The Economics of Next Generation Access Networks and Regulatory Governance: Towards Geographic Patterns of Regulation

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Abstract: This paper examines the mix of technical, regulatory, and business strategy issues that arise in implementing next generation broadband platforms in Europe. Our review of some European studies on NGAN in Europe and our specific focus on the Italian situation, in particular on the competitive situation in Milano, shows the relevant flaw of continuing to advocate national patterns of regulation. In fact, the deployment of NGAN calls for a radical shift of regulation on a geographic level. The recognition that a NGAN business case does exist for OLO in a number of local areas, mainly metropolitan ones, has relevant regulatory implications.In the first place, since the conditions of competition differ significantly among local areas, regulation should promote both incumbents' and OLO's investments in NGAN by limiting *ex ante* interventions to those enduring economic bottlenecks found at a specific geographic markets level. In the second place, market definition is the most important step in the market analysis procedure to help decide whether to regulate a given service provided over a NGAN or not. We have proposed a taxonomy of local areas that may be adopted in a country like Italy for a correct geographic definition of markets 4 and 5 and, as a consequence, for the imposition of appropriate remedies.

Key words: Next Generation Networks, geographic markets, geographic remedies, infrastructure sharing, market definition.

Many European incumbents and some alternative operators are starting to plan and in some cases deploy large scale fiber investments, resulting in significant changes for European fixed line markets. The technologies used and the pace of development vary from country to country according to existing networks and local factors. This paper examines the mix of technical, regulatory, and business strategy

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issues that arise in implementing next generation broadband platforms in Europe. While the conclusions in terms of market structure are likely to differ from market to market, our analysis suggests that the traditional "One size regulation fits all" approach is not going to work in Europe.

In fact, although we do not think that fiber will follow the US example - the forbearance model - throughout Europe, we strongly believe that regulation will have to be more flexible. If promoting facilities-based competition is the goal, it is necessary for regulation to adopt a case by case approach to regulate access in order to ensure a reasonable return on investment and guarantee fair competition (DASGUPTA & WAVERMAN, 2007). Given the different underlying cost conditions of entry and presence of alternative platforms, it may be more appropriate to geographically differentiate the access regulatory regime.

The balance of this paper is organized in four sections. The 2nd Section, using some business case studies, discusses the economics of Next Generation Access Networks (NGAN) in more detail, these networks' need for a more flexible approach to deployment and why the idea that each player can choose a different technology and architecture to fit its needs is at the heart of NGAN development. Furthermore, this section presents *ad hoc* geographic cases to show why geography matters in defining the right regulatory framework to guarantee efficient investment and development of competition. The 3rd Section provides an overview of the current European regulatory practice on geographic markets, using the body of knowledge on geographic markets from the European New Regulatory Framework. At the same time, this section suggests how to shape regulatory policies for NGAN using the geographic dimension of the market definition in an NGAN framework. The last Section concludes.

■ The economics of NGAN

In this section we present the economics of next generation access networks, focusing on the most used wired network solutions (Fiber to the Cabinet and Fiber to the Building/Home). Furthermore, we discuss the different solutions that these new networks suggest to incumbent and alternative operators to compete in the broadband market and examine the development of NGAN through ad hoc case studies, such as Milano in Italy.

NGAN architectures

The introduction of Next Generation Networks (NGN) [1] sets the stage for a new era in the communication sector. NGN represent a profound revolution where the electronic communications market becomes heavily integrated with information society services with far reaching implications for network architectures, market development, and the need for new approaches to policy and regulation.

However, for the purpose of this paper, the analysis of NGN will be limited to the current and future developments of network architectures in the local loop, i.e., Next Generation Access Network (NGAN). In the last few years, all major telecom operators have started trials or deployment of new access network architectures. This behaviour can be explained by the need to develop new services to generate new sources of revenue to recover from the losses from traditional voice services, to face network obsolescence and reduce operational expenses, to better compete with old and new players (such as Google), to handle the physical saturation of the copper broadband network and to exploit the availability of new network solutions at ITU-T standards such as VDSL2 and GPON.

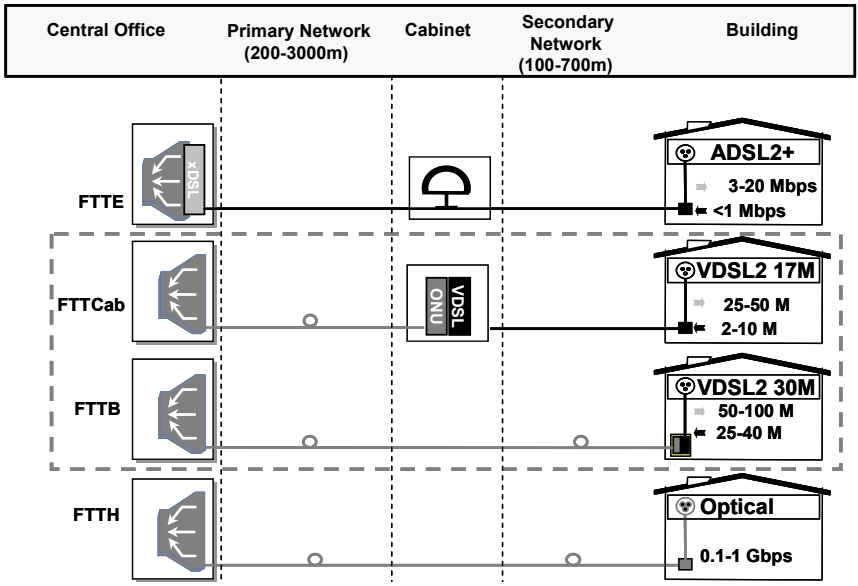
Although a NGAN can make use of fiber, copper utilizing xDSL technologies, coaxial cable, powerline communications, wireless solutions or a hybrid deployment of these technologies, we will focus on wireline access networks, which is where the current and planned efforts of incumbents and alternative operators is concentrated on, and regulators' attention is directed to. In fact, the timing and choices of specific technologies for NGAN may vary between countries, geographic areas and operators. This variation depends on a plurality of factors including state and age of existing physical network infrastructure, length of local loop, population density and structure of the housing market, distribution of number of users and number of street cabinets per Central Office, level of intermodal competition in the market, willingness to pay for broadband services and the existence of ad hoc national government plans for broadband development. Therefore, the idea of flexible solutions for NGAN, i.e. that each player can choose a different

[1] A "Next Generation Network (NGN) is a packet-based network able to provide telecommunication services and able to make use of multiple broadband, QoS-enabled transport technologies and in which service-related functions are independent from underlying transport-related technologies. It enables unfettered access for users to networks and to competing service providers and/or services of their choice. It supports generalized mobility which will allow consistent and ubiquitous provision of services to users". (ITU-T Rec. Y. 2001).

technology and architecture to fit its needs, seems to be at the heart of NGAN development. In fact the limits of the single, uniform architecture approach have been well known in the literature since the late 90's (PUPILLO & CONTE, 1998).

Figure 1 presents the wireline next generation access network architectures to bring broadband services to customer premises.

Figure 1 – Next Generation Access Network architectures



Source: Telecom Italia, 2007

Fiber to the Exchange (FTTE)

This solution uses the current copper network in both the primary and the secondary distribution network. It is based on the ADSL2+ technology and an optic fiber from the Central Office to the transport network. It allows for broadband connections up to 20 Mbit/s downstream and up to 1 Mbit/s upstream. It is recommended for sparsely populated areas.

Fiber to the Cabinet (FTTCab)

This solution uses fiber from the central office to the street cabinet and copper from the cabinet to the customer premises. It consists of a new cabinet containing the Optical Network Unit (ONU) serving a few hundreds of lines and including the VDSL2 apparatus. It allows for a downloading

capacity of up to 50 Mbit/s and uploading one of up to 10 Mbit/s at a distance of up to 700 meters.

Fiber to the Building (FTTB)

This solution uses fiber from the central office to the building. It consists of a smaller Optical Network Unit (ONU) (serving dozens of lines) including the VDSL2 modem to connect the fiber to the copper network of the building. It allows for a downloading capacity of up to 100 Mbit/s and an uploading one of up to 40 Mbit/s at a distance of up to 200 meters.

Fiber to the Home (FTTH)

This solution uses fiber from the central office to the customer premises and completely bypasses the copper network. It does not require any new cabinet. It allows for a symmetric capacity of up to 1 Gbit/s.

Cost drivers of NGAN

We will focus our attention on the FTTCab and FTTB/H architectures as they appear to be the most relevant cases in several European countries. Many factors and parameters constitute cost drivers for these architectures. The following broad cost categories can be distinguished:

- Infrastructures
- Electronics
- Customer Premises Equipment

Infrastructures

It includes the (horizontal) trenching and ducting and fiber cabling deployments and (vertical) costs of in-house wiring for the FTTH solution. It encompasses the cost of the splitters. For the FTTCab solution the fiber costs are relevant for connecting the street cabinet to the central Office. They are even more important for FTTB/H scenario as fiber is brought up to the building. Different studies assume these costs to be between 50% and 80% of the total costs per customer depending on the population density (ARCEP, 2006; JPMorgan, 2006). The ducting costs depend to a large extent on the usage of existing infrastructure such as trenches or ducts. When existing narrowband, broadband, or other utilities infrastructures can be used, these costs can be dramatically reduced.

Electronics

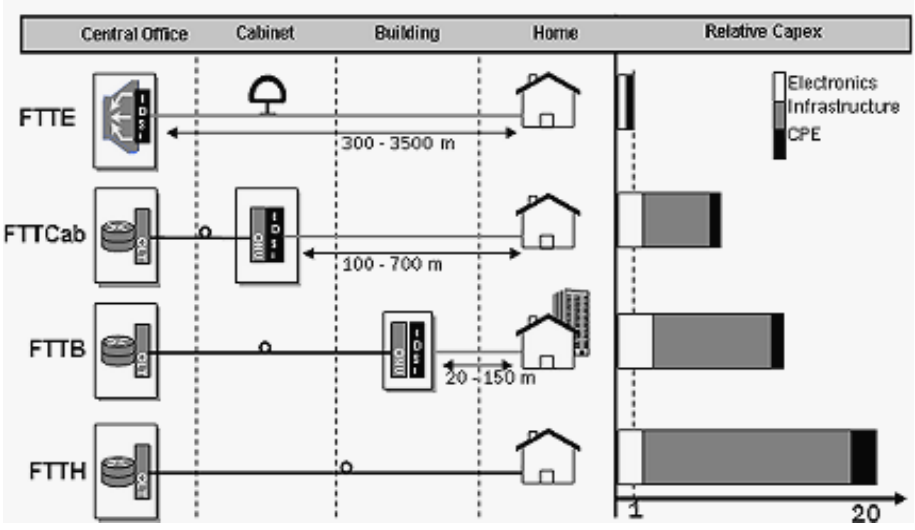
It includes the equipment costs such as ONU. For the FTTCab case, it also includes the cost of the cabinet. These are "fixed cost" per street cabinet and need to be recouped per line. The number of clients reachable per street cabinet plays a major role.

Customer Premises Equipment (CPE)

It includes the modem and all the electronics on the customer premises. In fact, for the FTTH solution the CPE cost includes the ONU itself that is placed on the customer premises.

Figure 2 presents the relative estimates of capital expenditures for the deployment of the different fiber access architectures.

Figure 2 – Capex estimates for different fiber access network deployment



Source: Telecom Italia, 2007

Comparing the per line capital expenditure of the current solution (FTTE) with the other architectures, the FTTCab architecture costs 7-8 times more than the FTTE, the FTTB 12-13 times and FTTH about 20 times more than the FTTE. The relative different weight of the electronics and CPE as well as the major role played by the costs of infrastructure is clear.

Incumbent *vs* alternative operators' architecture choices

Given the described cost structures, how are the incumbent and the alternative operators positioning themselves? The "Fiber Battle" report by JPMorgan (2006) emphasizes that incumbents and alternative operators in Europe have launched large scale fiber deployments. The majority of incumbents are choosing FTTCab; the alternative operators' choice is FTTH in densely populated areas, thus completely bypassing the incumbent network. Some operators, such as Telecom Italia, are choosing both FTTB and FTTCab solutions in different cities and even in different areas of the same city.

There are three reasons for incumbents to roll out FTTCab:

- Revenue Upside: Incumbents believe that the superior capability of VDSL2 will allow them to charge premium prices.
- Cost savings from reduction in operating expenses and from the planned closure of many central offices when the VDSL2 network is completed.
- Strategic evaluation: deploying VDSL2 is a rational way to face competition from cable companies and defend market share against triple play cable offering.

The JPMorgan report clearly suggests that the VDSL2 solution changes today's LLU paradigm. In fact, VDSL2 will have a disruptive impact on the current business models of LLU operators. Where the incumbents' VDSL2 plans imply the discontinuation of central offices, LLU operators need to revert to bitstream, where available, or deploy VDSL2 with uncertain returns, given the higher investments required compared to the LLU. However, the JPMorgan report calls for new choices from LLU operators. In fact, it shows that there is a FTTH business case for alternative operators in Europe's metropolitan markets, as shown by Iliad in France and NetCologne in Germany. In these cases, where alternative operators have sufficient market share and access to infrastructure (ducts from the municipalities), payback of six years or less can be justified without assuming market share or ARPU gains. We mentioned before that infrastructure costs play a significant role in explaining the cost differences between the various access network architectures. The JPMorgan report estimates that assuming a reduction of 50% duct and building related costs would lower the per customer connected cost from Euro 2,500 to Euro 1,500. Therefore, the payback for a 25% market share operator (without additional ARPU or market share

increase) would drop from 16 years to 10 years. At 40% market share, the Net Cologne case, the payback would be reduced to 6 years.

The importance of sharing infrastructure is also supported by ARCEP (2006) in the FTTH case study for the City of Clermont-Ferrand, where access to a network of ducts covering the whole city brings the coverage by a private operator from 1% to 21% of the area, and from 1% to 79% of all households [2]. It is also worth mentioning that in countries like Japan, USA and some rural areas of France, fiber to building or home is based on aerial deployment and does not need trenching and ducting, with a substantial reduction of capital expenditures. Furthermore, a recent study by WIK Consult (2007), shows that in a FTTH greenfield business case, assuming a scenario where a 25% market share operator would be able to avoid 50% of the infrastructure costs due to access to ducts and would be able to increase its retail market share to 30%, there would be a positive business case with an NPV of Euro +500 per customer. This is quite a realistic assumption in many major European cities.

These studies show that the availability, in specific geographic areas, of existing infrastructures such as ducts or fiber can make even the most costly fiber access network solutions viable and call for a much more flexible approach from regulators. This is based on the understanding of the different available technology solutions, the existing level of infrastructure competition especially in metropolitan areas, and the diverse geographic market conditions in order to limit the potential regulatory intervention only to enduring economic bottlenecks [3].

To complete our review of solutions for NGAN players, it is worth mentioning that Analysys Insight (2006), in an ad hoc report for OPTA, emphasizes that subloop unbundling for VDSL solutions to around 1000 of the largest street cabinets in the dense urban areas in the Netherlands may be economically viable for an alternative provider with a 10% market share under some specific circumstances related to SLU tariffs and reasonable expected ARPU increase.

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[2] ARCEP just launched a consultation on the evaluation of competitive access to ducts. http://www.arcep.fr/uploads/tx_gspublication/consult-ftth-fourreaux-juillet07.pdf

[3] Ofcom in its *Strategic Review of Telecommunications* defines an "enduring economic bottleneck" as the part of a network where the economics of alternative offerings are such that competition, through further market entry or innovation, is very unlikely to emerge in the relevant time horizon.

NGAN in Italy: where geography matters

Telecom Italia (TI), on March 9th 2007, announced, in a meeting with the financial community, its plans for network evolution. TI Next Generation Access Network project aims at fully migrating the current network to a broadband network which allows for more than 50 Mbit/s on fixed infrastructure and 10 Mbit/s on a mobile one. Furthermore, TI would like to massively introduce Fiber (FTTx) in the access network and to install VDSL2 technology (up to 65% of population coverage) and to implement a "Full IP" network. Total project capex is around 6.5 Bln €. About 65% of the lines will be covered by the new network with broadband downloading capacity up to 100Mbit/s, provided by a mix of technologies, including FTTCab and FTTB solutions (especially in main cities). The remaining 35% will be served by FTTE solutions. To understand the economics and regulatory implications of this process it is interesting to look at the deployment of Telecom Italia's NGAN in Milano.

On May 30th 2007 Telecom Italia signed an agreement with Metroweb (MW) to use MW fiber to deploy a TI next generation access network in Milano. Milano is one of the richest and quite densely populated areas in Italy. Metroweb is the owner of the widest distributed fiber optical network in the strategic areas of Milano and Valtellina. Metroweb operates as an independent open network access provider that offers its infrastructure to third parties which are providers of telecommunication services [4].

During this 15 year agreement (renewable for a further 15 years), TI will be able to reach 70,000 buildings in Milano with FTTB solutions. Metroweb's fiber will be used by TI only in the secondary access network, from the optical splitter of TI to the ONU in the building or nearby, while it will use its own fiber in the primary access network. Metroweb is acting as a wholesale open access network provider and is already offering fiber to Fastweb, the first operator to offer an all IP fiber network in Italy (from 1999) and the major broadband competitor to TI in Milano [5].

[4] On the sustainability of these open access models, see BANERJEE & SIRBU (2006). To find out more about Metroweb see : http://www.metroweb.it/index.php

[5] Until June 2003, Fastweb directly owned 23% of Metroweb and after that date sold its shares to AEM. As of April 2007 Fasweb's network - 23,500 km – covered 45% of the Italian population, 10 m homes passed and 850 Local switches with LLU. It has invested 4 b euros since 1999, and has 1.062.400 customers. See FASTWEB (2007) for further information.

In Milano there are currently 16 alternative telecom operators that offer services to business customers with their own fiber infrastructure. In addition, there are 4 alternative operators in the residential market and 8 alternative operators in the business market using LLU to compete with TI.

When looking at the residential broadband retail market, TI estimates that its market share in Milano is well below the 50% figure frequently used by the Italian National Regulatory Agency (AGCOM) to claim the dominance of TI in the retail broadband market (AGCOM, 2007, p. 22). Furthermore, this share has declined over time.

Milano's competitive scenario, where full facilities-based competition already exists, sets the development of Next Generation Access Network in a totally different situation compared to the first round of market reviews and calls for the identification of relevant market on a geographic basis to limit regulatory intervention only to existing enduring bottlenecks [6].

Is Milano an isolated case in the Italian competitive landscape? Milano definitely has some unique characteristics such as the extensive presence of the Metroweb fiber network, but in quite a few metropolitan and middle-sized Italian cities many operators already compete vigorously with TI, mainly by using LLU.

Furthermore, besides Milano, TI is well below the 50% market share of the residential retail broadband market also in Genova and Roma. In fact, Fastweb already has 2 m homes passed with its own fiber network. Moreover, many utilities and municipalities, such as ENI, ENEL, ASM, ITALGAS, from Milano in Northern Italy to Palermo in Southern Italy, own infrastructures (ducts and fibers) that can be used to build next generation access networks as TI is doing in Milano, using MW facilities.

Finally, we need to mention the presence of the legacy infrastructure from the Telecom Italia's Socrates Project, conceived in the middle 90's with hybrid technology HFC (fiber + coax), to bring pay TV and multimedia services to Italian households. Although this project was stopped after TI's privatization in 1999, it left TI's network with an "endowment" of fiber and ducts for 1.6 m homes passed in 57 major Italian cities. Actually, these ducts were opened to competition by an Antitrust Proceeding in 2001, paving the

6 Although the Italian National Regulatory Agency (AGCOM) has so far defined national markets, it has imposed some geographic differentiation of regulatory remedies. Specifically, it has imposed WLR regulation only in areas where access seekers are still not using LLU.

way for e.Biscom (which merged with Fastweb in 2004) to sign an agreement to use TI's free duct capacity [7].

The Socrates network will play an important role in the definition of the mix of FTTCab/FTTB solution for the deployment of Telecom Italia next generation access network, but it is also available to other telecom operators for NGAN investment projects.

■ Regulatory policies for NGAN

In the previous section, we stressed that NGAN represent a significant technological evolution that may allow a spur of infrastructure-based competition at least in selected metropolitan areas. In this section we first discuss the main regulatory models proposed for the transition to NGAN, and then focus on what we consider to be the key issue from a regulatory point of view: the achievement of proper market definitions to take the emergence of NGAN correctly into account.

Regulatory models for the transition to NGAN

The transition to NGAN raises a number of very complex regulatory issues. It is in fact the first time that a dramatic change in fixed access technologies occurs in a large number of industrialised countries. Given the likely implications for investments, innovation and competition, it is no surprise that such a technological transition is now at the core of the regulatory debate.

The main regulatory models proposed so far to address NGAN follow:

- *Extension of current wholesale regulation:* was basically proposed by ERG (2007). It focuses on an appropriate extension of current wholesale regulatory tools in markets 4 (wholesale network infrastructure access)

[7] On January 23, 2001 AGCM, the Competition authority, approved a concentration whereby Seat Pagine Gialle (Telecom Italia) acquired control of Cecchi Gori Communications, subject to some conditions. One of these was that TI should, from March 1st 2001, provide access to duct so that alternative operators could place their fiber optic lines "for the provision of interactive and multimedia services" in TI's existing duct infrastructure. The access had to be provided at non-discriminatory terms and cost oriented prices. See AGCM (2001).

and 5 (wholesale broadband access) in order to address the new bottlenecks brought about by NGAN.

- *Regulatory forbearance:* it foresees no regulatory measures on NGAN. It is essentially the regulatory model advocated by the USA and Hong Kong.

- *Temporary forbearance (regulatory holidays):* this model, initially proposed for Germany, foresees no regulation of so-called emerging markets for a certain period of time. It is therefore a "wait and see" regulatory model.

We believe that a mere extension of the existing obligations on the incumbent operator for new technologies is not the correct regulatory answer to the roll out of NGAN since, as has also been suggested by ERG, existing tools must be adapted to the NGAN environment. Simply replicating ULL and wholesale bit-stream access remedies for NGAN would in fact risk hindering or impeding new investments and innovation.

However, we also believe that both the "Regulatory forbearance" and the "Temporary forbearance" models can be satisfactory for a given country/region but, at the same time, completely inappropriate for another.

In fact, the above regulatory models have a common relevant flaw: they continue to advocate national patterns of regulation whilst, in our opinion, the novelty of NGAN calls for a radical shift of regulation on a geographic level in order to take into account the large differences in terms of competing networks and infrastructures that can be found in any given country.

In particular, we advocate a "geographic based regulation of enduring economic bottlenecks": the regulatory approach towards NGAN should limit *ex ante* access regulation to those enduring economic bottlenecks found at the level of specific geographic markets. This general principle needs to be accommodated first of all by means of appropriate market definitions in order to avoid unnecessary regulation.

The definition of geographic markets in the European New Regulatory Framework

It is a well known factor that the European Regulatory Framework (ERF) is based on technological neutrality and aims at the regulation of services and products regardless of the technology of the network used to deliver

them. This means that any regulatory measure must take the service in question - and not the network or the technology with which the service is provided - into account.

In regulating the service markets the ERF indicates three basic steps:

- The definition of relevant markets suitable to national circumstances (market definition).
- An analysis of the relevant market in order to establish whether a given market is effectively competitive and to identify any undertakings with significant market power (SMP operators) on that market (assessment of significant market power).
- The imposition of the appropriate *ex-ante* remedies to correct/avoid possible market failures due to dominant positions.

We contend that in order to decide whether or not to regulate a given service provided over an NGAN, the first step – market definition – is the most important one. In fact, it is basically at this stage that the regulatory approach towards NGAN services will be largely shaped.

As is common knowledge, a proper market definition procedure should consider two dimensions:

- a product dimension, and
- a geographic dimension in which the product is offered at similar conditions.

We will address this second methodological step since it is an area which has essentially not been addressed by regulators. We start by reviewing the approach taken by the ERF as regards the definition of geographic markets. The large number of market analyses completed so far by NRAs show that European regulators have almost invariably identified national markets. Indeed, NRAs have been very reluctant to identify specific geographic markets on the grounds of the 18 markets identified in the European Commission (EC) Recommendation on Relevant Markets (2003).

The definition of geographic markets by NRAs is however a duty clearly foreseen by the Framework Directive (2002), whereas article 15, paragraph 3 establishes that:

> "National regulatory authorities shall […] define relevant markets appropriate to national circumstances, in particular relevant geographic markets within their territory, in accordance with the principle of competition law".

Furthermore, Recital 27 of the Framework Directive, establishes that:

> "National regulatory authorities should analyze whether a given product or service market is effectively competitive in a given geographical area, which could be the whole or a part of the territory of the Member State."

Accordingly, the Framework Directive, which has been transposed in every EU Member State, has given clear-cut powers to NRAs, as well as duties, regarding the definition of geographic markets.

In particular, the methodology to be used by NRAs to define the geographic scope of the markets identified in the EC Recommendation has been addressed by the EC Guidelines on Market Analysis and the Assessment of Significant Market Power (2002).

Firstly, the EC Guidelines point out that the definition of the geographic dimension of a given market is a methodological step which follows the definition of the product market: it is only after a given market has been defined in terms of products/services that the existence of a geographic dimension for such a market can be investigated by regulators.

Secondly, the EC Guidelines establish the following general definition of a geographic market:

> "The relevant geographic market comprises an area in which the undertakings concerned are involved in the supply and demand of the relevant products or services, in which area the conditions of competition are similar or sufficiently homogeneous and which can be distinguished from neighbouring areas in which the prevailing conditions of competition are appreciably different". (EC, 2002)

It is interesting to note that such a definition is basically the same one adopted by the EC in its "Notice on the definition of relevant market for the purposes of Community competition law" (1997). It follows that the definition of geographic markets for regulatory purposes adopted by the Commission is fully consistent with competition law principles.

The above definition of a geographic market entails that in order to state that a given product market is characterised by a geographic dimension, it is not required that the conditions of competition in a given geographical area should be perfectly homogeneous; a finding of similar or sufficiently homogeneous conditions of competition is sufficient.

CAVE, STUMPF & VALLETTI (2006) point out, however, that the interpretation of homogeneity of conditions of competition is not straightforward and deserves a careful scrutiny. As regards the demand side, they note that "the number and concentration of buyers might differ from region to region, although consumers' preferences may be fairly homogeneous (absent substantial income differentials)". (CAVE, STUMPF & VALLETTI, 2006, p. 29). Indeed, there usually is a larger concentration of buyers, mostly business buyers, in metropolitan areas. In addition, per capita income can also significantly diverge between metropolitan areas and less developed urban and rural areas. Therefore, demand side conditions could significantly diverge between different regions.

As regards the supply side, CAVE, STUMPF & VALLETTI point to the very important role played by networks' availability on a local level. They stress that whereas mobile networks tend to be available nationwide, fixed networks are mostly deployed in heavily populated areas. As a result, supply side conditions in fixed telecommunications markets can significantly diverge on a local level.

However, we must recognize that in defining the geographic dimension, geographic demand-side substitution does not appear to be an effective criterion. In fact, given that the cost associated with moving location is usually very high, it follows that it is very unlikely that downstream customers would move to an alternative area in response to a SSNIP (Small but Significant Non-Transitory Increase in Price) in their living area. The same is true on the supply side, due to the high cost and long time associated with deploying new network infrastructure as a response to a SSNIP in a given area. It hence follows that, in assessing the geographic scope of a market on the basis of homogeneity of competitive conditions, it is essential to concentrate on appropriate narrow areas - ad hoc geographic units - and focus on specific factors enabling similar conditions of competition (Ofcom, 2006, pp. 37-41). We will return to this critical issue by proposing a possible geographic segmentation of markets 4 and 5.

In addition, it is also important to take the possibility of a geographic differentiation of remedies within a larger geographic market into account. Such a regulatory approach has been endorsed by the EC in the new Recommendation on Relevant Markets (2007). The Commission states that it can be both valid to identify geographic markets and to differentiate remedies geographically within a larger market if the nature or degree of market failure differs on a geographical level.

Along the same lines, ERG (2006) maintains that geographical variations in remedies may be justified even if markets are national in character due to common pricing constraints. ERG contends that, notwithstanding the presence of common pricing constraints, demand and supply conditions may be very different on a local level. Therefore, long-term prospects for infrastructure competition may significantly differ within a national market. In such circumstances, ERG concludes that a geographic differentiation of remedies can be fully justified.

Clearly, there are remarkable regulatory differences between a proper identification of a geographic relevant market and the variation in remedies in a given area. Amongst other factors, the former may even allow a finding of non-SMP in a given geographic area, which in turn would justify the removal (as well as the lack of imposition) of any remedy in a given territory, whilst a mere differentiation of remedies may not necessarily imply such a radical shift in regulation.

Geographic market definition in an NGAN framework

We can now address what we consider to be the core issue in establishing a fair regulatory policy to tackle the competition problems raised by the emergence of NGAN: the definition of appropriate geographic markets in the specific case of services provided over NGAN.

A correct completion of the first step of market definition – the product dimension – is, in fact, not enough. If relevant markets remain national in scope, whilst they should be defined on a local level, it follows that obligations would be imposed on a national level (with the significant exception, as we have underlined, of a possible geographic differentiation for some wholesale services). In this case they could be, at best, suitable for some local areas but, at the same time, completely unsuitable for others, thus creating artificial regulatory barriers – in these areas – to the development of an effective competition in the provision of services based on the new FTTH, FTTB and FTTC architectures.

In order to deliver correct market signals to investors and innovators, regulators should therefore concentrate on proper definitions of wholesale markets on a local level. For this purpose, it is of key importance to find a new geographic definition of markets 4 and 5, as the pillars of the regulatory intervention currently ensure, respectively, an infrastructure-based competition by means of local loop unbundling, and a "light" model of

competition (very often a simple resale model) based on the provision of bit-stream access products.

First of all, we must define the appropriate geographic unit for a possible geographic segmentation of markets 4 and 5. A number of different geographic unit options can be considered. As Ofcom (2007) puts it, the trade-off between granularity and practicality should be carefully assessed. In particular, Ofcom (2007) contends that the use of local exchange as the reference geographic unit strikes a reasonable balance in the trade-off between granularity and practicality. This approach is also strongly consistent with the current competitive landscape. In fact, LLU is provided at the local exchange level. Accordingly, variations in competitive conditions can be fairly observed exactly at the local exchange level. The FCC also adjusts remedies based on the number of competitive operators collocated at the central office (MAXWELL, SIERADZKI & WOOD, 2007, p. 182).

Individual exchanges can then be grouped by taking into account the different factors affecting the degree of competition on a local level. It follows that local exchanges marked by similar competitive conditions should be grouped together and then addressed by means of the same regulatory tools.

We argue that the above methodological approach should be implemented in the cases of both markets 4 and 5.

As regards market 4, it is likely that this market is still, as we write, national in scope in every European country. Nonetheless, market analysis should focus - on a local exchange level - on a number of factors that could deeply affect the evolution of access obligations imposed in market 4. In fact, the lack of any asymmetrical obligation in market 4 regarding the new networks (or at least a strong limitation of this type of regulation) would be fully justified, in a grouping of local exchange areas marked by one of the following conditions: presence of inter-platform competition; availability of a fibre open access network, such as the Metroweb network in Milano; availability of a legacy infrastructure which is de facto already open to third parties access due to the existence of antitrust undertakings (the case of Telecom Italia's Socrates Network); and, finally, availability of either utilities' or municipalities' networks that could be exploited for the deployment of NGAN.

Commercial agreements between operators (like the Milano example clearly shows) and, in addition, existing antitrust rules in countries such as

Italy, can indeed be sufficient in some local areas to ensure that potential investors develop, in a competitive setting, their NGANs according to their business plans. We must also underline that should commercial agreements be deemed as not fully satisfactory by regulators, NRAs might nonetheless introduce symmetrical regulation aimed at eliminating possible barriers either impeding or delaying the competitive roll out of NGAN [8].

Summing up, in this type of local areas, the transition from LLU to either a FTTCab or a FTTH/FTTB architecture could be for OLOs economically sustainable, provided that civil engineering costs, that represent the most relevant cost factor in the roll out of NGAN, are substantially reduced by means of access to existing ducts, suitable for fibre deployment, which can be owned by a number of different operators or municipalities. Accordingly, a geographical differentiation of remedies in market 4 with regard to NGAN access obligations might be fully justified.

As regards market 5, the grouping of local exchanges should be based on the level of LLU-based competition. The degree of competition in the wholesale broadband access market is in fact largely the result of LLU-based competition in markets downstream from wholesale local access. This is basically the approach adopted by Ofcom (2007). We share this methodological approach but we point out that the grouping methodology adopted by Ofcom could be adapted to the specific national circumstances.

Summing up, in local exchange areas marked by vigorous LLU competition, the lack of any SMP finding in market 5 appears fully justified. Hence, the removal of existing remedies in market 5 imposed by means of previous nation-wide proceedings as well as the lack of any new asymmetrical obligations regarding the new network would be clearly justified.

[8] This case could be the inside wiring one, where the best option is to encourage market forces to identify, and strike, the right balance. In fact, infrastructure sharing can be the result of freely negotiated agreements rather than the result of a regulatory intervention. However, in the event of market failures, the second best option is to address the in-house wiring by means of symmetrical regulation. In other words, each operator which owned in-house wiring should offer access to it.

■ Conclusions

Regulatory governance of Next Generation Access Networks in Europe cannot follow the "One size regulation fits all" approach. In fact, although we do not think that fiber in Europe will follow the US example - the forbearance model - we strongly believe that regulation will need to be made more flexible. If promoting facilities-based competition is the goal, then it may best to geographically differentiate the regulatory access regime based on the varying underlying cost conditions of entry and presence of alternative platforms.

Our review of some European studies on NGAN in Europe and our specific focus on the Italian situation, in particular on the competitive situation in Milano, has shown the relevant flaw of continuing to advocate national patterns of regulation while the deployment of NGAN calls for a radical shift of regulation on a geographic level.

The recognition that an NGAN business case does exist for OLO in a number of local areas, mainly metropolitan ones, has relevant regulatory implications.

First of all, as competition conditions differ significantly in local areas, we claim that regulation should promote both incumbents' and OLO's investments in NGAN by limiting ex-ante interventions to those enduring economic bottlenecks found on a level of specific geographic markets.

Secondly, market definition is the most important step in the market analysis procedure in order to decide whether or not to regulate a given service provided over an NGAN. We have proposed a taxonomy of local areas that may be adopted in a country like Italy for a correct geographic definition of markets 4 and 5 and, as a consequence, for the imposition of appropriate remedies. The adoption of a regulatory forbearance model in local areas like Milano is fully justified.

The analysis here presented shows the importance of shifting regulation on a geographic level. This provides a further justification for prospective analyses aimed at reducing costs driven by inappropriate regulation.

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