolving in this direction, there may still be a case for public intervention in areas where funds are available for very extensive new infrastructure deployment. However, market investments are to be protected and therefore, to limit the distortive effects of State aid and in order to ensure that this State-funded infrastructure would be truly conducive to more competition, the new infrastructure should represent a real step change compared to existing networks, be based in an open architecture and operated only on a wholesale basis. It has to be demonstrated that there is expected demand for such qualitative improvements and that past investments in NGA are taken into account.

Such infrastructure would allow for full unbundling which, according to sufficient evidence from market experience and analytical studies, provides the best opportunities for effective competition also in an NGA environment. As pointed out in the WIK study, if there are somewhat higher investment costs they are more than overcompensated by the competitive advantages in terms of welfare which is generated by the greater potential of competition.

This suggestion has been tested in the context of the second public consultation. The British consumer association welcomes the possibility of public financing of such networks in urban areas. Mobile and cable operators instead put forward that such financing should not be authorised in areas where Docsis3.0 cable and advanced mobile networks are available.

Otherwise such intervention could lead to a crowding out of future private investment and devalue investments already made.

As regards the conditions for NGA State aid approval, ETNO and ECTA take opposite views on whether symmetry and passive-only infrastructures are characteristics of an NGA network deserving public funding. Cable operators object to the wholesale access condition as this could exclude them from participating in aid-funded projects. This view was dismissed by some Member States in which access obligations have been imposed on cable operators.

Ensure competition by an effective tender process

In general, the open tender process does not pose specific challenges to the public authorities. The procedures for broadband projects are geared to national and European requirements which overall apply to public procurement procedures. From the perspective of potential bidders some challenges seem to be associated with the open tender process. On the one hand, market players claim that the open tender process is not sufficiently transparent for all potential investors in case tenders are published only locally. On the other hand, they conclude that the tender requirements formulated at a decentralized local level vary significantly but unnecessarily across the different regions within a Member State, thereby increasing the transaction costs of tendering for potential investors. In several State aid cases only a few bidders participated in the tender procedures. This effect results from the perception of potential operators that the tendered projects do not offer sufficient economic incentives to engage.

Transparency measures could correct the problems highlighted and a draft proposal to this aim has been included in the second public consultation. Generally, stakeholders supported such transparency measures while some Member States asked that they should only remain optional.

Best value for money: define the right criteria for the selection process

The amount of aid requested by the bidders always plays an important role for the selection of operators. The Guidelines offer the possibility to take into account additional qualitative criteria in the tender process. Based on case studies the WIK report found that these authorities often feel uncertain about the relevant criteria which could be used in the selection procedure in addition to the amount of aid. Due to this lack of information/know-how there is a risk that the authorities do not use all relevant broadband specific criteria and the tender process consequently leads to an economic suboptimal selection of a bidder.

As the final responsibility for defining the selection criteria and their respective weights is in any case assumed by the public authorities, the Guidelines can make concrete suggestions but can only suggest including certain qualitative criteria.

Ensure effective wholesale access

There exists only very limited empirical information in particular regarding details of the access products and the real demand of third parties for access to the subsidized infrastructures. Based on case studies, the WIK report concluded that in rural and remote areas there is often only limited demand for access. Economic incentives for third parties to engage in these areas may be still too small in comparison to other regions even when there are wholesale services available. Some national authorities have put forward that wide-ranging access conditions would therefore inflate costs of such projects without generating more competition. This point has been taken up in some decisions adopted by the Commission in 2011 and 2012 regarding access requirements in more remote areas.

The first public consultation showed that the open access requirement of the Guidelines does not seem to be sufficiently specified to market players and to public authorities. There is an uncertainty in the market with regard to the question which access products are able to meet the requirement of an “effective wholesale access”. Moreover there seems to be a lack of transparency about the set of potential wholesale products which could be mandated, at least on the side of public authorities.

It is impossible to define in the Guidelines all the possible types of wholesale access products that could potentially be requested under the State aid rules because of the large variety of technological solutions and since the access conditions differ in the Member States. However, It is possible to include a list with the minimum access requirements of typical broadband access network constellations, such as:

- deployment of passive network infrastructure: duct access, dark fibre, unbundled access to the local loop;
- cable network: duct and bitstream access;
- ADSL-based broadband: unbundled access to the local loop and bitstream access;
- FTTC networks: duct access, sub-loop unbundling and bitstream access;.
- Mobile and wireless networks: bitstream, sharing of physical masts and access to backhaul networks;
- Satellite networks: bitstream access.

The incumbent's association ETNO argued in the public consultation that access conditions should not go beyond what is required already under SMP (significant market power) regulation and that such conditions should only apply to operators which are not subject to regulation today. Alternative operators instead argue that access conditions should be more extensive since regulatory provisions do not go far enough. In particular they do not ensure effective unbundling. Mobile operators underline that ensuring effective wholesale access is essential arguing that a non-discriminatory passive backhaul offer at reasonable tariffs should be added to the menu of wholesale access products. Internet service providers seem to consider that only in the case of unlimited wholesale access, unrestricted access to the internet could be guaranteed.

BEREC agrees that effective wholesale access should be an indispensable component of any State aid measure in relation to the deployment of broadband infrastructure and it shares the objective to require full and effective unbundling. The access obligations should not go below the access conditions currently imposed on a SMP operator, for a comparable network. However, specific circumstances in rural areas would sometimes justify a different approach which would require a proportionality analysis. The NRA should be consulted for such an assessment. Furthermore, as the actual choice of access products can have a significant impact on the effectiveness of competition in the retail market, BEREC believes that it should be mandatory that the NRA checks non-standard access conditions.

Access pricing

As regards access pricing, the objective of the Guidelines provision is to ensure that access seekers face the same opportunity costs of the wholesale services as the state aid beneficiary. Wholesale access pricing may pose serious challenges to public authorities as benchmarking wholesale prices is a complex regulatory task even for experienced NRAs. Public authorities in particular at a local level are often missing a comparable expertise as well as specific know-how and therefore are unable to assess wholesale price proposals of awarded operators effectively. This holds true even when relevant benchmarks are potentially available (e.g. if

they are published). The WIK study therefore suggests to foresee a stronger role of NRAs in assessing wholesale pricing issues of State aid projects and the corresponding obligations.

Since price benchmarking is a difficult exercise, guidance is needed in the sense of specifying the principles to be applied for benchmarking. If no published or regulated prices are available, pricing should follow the principle of cost orientation (including incentives to firms to reduce costs over time). The subsidies received have to be taken into consideration when setting such prices.

BEREC requests more flexibility for Member States to choose the proper methodological approach to reach the goals of non-discriminatory wholesale access prices. For instance, "cost oriented" pricing based on cost modelling would be an inappropriate burden for small networks serving only some hundred end-users. Further, access prices should be part of a consistent system, according to the "ladder-of-investment" principle. It advises against a system of upward and downward price limits, as under certain circumstances higher prices could still be efficient and a minimum price level set at the regulated price would eliminate incentives to use the subsidised wholesale network. Finally, when setting benchmarking criteria, the Guidelines should also address the possibility that the tender is not competitive.

As regards its own role, BEREC considers that the aid granting authority should consult the NRA when setting wholesale access prices and that the NRA should be involved in the dispute settlement, as long as that is possible under its legal mandate.

Better involvement of NRAs

Only in exceptional cases local authorities have the required technical knowledge and expertise to deal with regulatory issues in the broadband sector. Issues like access pricing and the choice of the adequate access technology can be quite complex. Such lack of knowledge can create numerous problems. For instance, it implies the risk that awarded operators may try to fleece the less experienced local authorities in the context of defining access and pricing obligations. This could result in unwarranted advantages over access seeking competitors. Second, a decentralized policy significantly increases transaction cost of network operators if there is no harmonization at the national level between the different State aid projects. In some State aid cases the NRA is deeply involved in this step (e.g. Finland, France), or former decisions of the NRA regarding wholesale access prices are explicitly taken into account (e.g. UK, Italy). This allows limiting the risk of competitive distortions and reducing the transaction cost of operators. It would be appropriate to give to the NRAs an advisory role on technical aspects of the implementation of the Guidelines.

When testing such solution in the second public consultation, some concerns have been raised in certain Member States regarding having a clear mandate for the NRAs at European level (in the Regulatory Framework) to engage in wholesale access pricing issues, assessment of wholesale price proposals and corresponding obligations to awarded operators (including a proper legal framework for such a mandate within the respective national legislation and proper staffing).

As regards, private stakeholders, both alternative operators and incumbents agree that NRAs are well placed to define access products. Some go even further and, for consistency purposes, propose that the Guidelines should request establishing a national body in charge of coordinating state aid initiatives in the sector. By way of contrast, several Member States have maintained their concerns about increasing the role of the NRAs, pointing out limited staffing and legal constraints. At the same time there was a common understanding that NRAs have vast experience which can be useful for local or regional aid granting authorities.

BEREC also points out that in many Member States NRAs lack the legal basis for an active involvement. Furthermore, such an involvement can be highly resource-consuming. BEREC expressed the concern that a mere encouragement for Member States to address these problems would not suffice. It therefore suggests that such a mandate should be put in the next revision of the EU Regulatory Framework for Electronic Communications.

Relationship between SMP regulation and State aid rules

In an increasing number of state aid schemes, the incumbent operator is the beneficiary of State aid. As incumbents are subject to SMP regulation under the Electronic Communications Regulatory Framework, the respective SMP obligations also apply to their activities in the State aid funded projects. It has been suggested that this would justify harmonising State aid rules with SMP regulation.

Where possible, such adaptation to the SMP regulation is beneficial. However, in certain cases – as for instance access conditions – the current broadband Guidelines **deliberately go beyond** what is required under SMP regulation. Where operators benefit from public subsidies, under certain circumstances it is justified to require further opening of the network which would promote competition to the benefit of the end consumer. Simply adopting SMP regulation would also have disadvantages for competition under the tender. It would put alternative operators at a disadvantage, as they would face additional cost while due to regulation incumbents already have to fulfil those conditions.

Framework programmes

To improve efficacy of administrative action, national State aid measures can be designed as framework programmes: local broadband projects would be implemented along the lines authorised by the Commission in the framework scheme, thus significantly simplifying administrative burden, achieve greater consistency and leading to a greater overall efficiency for all stakeholders. However, framework programmes also bear the risk of less transparency because they are approved at a fairly general level. Information about the actual application of a framework programmes and its implementation effects may be hardly available if the programme is not accompanied by adequate monitoring/reporting procedures (e.g. a register about the broadband projects under the umbrella of the framework and their key characteristics).

Better use of existing infrastructures

The actual use of existing infrastructure does not seem to exploit its full potential in many Member States and it is therefore the subject of a specific public consultation of the Commission³¹. This, of course, creates inefficiency and requires Member States to pay more State aid than what would be otherwise needed. The public consultation and the WIK report highlighted that the actual use of existing infrastructure is associated with two major challenges for stakeholders. First, relevant and accurate information about the availability of

³¹ The Public Consultation on an EU Initiative to Reduce the Cost of Rolling Out High Speed Communication Infrastructure in Europe launched in April 2012 aims at seeking views on how to cut the costs of setting up new networks for high speed internet in the EU. In particular, the Commission wants to explore how to reduce the costs associated with civil engineering, such as the digging up of roads to lay down fibre, and which can account for as much as 80% of the total cost. The text of the public consultation is available at http://ec.europa.eu/information_society/policy/ecomms/library/public_consult/cost_reduction_hsi/index_en.htm.

infrastructure is often missing. This may hold true even if there is a central register of broadband infrastructures as the example of Germany (“infrastructure atlas”) shows. The lack of information makes it difficult (if not impossible) for operators to account for synergies in their network planning in order to reduce the amount of aid needed. In order to enhance the level of information about existing infrastructure there are cases where the beneficiaries are at least obliged to include information about the funded infrastructure in the central register of broadband infrastructures. Second, access to infrastructure is not provided at all or not necessarily in a non-discriminatory way (e.g. with regard to prices or time). Overall, market participants raise concerns that incumbents may be favoured in tendering proceedings because they have access to their own infrastructure at no or lower opportunity costs compared to their competitors.

A possible way to alleviate those concerns by introducing additional access obligation and information sharing, was tested in the second public consultation. ETNO and ECTA agree that undertakings participating in tenders should offer access to their existing infrastructure under reasonable terms. However, some individual incumbents objected to extensive access as such obligations would only favour those operators who have not yet taken the commercial risk investing into their own infrastructure. Mobile operators welcome enhanced transparency measures for existing infrastructure and consider this particularly important for the backhaul segment on which they rely to deliver their services.

Claw-back mechanism to avoid over-compensation

So far, the practical relevance of the claw-back mechanism to avoid over-compensation has been limited. While certain regional projects such as Cumbria in 2003 and Sardinia in 2006 have experienced a profitable application of the claw-back, some Member States have put forward that the implementation of the claw-back mechanism tends to be a very complex process and requires specific know-how at the local level and for smaller projects. The WIK case study found that in some cases these difficulties have led to limit State aid virtually below the threshold for introducing a claw-back mechanism. WIK therefore suggested giving up the claw-back mechanism where the competitive tender process works effectively.

To accommodate these instances, a new threshold for the obligation to insert a claw-back has been proposed, i.e. projects below € 10 million. Instead of reclaiming extra profits, re-investment by the beneficiary in order to extend the coverage area and to include additional unprofitable areas may achieve the same result as an actual claw-back.

4. OBJECTIVES

4.1. General objective

The general objective of the Broadband Guidelines, as explained in the context part of the Report and in the Guidelines themselves, is to increase growth and consumer welfare by wide and rapid deployment of fast and ultra-fast broadband networks in a competitive market landscape. Therefore, the main components of this general objective, therefore, are:

1. Correcting the market failure of the lack of suitable broadband infrastructure by stimulating infrastructure deployment
2. keeping electronic communications markets open and competitive avoiding undue distortion of competition and crowding out of commercial initiatives

3. avoiding to impose an excessive administrative burden on national authorities, commercial operators and the Commission itself.

4.2. Specific objectives

The Broadband Guidelines have been in place for three years and are now subject to review pursuant to their paragraph 83. Therefore, the general objective of the Guidelines has to be read in the context of reviewing their application and – if the case – introducing the necessary changes.

In light of the preceding caveat, the general objective above can be further specified into the following specific objectives within each of the three mentioned above:

1. Bringing infrastructure to under served areas:
 - i. aligning with the DAE
 - ii. Accelerating NGA roll-out
 - iii. Avoiding duplication of infrastructure

The 2009 Guidelines foresee a review within 3 years mainly because of the rapid technological development in the sector. The Guidelines need to take that development into account, as it has an impact on competition between different platforms and different operators in the market. In particular the definition of "NGA" and the mapping of "white", "grey" and "black" zones need to be critically assessed.

The 2010 DAE sets ambitious targets in terms of broadband roll-out for the EU. The Broadband Guidelines should be reviewed to ensure that they support the achievement of these targets.

2. Avoiding undue competition distortions
 - i. mimicking the market mechanism through tender process
 - ii. increasing transparency
 - iii. ensuring open access
 - iv. reducing aid to the minimum

A central objective of the Broadband Guidelines is to ensure that competitive markets are maintained. A competitive process plays a role at different levels. First, most of the broadband investment will have to come from private investors. When doing so, the latter take considerable commercial risks. Therefore, it has to be avoided that state intervention leads to the risk of crowding out such private investment.

However, a functioning competitive process is also necessary when State aid is made available. An open tender shall ensure that bidders compete for State aid to build a new broadband infrastructure. Such bidding competition should help keeping aid to the minimum and to select the most effective operator and technology.

Once the publicly financed infrastructure is in place, effective access shall be granted such that competition on the new platform between different operators and services providers is

ensured. Furthermore, to ensure that public resources are used efficiently, use of existing infrastructure should be effective.

3. Minimising administrative burden

- i. encouraging Framework programmes
- ii. streamlining regulatory and state aid obligations
- iii. improving NRA involvement

In the public consultation, stakeholders have raised the concern that in particular local State aid granting authorities are sometimes overwhelmed by the technical complexity. The review should also include an attempt at improving the implementation of State aid schemes.

The claw-back mechanism should ensure that state aid granting authorities do not spend more than necessary for such investments. This seems to further raise administration costs and needs to be re-assessed.

5. POLICY OPTIONS

This section presents the policy options proposed to address the specific objectives of the review of the current Broadband Guidelines as highlighted above.

The following options take into account (1) the limits of the present exercise, which covers only the revision of the existing guidelines, given the Commission's commitment of paragraph 83 of the Guidelines; (2) the on-going State aid Modernisation process; (3) the limits of the Commission's action as regards proportionality and subsidiarity. In the light of these considerations, other options besides those presented below have been discarded, despite being sometimes proposed. For example, the Commission cannot simply give up State aid control on public investment in broadband networks, as sometimes advocated, since it is a legal obligation stemming from the Treaty.

Options which would not fit the stated objectives have also been discarded, for example the option of withdrawing the Guidelines and analysing the State aid measures to broadband directly under the Treaty. This would make the State aid process lengthier, take away the guidance function for local authorities and reduce transparency. It would also contradict the broad message received from the two public consultations. Member States and stakeholders generally consider that the Broadband Guidelines have been very useful in providing guidance on granting State aid in this sector.

Following more than 100 cases adopted in this sector, the Commission has gained significant experience with broadband projects. Many Commission approvals for simple, low budget broadband measures are adopted under the simplified procedure. Therefore one may consider to block-exempt certain categories of broadband projects similarly to other State aid instruments (such as regional aid, RDI aid, etc.). However, the Commission's case practice is mainly limited to basic broadband cases in rural areas. This might suggest that the scope of such a block-exemption - if adopted at present - should also be limited to "basic white areas". Indeed, the Commission has very limited experience yet with aid for NGA deployment which will be the issue for State aid in the future.

In any event, a block exemption is currently not feasible given the scope of the existing Council Enabling Regulation that lays down the possibilities for block exemption in the different areas. A future amendment of the Enabling Regulation could of course allow block exempting measures in the field of broadband. Following such an amendment, one would have to amend the Commission's GBER that lays down the precise categories of block exempted measures. Block-exempting measures in the field of broadband is therefore not an option before 2014.

All three options for the revision of the Broadband Guidelines, as identified below, can be combined with a future block-exemption. The latter therefore should not have an impact on the selection of one of these options.

For these reasons, the issue of what a possible future block-exemption should comprise goes beyond the scope of the current revision exercise (and beyond the scope of this impact assessment).

5.1. Option 1 – Baseline scenario: prolonging the existing Guidelines for three more years

The current Guidelines bind the Commission to carry out the revision process within three years from their adoption. After carrying out the revision as envisaged, the Commission could

conclude that no change is needed from the current text, which has been consistently applied in the past three years with satisfactory results.

The 2009 Guidelines were drafted at a time when the Commission had a rather extensive experience with basic broadband but was just starting to deal with NGA. In addition, the Digital Agenda for Europe, the revision of the EU Regulatory Framework for electronic communications and related Commission Recommendations had not been finalised yet. This implies that a number of adjustments happened in the subsequent application of the Guidelines via the Commission's case practice.

As a consequence, the Commission could still rely on the existing text, applying it as it is to the "classic" broadband cases as it did so far. The Guidelines do not formally expire, however for reasons of legal certainty it is advisable to issue a formal act of prolongation.

Since the Guidelines predate these technological and regulatory developments, the rules contained therein in some cases do not match exactly the current situation. Therefore, the application of the Commission's policy to the new cases would need to be done by analogy whenever the cases fit, if not the letter, then the spirit of the framework established in 2009 and allow flexibility for new developments.

For all other cases, the Commission would probably have to open a formal investigation procedure to assess more in-depth whether the measures proposed do not distort competition to an unacceptable extent. In particular, aid to ultra-fast broadband deployment in urban areas might have to be prohibited.

5.2. Option 2 – Revising the Guidelines to ensure a rapid and competitive deployment of broadband infrastructure

As mentioned above, the evaluation of the current policy case experience of the Commission, the consultation of stakeholders and the expert study carried out by WIK have highlighted a number of issues for which fine-tuning is suggested. .

In principle a very large number of possible packages of individual changes of the Broadband Guidelines is possible, as these amendments are not mutually exclusive. Below three sub-options are developed. The first one focusses on better implementation of the existing Guidelines. The second one is more ambitious as it proposes some policy change by adapting the Guidelines to technological development. It makes it possible to change the approach to NGA if justified by technological progress. Also the third sub-option implies a policy change as it aims at bringing the Guidelines in line with the Digital Agenda targets. Each of the three sub-options can be carried out on a stand-alone basis. However, if one wishes to have different ambition levels, one may consider them to be cumulative, i.e. the more ambitious option includes also the measures of the preceding option. This approach is proposed in what follows.

In relation to the specific objectives highlighted above, the following sub-options, starting with the lowest ambition level are proposed:

5.2.1. First sub-option (minimum level): improve the use of resources

On the basis of recent case practice after the adoption of the 2009 Guidelines, some steps can be taken to improve the implementation of the Guidelines. Such measures include adapting the rules for access to publicly financed infrastructure, clarifying the rules for public tendering, stricter rules for the use of existing infrastructure, involvement of NRAs in the

implementation, more transparency (including ex post reporting), a lighter claw-back mechanism and up-dating the Guidelines with regard to relevant recent jurisprudence.

The current Guidelines foresee, as a quid pro quo for the subsidies received, an obligation to provide effective wholesale access for at least 7 years for any network receiving state aid, regardless of the existence of SMP regulation. This is perhaps the most important pro-competitive safeguard in the broadband state aid approach. Our proposed option is to strengthen this provision, in line with the previous point, by requiring a neutral and open infrastructure for ultra-fast networks, which tend to have the characteristic of natural monopolies. At the same time, it can be envisaged to reduce the access obligation with regards to very remote areas. This would allow reducing cost in areas where such access most likely will not be requested anyway.

To ensure competitive markets, a number of amendments concern the selection of the most economically advantageous offer (regarding the geographical coverage and the effect on competition), wholesale access and access pricing.

One purpose of State aid control is to ensure that public resources are used efficiently. The Guidelines aim to contribute to this objective by ensuring that existing broadband infrastructure is used when building new networks. In practice, this condition has not always been adhered to as there is only limited public information available with regard to existing infrastructure. Requiring that bidders make such information available at an early stage would make this condition more effective. Similarly, the claw-back mechanism should ensure that state aid granting authorities do not spend more than necessary. However, the public consultation has shown that Member States consider this to be a significant burden. To ease the administrative burden on the granting authorities, this option include an increase in the thresholds for projects to include a claw-back mechanism: from 1 million Euros to 10 million Euros.

The existing Broadband Guidelines require that Member States consult the relevant NRAs if they grant aid to broadband networks. Due to their role in the electronic communications sector, NRAs have developed expertise and knowledge which can be very useful especially for implementing access conditions attached to State aid schemes. Under this option, the position of NRAs could be clarified and strengthened. NRAs should not be given discretionary policy powers but merely be involved in the implementation process in particular as regards access pricing and conditions. Because of the need, perceived in some countries of a legal basis to involve NRAs in the state aid process, a mention can be made in the new Guidelines. However, as a soft law instrument it cannot constitute the source of an obligation for the Member states. An optional consultation of the National Competition Authority (where separate from the NRAs) or other competent body set up by the Member State could also be envisaged.

The current Guidelines put strong emphasis on transparency in State aid broadband schemes, yet the relevant provisions are kept at a general level without detailed specifications. The case practice of the Commission and the views of the stakeholders indicate that additional guidance would be appreciated. Therefore, this option foresees to (a) include more details on the content of the transparency obligations, (b) include a requirement for Member States to keep a centralised database of infrastructures and of tenders.

The WIK study has shown that there is little knowledge about the implementation of EU State aid decisions in the broadband sector. In the public consultation, stakeholders have raised the concern that in particular local State aid granting authorities are sometimes overwhelmed by the technical complexity. It should be reviewed how to improve the implementation of State aid decisions in particular with regard access conditions. Gathering information about the

implementation of State aid decisions may lead to "best practice" recommendations in the future.

Additionally, a new requirement of a "light" ex post reporting obligation on certain elements of the authorised measures would lead to an improved assessment of the effectiveness of the authorised aid and of state aid policy in the field, more generally. This initiative will be handled in cooperation with the already on-going initiative to streamline reporting obligations of Member States.

The current Guidelines describe the conditions for the application of Article 107 (1) TFEU (State resources, advantage, selectivity, distortion of competition, effect on trade) in the broadband sector. Certain judicial developments like the Leipzig Halle case law on the existence of State aid on the level of the construction of a network by the State as well as some clarifications emerging from our case practice would need to be reflected in the updated text. Additionally, the current text of the Guidelines stays at a general level by highlighting the main principles, which the Commission will apply in its assessment. More concrete details could be given as regards the characteristics of the most common public intervention models.

5.2.2. Second sub-option (intermediate level): Adapt the Guidelines to technological progress

The second option builds on the measures of the first option but in addition also adapts the Guidelines to technological developments. The 2009 Broadband Guidelines define NGA as mainly wired based technology. As the performance of technological platforms (cable mobile, satellite etc) is constantly improving, one may refine that definition by also including other platforms, as long as they fulfil technological requirements (NGA capabilities). This would be in line with comments received in the second public consultation. As proposed by BEREC, under certain conditions the combination of a fibre deployment in conjunction with a wireless access technology could also fall in this category.

However, a more open NGA definition would also imply that the category of NGA networks becomes more diverse. Future-proof NGA networks have significantly enhanced characteristics and require a different magnitude of investment, extensive civil works, and therefore they also require additional public funds. These ultra-fast future-proof networks do not constitute a new category, but are NGA networks which can achieve more ambitious targets of performance, including but going beyond the mere speed.

The existing conceptual framework of the Guidelines (basic/NGA networks, white/grey/black areas) does not need to be changed to accommodate technological developments. However, given that the diversity of NGA networks increases, one should clarify under what conditions state funding of new infrastructure is justified. This may be achieved by introducing the notion of "step change". A "step change" can be demonstrated if as the result of the public intervention (1) the selected bidder makes significant new investments in the broadband network and (2) the subsidised infrastructure brings significant new capabilities to the market in terms of broadband service availability and capacity.

5.2.3. Third sub-option (advanced level): Align the Guidelines with the Digital Agenda

The third sub-option includes the measures discussed for the less ambitious sub-options (1) and (2) and adds a specific additional compatibility section for ultra-fast networks.

With a view to support the Digital Agenda targets, the additional section introduces the possibility to publicly finance NGA infrastructure in black NGA areas, provided that strict conditions and important pro-competitive safeguards are respected.

To preserve the incentive to invest, private investments need to be protected against being overbuilt with publicly financed infrastructure. Therefore, state aid to ultra-fast networks reaching the end users premises may be authorised where (a) it can be proved that private investments alone will not make the networks evolve into genuine future-proof infrastructure, (b) the network operator manages it only at wholesale level, so that access is granted to any operator wishing to connect to the infrastructure with the technology of their choice and (c) major commercial investments have not been undertaken in recent times and there are not investment plans for the near future.

In such areas where NGA networks are already available, genuine ultra-fast networks may be subsidised only if (1) there is a real added value in terms of additional services and (2) the network is a neutral and open infrastructure.

5.3. Option 3 – A more radical amendment of the Guidelines by putting DAE objectives first

The third option is to put the achievement of the DAE targets as top priority. It implies radically changing the approach followed so far and substantial modification of the current Guidelines to accelerate as much as possible broadband rollout. It is important to note that a radical amendment cannot go as far as overhauling completely the existing approach (as regards the target areas, for example) because it would run against the general objective of keeping markets open and not crowding out private investments. Therefore, the more substantial modification proposed will remain in the limits of the mentioned general objective.

In line with this objective, in the revised text new concepts and definitions as well as new requirements for the compatibility test may be introduced.

In particular, the revised text could:

5.3.1. Incorporate the Digital Agenda targets into the Guidelines concepts

While the current Guidelines distinguish "basic" and "NGA" networks, the revised text could include three categories based on the DAE targets: "basic", "slow" NGA (above 30 Mbps) and "super-fast" NGA (above 100 Mbps). New quantitative definitions would need to be drafted based on the speeds indicated in the Digital Agenda, as opposed to the "qualitative" definition currently used. Additionally, specific compatibility conditions for the different categories (basic, "slow" NGA and "ultra-fast" NGA) would have to be applied.

5.3.2. Reducing the access obligation requirements

The new text could change the approach to the access obligations by referring simply to what is imposed in sectoral regulation to operators enjoying a position of significant market power (SMP), where this is found to be the case by the NRAs. In other words, no access obligation would be imposed in principle but the aid beneficiary may be subsequently subject to scrutiny by the NRA and access obligation could be imposed if the applicable conditions are fulfilled.

5.3.3. Easing the proportionality requirements

To further simplify application of the Guidelines by national and especially local government and to potentially reduce the amount of aid necessary to rollout the network, the existing proportionality requirements could be relaxed. Among the proportionality requirements, the new Guidelines could eliminate the step of involving the NRAs in the state aid authorisation process and could limit the obligation to do a public consultation and tender only in case of big projects, leaving open the possibility to undertake informal contacts with the operators for the measures of limited aid amounts.

6. ANALYSIS OF THE IMPACT OF THE OPTIONS

This section presents the most significant elements as regards the impact of the policy options described in the previous section. Bearing in mind that the Commission does not have the choice not to intervene in the sector (i.e. not performing the state aid assessment of the measures in question) and that there is already a consistent case practice and Guidelines in place, only the variation of the relevant impact factors of each option will be pointed out. For example, the options are expected to broadly have similar environmental impacts, which therefore will not be analysed. The main elements which will be analysed are the economic and social impact.

The options could have a certain impact on simplification, administrative burden and implementation arrangements. We do not expect any impact on the relations with other countries and we do not anticipate difficulties to transpose for Member States, given the choice of legislative instrument (soft-law).

6.1. Option 1 – Baseline scenario: prolonging the existing Guidelines for three more years

This option presents a number of benefits.

The benefit of this scenario would be a relatively quick update from the internal procedure point of view. Moreover, this option would allow the granting authority and stakeholders to rely on a policy which is well known by now and so far has been reasonably successful. Therefore, naturally, this option minimises the adaptation costs as well as the costs to apply the Commission's approach to future cases brought to its attention.

The risk of this option is that in order to pursue the specific objectives of the revision process, the Guidelines would not be sufficient. As a consequence, a higher number of formal investigations may become necessary to assess new types of measures which take into account technological developments or explicitly aim at the achievement of the DAE targets, beyond what is in the text of the current Guidelines.

The above translates, in fact, into a higher administrative burden, longer authorisation procedures, risk of Type I errors, i.e. not allowing a measure which would be beneficial for society (for example, rollout of infrastructure in areas where investment to achieve ultra-fast broadband is sluggish) because the conditions of the current Guidelines cannot be fulfilled.

As a result, the roll-out of more advanced broadband infrastructure would be delayed. As more sophisticated internet services require large broadband capacity, the delay of infrastructure investment will hamper the development of new services in Europe. This will be to the detriment of European industry and in particular new start-ups (SMEs) when developing innovative services.

Prolonging the existing Guidelines would also imply to relinquish the opportunity of improving the implementation of State aid broadband decisions. As described above for option 2, there is some scope to increase the efficiency of broadband State aid measures and to reduce the administrative burden. This would be to the detriment in particular of SMEs which have complained about the administrative cost arising from the existing claw-back mechanism.

Basically all stakeholders and Member States have – to various degrees – argued in favour of adapting the current Guidelines. Thus, this baseline option of merely prolonging the current Guidelines has not been supported in the consultation process.

6.2. Option 2 – Revising the Guidelines to support rapid and competitive deployment of broadband infrastructure

This option builds on the current policy of the Commission and gives an immediate follow up to the issues arising from regulatory and technological developments, case practice, stakeholders consultation and expert reports.

This approach has already been applied in the new draft Guidelines as published for consultation on 1 June 2012 and further revised following the second round of public consultation. In general, the conceptual approach of the existing Guidelines would be kept, thereby reaping the benefits of consistency and legal certainty.

Generally speaking, Option 2 would imply allowing, under strict conditions, to roll out (publicly financed) infrastructure in urban areas (which may be black NGA). However, it would raise concerns about distorting competition as it may discourage private investment. It would therefore be necessary to ring-fence. This is achieved by the definition of NGA and the conditions imposed for publicly financing ultra-fast infrastructure in black areas.

The impact of the specific amendments to fine-tune the text of the Guidelines as described in section 5.2, looks as follows.

6.2.1. First Sub-option: improve the use of resources

The first sub-option combines a number of different measures which adapt the Guidelines to make the use of resources spent on broadband development more efficient. The measures include adapting the rules for access to publicly financed infrastructure, clarifying the rules for public tendering, stricter rules for the use of existing infrastructure, involvement of NRAs in the implementation, more transparency (including ex post reporting), a lighter claw-back mechanism and up-dating the Guidelines with regard to relevant recent jurisprudence.

In what follows, the impact of these measures is looked at in particular with regard to the specific objectives as set out above.

Impact on competition and prices

Several measures proposed under the first sub-option support specific objectives related to the avoidance of distortion of competition. Improving and clarifying the conditions for access to publicly financed broadband infrastructure has the benefit of further improving the pro-competitive nature of the approved measures. In particular, it represents a fundamental safeguard that public authorities would not fund with taxpayers' money the rollout of a "closed" NGA architecture and would thus not restrict future competition on the subsidised infrastructure. Better access conditions generate more competition on the network and thereby a larger variety of services at lower prices.

Clarifying that access to the subsidised infrastructure must be foreseen in all State aid projects from the start is a crucial safeguard for keeping markets competitive. Such access conditions must be fulfilled irrespective of the particular technological solution proposed. All technological platforms proposed for a publicly aided project must respect wholesale access requirements and allow "full and effective unbundling" in order for the broader objectives of State aid control to be achieved (open market, lower prices and better quality for citizen and companies).

The 7 years access period should be extended as regards passive infrastructure or infrastructures which are publicly owned and/or managed, since in such case there is no issue about protecting private investments. The access conditions shall be particularly strict in case

of aid to ultra-fast broadband networks (in the scenario described is the third sub-option) to make sure that the new infrastructure stays "neutral and open".

With regard to the involvement of NRAs, this option adds a few specifications to better detail the role they are expected to play in the State aid procedure. Such role implies neither assessment nor discretionary policy decisions, but merely the use of NRAs existing expertise in market regulation limited to (1) access conditions and tariffs and their supervision (2) a centralised inventory of existing infrastructures, (3) conflict resolution among operators.

The benefits of this change in the Guidelines would be an improvement of the pro-competitive nature of the authorised measures, since the involvement of NRAs would further ensure that access to the subsidized network is adequate and effective. It would also ensure additional consistency of SMP regulation and State aid access obligations.

Consumers would benefit from these measures as a better implementation of the Guidelines would lead to a more competitive broadband infrastructure.

Impact on the speed of broadband roll-out

The specific objective of addressing the lack of suitable broadband infrastructure is addressed by some of the measures proposed under this sub-option. A better use of existing infrastructure would improve the availability of broadband networks and would allow focussing available resources on areas where such infrastructure is lacking. The increased flexibility for approving investments in very remote areas where it is unlikely that more than one operator has an interest in accessing the network, makes it more attractive to invest in such areas with the support of public funds.

Impact on administrative burden

As regards the specific objective of reducing the administrative burden, this sub-option provides a mixed result. Raising the threshold for the claw-back mechanism should ease the administrative burden on the granting authorities. At the same time, it may of course imply that excessive aid may be granted for smaller projects.

A more extensive involvement of NRAs could entail certain additional administrative costs for both the governments and NRAs themselves. However, that administrative cost would be limited. To some extent, already in the present text of the Guidelines NRAs are entrusted with additional tasks compared to their statutory role. Most of them have already happily taken up such tasks. If feasible, a legislative amendment to the EU Regulatory Framework for electronic communications should provide NRAs an EU legal basis. In the absence of such an amendment, the Guidelines may at most include a recommendation.

As regards transparency, the new Guidelines would include two new tools: (1) require Member States to keep a centralised database of infrastructures and of state aid related tender procedures in the sector and (2) require Member States to do a light ex post reporting on the results achieved by the authorised measures in terms of type of technologies selected, number of operators using the subsidised infrastructure etc. This would allow the Commission to perform an ex post analysis on the successes and failures of its approach to State aid broadband measures. A problem with assessing the success of the Commission's policy is in fact the lack of reliable first hand data. The light ex post reporting obligation would allow the Commission to better assess the impact of its policy in the future in view of better fine-tuning, if proved necessary.

With regard to the administrative burden, such transparency measures will have mixed results. On the one hand, it is a limited burden on administrations which have to publish information on a website. On the other hand, the availability of such data reduces searching cost to private

investors (incumbents and alternative operators) and it reduces administrative costs for other administrations which, in line with a "best practice" policy could benefit from such information when designing their own broadband projects.

Experience shows that explaining to the public authorities on a case by case basis the type of information which needs to be shared with stakeholders may be a time consuming exercise and may delay the state aid authorisation process. Both private operators and local authorities signalled the difficulties they encounter without a centralised guidance and repository of information. Clearer indications in the Guidelines, as requested by a majority of stakeholders would correct this problem.

The benefits of increased transparency should outweigh the administrative burden arising from it: e.g. with centralised databases new operators will find it easier to ascertain in which areas public funding will be available, which is a difficulty often reported by small operators. Collection of information on the location of subsidised infrastructure is an important tool to enable access as the existence of infrastructure first needs to be identified. It is in the hand of Member States to alleviate the difficulties of reporting obligations by – as often suggested by the Commission – working rather with national than with regional support programmes.

Finally, this option includes amendments to make the Guidelines consistent with judicial developments. The text describes the different investment models observed so far and explains how they fall within the notion of State aid. It clarifies that all such models fall within the notion of aid in the sense explained in the Leipzig Halle case law, i.e. that the construction of a broadband network with the aim of future commercial exploitation can already constitute State aid.

The changes are expected to increase legal certainty and provide clarity on the Commission's approach for the various investment models, taking recent case law into account.

Impact on tax payers / public budgets

Stricter access conditions have the drawback of potentially increasing the State aid to be granted to the beneficiary: open and competitive networks are more costly to build because they have to be able to allow connection by different technologies and multiple operators. Further, open networks are less profitable as, in comparison to a closed network, the network operator cannot rely on a monopoly rent. However, these additional costs should be limited. First, the Guidelines allow for flexibility in rural areas where for commercial reasons one may expect only very limited access requests. Second, competition under the open tender procedure should keep these additional costs to the minimum. Finally, any potential increase in cost to the aid granting authority (in terms of higher State aid to be paid) needs to be compared with the benefits to citizens and companies as open networks lead to lower prices and better quality.

Impact on stakeholders

Under this option, the rules are clarified regarding the use of existing infrastructure in the tender procedure of state-funded broadband projects. This should provide alternative operators, many of them SMEs, better access to such infrastructure when preparing their own bids. In the public consultation, such alternative operators have supported this measure as well as the increase in transparency. As a drawback, in the second round of public consultation the concern was raised that such obligations could discourage incumbents from participating in tenders and that the measure would punish those operators which have already carried out their own investment. However, that effect should be limited, as incumbents are subject to SMP regulation and therefore have to provide such information anyway.

Incumbents are generally not in favour of stricter access rules, as they argue that obligations under State aid should be aligned to regulation. Alternative operators instead favour better access conditions as it would allow them to compete on existing infrastructure. On the downstream market, also the federation of Internet companies has argued in favour of more competitive broadband infrastructure. This would spur investment in Internet services to the benefit of end consumers as a more competitive environment should have a downward pressure on prices and increase choice.

The proposed transparency measures are welcomed by most stakeholders. In particular operators and most local authorities which may lack a global outlook of the measures implemented in the rest of the country would highly benefit from increased clarity and guidance. In fact, some Member States are already applying these additional transparency safeguards – including reporting obligations to the Commission.

6.2.2. Second sub-option: Adapt the Guidelines to technological progress

If, as proposed above, the sub-options should be considered to be cumulative, the impact of the second sub-option is the same as the one of the first sub-option with an incremental effect from a new NGA definition. The impact of this incremental effect is discussed in what follows.

A broader NGA definition sets out certain qualitative criteria which have to be fulfilled by any platform to be considered under the NGA category. In the light of technological development at this stage it would include certain mobile technologies (LTE Advanced) and fixed-wireless networks, provided they are able to deliver adequate NGA-level services.

Impact on competition and prices

The broadening of the NGA definition has two effects on competition. On the one hand, it will increase the number of platforms and platform operators which can participate in a public tender for state-funded NGA networks. This should increase the competition in the tender and thereby potentially reduce the necessary aid amount. It thereby contributes to the specific objective of reducing the aid to the minimum.

On the other hand, different technologies have different qualitative performances, including the technical ability to grant access. If a platform is selected which, for technological reasons can only provide inferior access, the competitive impact of the new infrastructure is reduced. Which effect is stronger can only be decided on a case by case basis. One important element is the expected demand for access by competing operators. This demand can be very limited in remote rural areas but it may be high in urban areas.

Impact on broadband roll-out

The broadening of the NGA definition has several effects on broadband roll-out. First, by considering for instance that LTE and fixed-wireless networks are NGA, the change of definition automatically increases the areas which are considered to be NGA "grey" or "black". Second, it will encourage private investment in these technologies as they would be better protected against being overbuilt by another publicly funded NGA network.

On the other hand, as a result of the first effect, "white" NGA areas may turn "grey" and "grey" ones may become "black". As a result, the granting of State aid may no longer be possible in certain areas. Whether that has an effect on overall public investment in NGA networks is uncertain. In principle, the public funds could be directed to other areas which are not yet sufficiently served. However, in many cases, investments are carried out by municipalities using their own local funds. Such funds would not be available in other regions of the country.

Impact on stakeholders and consumers

Incumbents, mobile and satellite operators would favour a broader NGA definition. Their investments would be better protected against overbuilt and they may benefit from State aid when participating in the tender for NGA projects. To the extent that technologies are included which can only support limited access, a broadening of the NGA definition could affect negatively alternative operators and service providers, if the choice of such technology reduces the choice for access. To the extent that it would limit the investment into more advanced technology, it could also have a negative impact on the quality of service provided to end consumers.

6.2.3. Third sub-option: Align the Guidelines with the Digital Agenda

Section 5.2 above already sets out the main conditions under which public funding of "ultra-fast" NGA infrastructure in black NGA areas may take place. State aid could be authorised in areas where slower, interim, technological solutions are already available, provided that the publicly funded network (1) delivers a clear added value for consumers and that (2) there are safeguards against an undue distortion of competition.

To support the specific objectives of accelerating NGA roll-out and of aligning the Guidelines with the Digital Agenda, the publicly funded infrastructure should be able to deliver significantly advanced connectivity services (such as higher speeds, symmetry, long-term sustainability) which private operators would not deploy absent public intervention.

To also meet the specific objective of avoiding undue distortion of competition, a number of conditions would have to be attached. The subsidised ultra-fast NGA network would have to consist of a neutral and open infrastructure on which all operators can provide connectivity services.

Impact on competition, prices and broadband roll-out

This option balances the risk of crowding out private initiatives in profitable areas with the need to encourage fibre rollout: public funds will be allowed in such areas only if it is proven that existing private investments merely concern marginal and temporary improvements, while the subsidies aim at encouraging a substantially new infrastructure. Such change would further incentivize existing operators to invest in fibre networks, either by their own financial means (state intervention would be used as a credible pressure) or by relying on the publicly funded infrastructure. New open and competitive NGA networks are expected to be rolled out, delivering to society not only new infrastructure (with its consequent benefits in terms of economic growth and social cohesion) but also a more competitive landscape in the market: multiple operators will be allowed on the network and will compete to provide services to the end-users (citizens and enterprises) thereby starting a virtuous circle of better quality and lower prices.

Impact on stakeholders

In the public consultation incumbent and cable operators have argued that their investments in upgrading their own infrastructure may be jeopardised by the public intervention. While such investments may not be too capital intensive and not imply new infrastructure development, nevertheless they need to be protected to avoid unduly altering the market mechanism. The public consultation suggested that a "competition check" may be a good solution to mitigate these effects.

6.3. Option 3 – A more radical amendment of the Guidelines by putting DAE objectives first

Following arguments advanced by certain stakeholders, one could generally allow public investments supporting DAE targets. To make such investments easier, the access obligations and proportionality requirements would be reduced. This would also reduce the amount of state aid necessary, as the profitability of the funded network would increase (the network operator benefitting from aid would be able to exclude competitors using the newly built infrastructure).

A more radical change of the Guidelines making the state aid assessment far more lenient vis-à-vis public investment in broadband may help achieving these results. Without completely eliminating State aid control, which would not be possible under the existing legal setting, the changes proposed under this heading (in the previous section) may achieve the result advocated.

However, it is not obvious that this more lenient approach would actually lead to increased investment in NGA and ultrafast NGA. As most of the infrastructure is built by private investors, the latter may decide to hold back on such investment if the perceived risk of later being "over-built" by state funded infrastructure is increased (the crowding out effect). Second, public money would be used to finance dominant operators (or even monopolies). This would stifle competition and therefore it would be to the detriment of consumers.

The impact of the proposed changes under Option 3 is analysed as follows:

6.3.1. Incorporate the Digital Agenda targets into the Guidelines concepts

Instead of the existing distinction between basic and NGA networks, the Guidelines could simply incorporate the DAE quantitative targets in its definitions. This option would imply a substantial change in the existing State aid approach to broadband. While the current Guidelines distinguish "basic" and "NGA" networks, this option would require adding a third possibility: "basic", "slow" NGA (above 30 Mbps) and "super-fast" NGA (above 100 Mbps).

This option would have the benefit of increasing consistency of EU documents and would more directly adapt the Guidelines to the Digital Agenda. Additionally, it would introduce a very clear-cut division which would increase stakeholders' understanding (in particular small local authorities) as regards the objective of the public intervention they can undertake.

However, this approach would also entail substantial drawbacks. First, the approach is currently untested and neither the Commission nor the national/local authorities have experience with it. As a consequence, it could generate uncertainty among stakeholders as it is not clear what could be the impact on market dynamics, in terms of incentives to invest and competitive pressure. As a result both type I (rejecting broadband projects which are beneficial) and type II errors (approving broadband projects which significantly distort competition) become more likely entailing a reduction of welfare gains.

In addition, the assessment may actually be more complicated. By introducing three categories ("basic", "slow NGA" and "ultra-fast NGA") instead of currently two, many more possible combinations would have to be assessed. Specific compatibility conditions for the different categories would have to be applied. Flexibility in the assessment would be greatly reduced by having to refer to specific speeds, which are only one important factor in the context of delivering broadband services. Moreover, quantitative definitions bear the risk of being quickly outdated, which would require another revision of the Guidelines in a short period of time, while binding the Commission to their application while they are in force.

6.3.2. Reducing the access obligation requirements

Limiting access obligations to what would be imposed under sectoral regulation, would have the likely impact of reducing investment costs and necessary aid amount per project. Additionally, as regards existing operators, in particular incumbents, currently eligible to be subject to SMP obligations, it would reduce their cost and increase legal certainty, as the same access provisions would need to be provided in their complete network.

Reducing the amount of aid needed per project would make funds available perhaps for other projects or additional areas and ultimately help achieving the DAE objectives quicker.

The risks connected to this option however, are exactly the mirror image of those highlighted above under the previous option (5.3.2). In particular, the risk is high (based on the recent investment pace as well as the promised but abandoned operators' investments plans) that investments might not materialise at all and that public funds would help to create or strengthen dominant positions and that public authorities may fund with taxpayers' money the rollout of "closed" NGA architectures. Thus would restrict future competition on the subsidised infrastructure with consequent increasing prices and decreasing quality. Sectoral regulation would be expected to take care of these problems, with the consequence that (1) the administrative burden will increase (market analysis, regulatory remedies to be devised etc.) and (2) the remedies may intervene only once the situation has materialised and may be difficult or lengthy to implement if the technological choice of the subsidised network is incompatible with open access remedies.

6.3.3. Easing the proportionality requirements

Finally, this option envisages relaxing a number of existing pro-competitive safeguards. One could envisage either eliminating altogether the need to consult NRAs or envisage a faster track State aid assessment in case the planned project already has the approval of the NRA, while in the absence of such approval, the proposed aid scheme would be subject to a more thorough scrutiny by the Commission.

This solution would overcome the problems indicated by some Member States as regards the formal entitlement of the NRAs to intervene in State aid cases, it would reduce the administrative burden and would simplify the notification procedure. On the other hand, it would entail a loss of control over how access conditions and tariffs are set on subsidised networks, a potential loss of consistency between regulatory obligations and State aid access conditions and a potential increase in market distortions due to the loss of NRAs' first-hand knowledge on local telecoms markets on which the Commission has relied so far. Additionally, most stakeholders would not support this approach.

Relaxing the public consultation requirement and/or the tender requirement has the advantage of speeding up the planning of the measure and the timing for granting authorities to be able to implement their measures. Most probably it would also entail faster Commission decision making, more public investments in this sector with significant amount of EU funds spent in particular in new Member States and publicly funded broadband networks would be rolled out more quickly.

On the negative site, commercial operators might hold back/postpone their investments due to enhanced public intervention in this area, public and EU monies might be misused or not effectively used, and the Commission could face a high number of complaints and litigations from commercial operators.

7. COMPARISON OF THE OPTIONS

Options	Effectiveness	Efficiency	Coherence
Baseline: Prolonging the existing GL	-	+/-	-
Option 2: Revising the GL			
Sub-option (1)	+	+	+/-
Sub-option (2)	+	+	+
Sub-option (3)	++	+	++
Option 3: Radical overhaul of the GL	-	-	+

Magnitude > ++ strongly positive; + positive; -- strongly negative; - negative; +/- both positive and negative; = marginal / neutral; ? uncertain.

Effectiveness refers to the extent to which options achieve the objective. Efficiency refers to the extent to which the objective can be achieved for a given level of resources / at least cost (cost-effectiveness). Coherence refers to the extent to which options are coherent with the overarching objectives of EU policy.

8. MONITORING AND EVALUATION

The Broadband Guidelines are adopted under the State aid rules of the Treaty. As a result, Article 21 in chapter VII ("Monitoring") of the Council Regulation No 659/1999 apply. Thus, all Member States that adopt aid schemes covered by the Broadband Guidelines shall submit annual reports on such schemes to the Commission.

Nevertheless, meaningful evaluation on the effectiveness of the State aid broadband measures cannot be carried out because, as came out of the WIK study, the basic set of data on the measures is not available. Therefore the new Guidelines propose that a basic set of data –as the name of the aid beneficiary, the aid amount received, the aid intensity and the technology applied shall be published on a central website and made available for the general public.

In addition, the new Guidelines introduce an ex-post reporting obligation whereby under each State aid decision Member States have to report on the implementation of a state-funded broadband project. Such information includes, for instance, the number of bidders which have participated in the tender, the winning bidder, the number of access requests received and granted etc. This should facilitate a future review of the Broadband Guidelines, once this becomes necessary.

ANNEX I: GLOSSARY OF TECHNICAL TERMS

For the purpose of this impact assessment, the following definitions should apply. The definitions are without prejudice to further market, technological and regulatory changes.

Access segment: "last mile" segment connection the backhaul network with the end user premises.

Backhaul network: The part of the broadband network, which constitutes the intermediate link between the backbone network and the access network.

Bit-stream access: Wholesale access provider installs a high speed access link to the customer premises and makes this access link available to third parties.

Dark fibre: Unlit fibre without transmission systems connected.

Duct: Underground pipe or conduit used to house (fibre, copper or coax) cables of a broadband network.

Full unbundling: Physical unbundling grants access to the end-consumer access line and allows the competitor's own transmission systems to directly transmit over it.

FTTH: Fibre to the home network, which reaches the end user premises with fibre, i.e. an access network consisting of optical fibres lines in both the feeder and the drop segments of the access network (including in-house wiring).

FTTB: Fibre to the building, which reaches the end user premises with fibre, i.e. fibre is rolled out to the building, but copper, coax or LAN is used within the building.

FTTN: Fibre to the Nodes. The fiber is terminated in a street cabinet up to several kilometers away from the customer premises, with the final connection being copper (in fibre to the cabinet/VDSL networks) or coax (in the cable/DOCSIS 3 network). Fiber-to-the-node is often seen as a temporary, interim step towards full FTTH.

Neutral networks: networks which can sustain any type of network topologies. In case of FTTH networks, the infrastructure shall be able to support both point to point and point to multipoint topologies.

Next Generation Access Network: The 2009 Guidelines definition refers to wired access networks which consist wholly or in part of optical elements [...] In the new Guidelines a more technologically neutral definition could be applied. This could include for instance the following elements : (i) deliver services reliably at a very high speed per subscriber (e.g. at least 30 MBps); (ii) support a multitude of advanced digital services including converged all-IP services; (iii) provide the possibility of flexible capacity management between download and upload directions including symmetric speeds;

Passive network: Broadband network without any active component. Typically comprises ducts and dark fibre and street cabinets.

Passive wholesale access: Access to a transmission medium without any electronic component.

Point-to-multipoint: A network topology that has dedicated individual customer lines to an intermediate passive node (e.g. street cabinet) where these lines are aggregated onto a shared line. Aggregation could be either passive (with splitters such as in a PON architecture) or active (such as FTTC).

Point-to-Point: Network topology whereby the customer lines remain dedicated all the way from the customer to the Metropolitan Point of Presence.

Wholesale access products: Access enables an operator to utilise the facilities of another operator. The wholesale access products that can be provided over the subsidised network are the following:

- **FTTH/FTTB network:** ducts access, access to dark fibre, unbundled access to the local loop (WDM-PON or optical distribution frame (ODF) unbundling), and bitstream access.
- **Cable networks:** duct access and bitstream access.
- **FTTC networks:** duct access, sub-loop unbundling and bitstream access.
- **Passive network infrastructure:** duct access, access to dark fibre and/or unbundled access to the local loop. In case of an integrated operator: the access obligations (differing from the passive infrastructure access) shall be imposed in accordance with the provisions of the NGA Recommendation.
- **ADSL-based broadband networks:** unbundled access to the local loop, bitstream access.
- **Mobile or wireless networks:** bitstream, sharing of physical masts and access to the backhaul networks.
- **Satellite networks:** bitstream access.

ANNEX II: OVERVIEW ON BROADBAND TECHNOLOGIES

1. *FTTC/xDSL*

FTTC stands for Fibre to the curb/cabinet and refers to a particular architecture of the telecommunication access network. The fibre cables connect the network provider's central office (CO) and an intermediate node / street cabinet (hereafter denoted as Network Access Point - NAP). In most cases, the street cabinet is placed inside or near an existing intermediate network node where the existing copper-based telephony network of the area is split to multiple subscribers or lots of subscribers. The distance between the NAP and the end-user premises varies depending on the telephony network architecture of the access provider. On average, the distance can be considered to be roughly 300 meters. This part of the network is also called sub-loop since it is the final segment of the copper local loop. Essentially, the cabinet (NAP) introduces a point-to-multipoint topology in the network. One fibre or pair of fibres (depending on the optical technology used) can serve multiple subscribers over their respective pair of copper wires.

In this network setup, usually DSL-based technology is used to provide broadband access to the end- customer. All DSL technologies (e.g. ADSL, ADSL2+, SHDSL) are supported by a FTTC architecture. The most common technology used by network providers in Europe is VDSL/VDSL2 (very-high-bit-rate digital subscriber line). VDSL speeds are directly related to the operational conditions of the copper wires as well as the distance between the NAP and the end-user premises. Assuming top quality copper cables and NAP - end user distances up to 300m, the download speeds supported by the VDSL network are 90 - 100 Mbps. However, actual network conditions, weather conditions, signal interference from other copper pairs inside the same copper cable reduce significantly the actual speeds. As an order of magnitude a good engineered FTTC+VDSL network can support downstream speeds ranging from 20Mbps to 50Mbps (and higher for premises in close proximity to the CO). Actual upstream speeds are significantly lower and can go up to 15Mbps.

Since the roll-out started in 2009, it is reasonable to assume that the second generation VDSL2 has been adopted. Thanks to FTTC/VDSL topology, the incumbent operator reuses existing copper deployed and provides high-speed connectivity to subscriber utilizing VDSL2 in the last-mile, with fibre being extended to the curb, thus providing nominal speeds of 100 Mbps in downstream and 50 Mbps in upstream within 300 meters, even though performance degrades as the loop length increase. VDSL2 is continuously evolving in order to extend the service life of the copper plant, and to allow operators to get the most out of their existing infrastructure. Two key evolutions in this regard are VDSL2 bonding and VDSL2 vectoring. By using these enhancements to VDSL2, at a distance of 500 meters, the data rate could increase from 50 Mbps to 150 Mbps. The FTTC/VDSL network, being asymmetrical (i.e. the downstream significantly higher than the upstream), may not be the optimal solution to serve very high broadband demand.

2. *FTTB/H*

FTTH stands for Fibre to the Home. It corresponds to architectures that extend the fibre cables from the CO up to the end-user premises. Fibre cables are typically deployed by directly digging new trenches and then laying ducts where cables are subsequently pulled in. Often, existing duct systems are used to save on the construction costs related to digging up

and resurfacing city streets. FTTH provides high speed connectivity to end user which can in practical terms go up to 10 Gbps.

There are two topologies available for deploying FTTH. A point-to-point topology links directly each subscriber to the CO with a point-to-point fibre link. With a point-to-multipoint topology one or more intermediate points are introduced in the outside plant where links coming from the CO are split to multiple routes/end customers or lots of customers. There are two available technology options for FTTH networks: Ethernet and PON. Ethernet is a well-known and popular standard that was revised to support long distance links and sustain the special conditions of outside deployments. PON is a point-to- multi-point family of protocols (most common being GPON) where a passive splitter is introduced at an intermediate point in the network to split an incoming link (from the CO) to multiple routes (towards the end users). Typical configurations for an FTTH network include Ethernet point-to-point, Ethernet point-to-multipoint (called Active Ethernet) and GPON.

FTTH network is capable to provide broadband services from 100 Mbps up to 10 Gbps. A mix of different technologies can be adopted to implement these requirements:

- Point-To-Point Fast/Giga/10 Giga Ethernet, where a fibre is univocally dedicated to a customer from the local exchange to the customer premise and it is able to guarantee symmetrical bandwidth. It is the most expensive solution, its main advantages are: the maturity of the technology (relevant field plants already running services), the existence of several vendors offering equipment, high openness (both physical and virtual unbundling are supported);
- GPON and 10 GPON: the ITU-T G.984 (GPON) standard provides 2.5 Gbit/s of downstream shared bandwidth, and 1.2 Gbit/s of upstream shared bandwidth. The available speed for customer depends on the number of "splitters" deployed in the network implementation. 10G-PON (XG-PON1) enhances network throughput up to 10Gbit/s downstream and 2.5 Gbit/s upstream. Symmetrical 10Gbit/s can be obtained with XG-PON-2. However, only G-PON can be considered today a mature technology. G-PON is cheaper than Point-To-Point and it could be used for residential districts which usually do not require very high upstream speeds. Only virtual unbundling is supported.
- WDM-PON: multiple wavelengths are used to share the same fibre among different customers by assuring up to 1 Gbit/s symmetrical to the end-user. This technology does not currently have large installed base mainly due to economic reasons. Hybrid solutions mixing WDM-PON with GPON are under study and may represent promising alternatives on a middle term in order to enable physical-like unbundling.

3. *Hybrid fibre coax*

Today's cable networks are bidirectional and deliver interactivity and high speed broadband capabilities. The DOCSIS architecture allows separate communication channels besides the TV signals to communicate in both directions over the network. Cable networks by definition are a shared infrastructure, i.e. the resources are shared between all end-users connected.

In order to reduce the number of competing end-customers in this shared medium and to increase the available bandwidth for each customer, cable operators more and more replace some of their co-axial infrastructure by a fibre network (with a fibre hub closer to the end-customers; hybrid fibre coax (HFC) network infrastructures) and thus reduce the amount of customers per fibre hub or per given total bandwidth.

The bandwidth provided by the latest standard DOCSIS 3.0 is 160 Mbps downstream and 120 Mbps upstream. This capacity can be increased with bundling techniques but capacity remains shared by all connected customers. By pushing fibre closer to end users and thereby reducing the number of customers per fibre hub cable operators can increase the bandwidth that is available to an individual user. Like for all shared media performance per end-customer has a wide spread, offering at maximum the whole channel capacity to one single user if nobody else competes for it at the same time, or at minimum the channel capacity divided by the amount of users connected. In any case this user interaction causes delay and jitter for the data packets.

It is obvious that today's cable-TV based access networks are able to support fast broadband speeds only to a limited degree. This disadvantage may be overcome when the fibre nodes are migrated to the homes, thus requiring a FTTB point-to-point fibre topology and in addition opening the opportunity for additional communication channels outside the DOCSIS 3.0 architecture. In this way hybrid fibre coax networks offer the option of a smooth migration path by extending transmission capacity according to end customer demand, resulting in a FTTB fibre access network over time.

4. Fixed Wireless access technologies

Regarding mass market there are two different standardized wireless access technologies in use today on the basis of which broadband Internet access can be implemented: Wireless LAN approaches and WiMAX (Worldwide Interoperability for Microwave Access).

A Wireless LAN access point serves as a central base station to connect end customers in an area with a radius of approximately 30 – 100 m as a shared medium. The “feasible” distance between end-customer and access point depends on the specific local circumstances, e.g. regarding line of sight, indoor conditions, construction materials, etc. Over time the 802.11 standards have been improved; today they cover a range between 2 Mbps and approximately 300 Mbps (802.11n) in the shared channel. The available transmission speeds depend on the specific standard deployed, on the amount of users being active simultaneously, and on the distance and quality of the radio connection. Since many of the access points are backward compatible to older standards the oldest end system connected to it determines the maximum speed of the access point at a given time. Real speeds which can be achieved always are below half of the theoretical maximum (0.5 – 150 Mbps). Thus, WLAN cannot offer homogenous access speeds and a dedicated QoS to the end-customers connected.

WLAN is an access technology ideally suited for hot spots like railway stations, trains, airports and planes, restaurants and event locations, where nomadic end-customers stay for a while (because they are waiting, travelling, ...) and can use their terminal systems, which all have been designed and equipped as a WLAN end system. In larger locations there may be several access points, together covering the area, supporting moving end-customers, but not seamlessly, usually with a short interruption when switching over to another access point.

WiMAX encompasses technologies standardized in the IEEE 802.16 standard family. The technology can be used for Point-to-Point backhaul connections and for Point-to-Multipoint customer access networks. Used as an access network technology, central base stations serve the surrounding area in a shared manner. Thus, a bandwidth of up to 75 Mbps (over short distances) is shared between the customers. The available customer bandwidth also depends on the distance to the central base station. While in theory a coverage radius of 50 km is possible, requiring line of sight between the endpoints, in reality radio transmission is affected by buildings, trees etc. and restricts coverage to a radius of approximately 3 km. Indoor

coverage is even harder to achieve, if at all, thus, restricting the applicability of WiMAX in dense populated areas. In many cases the antennas have to be placed at a window and directed to the base station. The transmission capacity per customer depends on the number of customers active at the same time (shared medium) and is reported to be at 1 – 6 Mbps maximum, on average around 3 Mbps in medium distance to the base station. Accordingly, capacity and indoor penetration requirements may lead to the need for many base stations with small cells, potentially making it expensive. WiMAX therefore is an access technology that does not offer homogenous services in its coverage areas. Ensuring coverage of all customer locations, especially in urban areas, can become expensive.

WiMAX is designed with short latency times and additional features to offer guaranteed bandwidth, thus, the technology is in principle able to offer QoS features for a limited number of end-customers at the same time. WiMAX standards have also been expanded to serve mobile end-customers. The technology therefore could be viewed as a competitive technology to LTE, see below. But it seems that WiMAX has further weakened its competitive position when Cisco in spring 2010 announced to stop its WiMAX development.

The ability to also operate WiMAX as a backhaul technology allows to use it to connect (several) base stations of the same technology or different technologies in order to build meshed networks of base stations.

WLAN and WiMAX are wireless technologies with a common communication channel delivering bandwidths of up to 300 Mbps, being shared by all users communicating over the network at the same time. While in principle these networks can offer ultra-fast broadband speeds, they then are only suited to a handful of customers working in parallel, not for the mass market. Even fast broadband cannot be supported for a relevant amount of customers. For mass market usage and in dense populated areas these technologies also require a dense network of base stations, thus exhibiting severe challenges for profitability.

5. *Mobile technologies*

Since about the year 2000, when the UMTS frequencies were auctioned off in many European countries, mobile networks are able to deliver at least to some extent “broadband” speeds. UMTS in its original form was only providing 384 kbps. However, the further technical developments based on the UMTS standard, i.e. the “3.5 G technologies” HSDPA/HSUPA (High Speed Downlink (Uplink) Packet Access), deliver much higher bandwidths. Many mobile carriers in Europe today have implemented HSPA networks delivering up to 14.4 Mbps downstream and up to 5.7 Mbps upstream. Evolved HSPA technology allows for 42 Mbps downstream as a shared medium. From a technical perspective, the available bandwidths of HSPA technology will, however, remain limited. In all likelihood, it will not deliver 30 Mbps, but remain clearly below 10 Mbps per user.

The “standard” technology for mobile broadband access “tomorrow” apparently will be LTE (Long Term Evolution). LTE will be a major technological move of mobile carriers to serve growing customer needs requiring higher network speeds. LTE base stations could in theory and under special laboratory conditions provide 300 Mbps downstream and up to 100 Mbps upstream. Under real conditions, however, they are likely to provide a nominal download speed of up to 100 Mbps and an upload speed of up to 50 Mbps. Due to the cell based characteristic of this technology the effective access speed for the individual user therefore only is a fraction of the speed mentioned above. The effective speed for the individual user furthermore depends on the propagation characteristics of the frequencies and the topology. The effective speed at the edge of a radio cell only is a fraction of the access speed close to

the base station. LTE will definitely support basic broadband access and to some extent also fast Internet access. It will, however, not support ultra-fast NGA. This assessment is supported by the marketing policy of mobile operators in Germany which is ahead in Europe in deploying LTE.

Summing up, any of the aforementioned mobile technologies by definition are cellular technologies. Like all radio technologies they use a shared medium, thus bandwidth is shared between the active users in a cell in a controlled manner. The more active users there are in a given cell the less bandwidth is available for each user. The available bandwidth for each user moreover depends on the length (distance between the base station and the end-customer) of the radio connection. For mobile users it also may depend on the speed of the moving user and it may vary from radio cell to radio cell.

6. *Powerline technologies*

Electric power lines are a physically shared medium for power transmission between the last transformer and the end-customer homes. Consequently powerline technology provides a shared communication medium on utility power lines. The bandwidths of the newest technologies are limited to approximately 85 up to 200 Mbps shared between all customers.

Electric power cables serve as emitting antennas for the high frequencies transmitted over it for powerline communication use, thus it may be required not to use all of the theoretically usable frequency spectrum in order not to disturb other radio based applications (e.g. broadcast, TV, microphones, private radio, aircraft radio, ...), resulting in lower transmission capacity than its theoretic maximum. Powerline bandwidth also depends on line length and its performance can potentially also be affected by other electric equipment. The technology never reached maturity as an access network substitute and many experts today see the future of powerline as a technology solely for in-house networking or potentially as an access technology for smart electric grids. Due to shared capacity limitations, accompanied by high costs, lack of standards and defined processes for interaction with power utilities, powerline cannot be regarded as a relevant technology to support ultra-fast broadband access.

7. *Satellite technologies*

Satellite technology has been designed as a broadcast medium: the respective transponders deliver a portfolio of TV programmes in principle to all households in the area on earth that is covered, called a footprint. A further satellite application already in use since decades is the provision of transcontinental and transoceanic (large distance) leased lines and telephony connections in point-to-point topology. Due to large signal run times, however, these applications have been replaced by terrestrial or submarine fibre optic cables to a large extent.

Satellite technology providing two-way communications via low price Very Small Aperture Antennas (VSAT) in a point-to-multipoint topology is available since more than two decades. It also provides a shared medium communication.

Satellite as an Internet access medium never got off the ground at least in Europe: Astra claims to have about 60,000 subscribers and Eutelsat claims to have 25,000 subscribers. Eutelsat just recently introduced a new technology ("Ka-Sat") and commercialise that the technology is able to deliver 18 Mbps downstream and 4 Mbps upstream for a limited number of end-customers in parallel per footprint. Even when the satellite is able to serve several footprints for Europe and thus increases the number of customers to serve in total, its service mainly is suited for sparse populated (white) areas without any basic broadband

telecommunication alternative for cost reasons. Also, existing new generation satellites do not provide for enough capacity, should demand for satellite broadband increase significantly.

Yet, to use satellite technology for two-way and real time applications like video conferencing or interactive gaming is a challenge because (twice) the distance between earth and satellite (i.e. about 70,000 km) causes relatively high signal delay times (several 100 ms to 1.5 s).

Satellite broadband offerings in all likelihood are considerably higher-priced as regular broadband services. The differences are not that big with regard to lower bandwidths but they increase with higher downstream bandwidths and even more with higher upstream bandwidths. Moreover, the end-user has to buy specific hardware for satellite based Internet access which may cost up to several hundred Euros, even if prices are dropping steadily.

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