# Broadband Access in Europe: Challenges for Policy and Regulation

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This article reviews the development of broadband Internet access throughout the European Union. Based on international experience, it discusses challenges for policy and regulation in telecommunications markets, in particular in the light of the emergence of IP-based telephony (VoIP).

The European Commission views broadband as a key ingredient of competitiveness in Europe, and has been active in promoting developments in broadband. This appears, for instance, in the Lisbon 2010 goals, which pay explicit attention to the take-up of broadband. Although such goals are, in principle, praiseworthy, it is important to relate them to the nature and effectiveness of competition and regulation in the markets in which broadband plays a role. This article links recent experience in broadband to the telecommunications sector, and points to a couple of important policy considerations.

We briefly mention some related papers. For background on the regulatory framework in the EU, we refer to De Bijl and Peitz (2005), who focus mainly on local loop unbundling (LLU) and related regulatory issues. For economic analysis of the link between regulation and the effectiveness of competition in telecommunications, see De Bijl and Peitz (2002). On the relationship between LLU regulation and the incentives for investments in competing infrastructure, see for instance Bourreau and Dogan (2005). Papers that present empirical results on the up-take of broadband include Gruber and Denni (2005) and Distaso, Lupi and Manenti (2004).

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We will start by looking back at what has happened in telecoms markets and by explaining the relevance of broadband developments. Based on data and country experiences in the EU and beyond, we then discuss the international development of broadband Internet access, in particular in relationship to the market for telecommunications services. Finally, we discuss some challenges for policy and regulation.

## Telecommunications markets

A major promise of the liberalisation of telecommunications markets was competition between networks, enabled by the rollout of new networks as well as by the upgrading of cable networks. Both local network rollout as well as upgrading by cable operators was initially disappointing, however, at least in the light of initial expectations. Local network investments have been narrowly targeted, as they were mainly aimed at corporate customers in business districts or metropolitan areas more generally. Residential customers, especially in rural areas, have hardly experienced the rollout of competing local loops to their houses. Cable operators have been inactive for some time. However, due to LLU, broadband Internet access and voice telephony over the Internet, the telecoms industry is now undergoing important changes.

To a certain extent, residential customers benefited from entry made possible by mandated access to incumbents' networks, as in the case of carrier (pre)selection (CS, CPS) and LLU.[1] Arguably, initially LLU failed to give a strong push to competition in markets for fixed voice telephony.[2] Entrants leasing unbundled local lines from incumbents mainly used them to offer only broadband Internet access based on digital subscriber line (DSL) technology. They could do so by purchasing relatively "plain" types of unbundled lines, which are less suited for offering (traditional) voice telephony.[3] However, with the emergence of telephony based on the Internet Protocol (IP), the picture is changing, as voice services can be offered over "plain" broadband lines.

[1] In terms of required investment levels, LLU-based entry can be seen as an intermediate entry mode between pure access-based entry (CS and CPS) and complete facilities-based entry. LLU gives entrants more control over the types and quality of services that they provide to end-users.
[2] See Delgado et al. (2004).
[3] To offer voice services, entrants traditionally needed an elaborate type of unbundling ("full unbundling"), giving them full control of the copper pair.

A somewhat similar comment can be made for cable operators. While most have remained (more or less) passive in offering traditional voice telephony over their networks, many of them have not hesitated to offer broadband Internet access. And here again, IP-based telephony now allows them to offer voice services over broadband lines. Accordingly, even if cable operators' activities, similar to the supply of voice telephony by entrants using unbundled lines, have been disappointing in several countries, IP-based telephony may drastically change the picture in the coming years.

**Recent developments in broadband access**

*Background*

The main types of broadband access technologies are digital subscriber line (DSL), cable modem, fibre to the home (FTTH), and wireless local loop (WLL). DSL is typically offered by network operators, such as incumbents who have upgraded their PSTN (Public Switched Telephone Network) networks and by operators who use incumbent's local networks through LLU. In addition to these types, there are various other means of broadband access, such as satellite and power line communication. Depending on the speed that can be reached, mobile technologies may also be relevant, such as the third generation of mobile telephony (UMTS), WiFi and WiMAX.[4]

Broadband is typically defined as allowing for incoming traffic at a rate of at least 256 kB per second. Since existing FTTH connections already manage more than 30 MB per second, a more detailed look at broadband connections that distinguish between different speeds would be desirable. This is particularly the case because certain services, such as video-on-demand, only become attractive at sufficiently high broadband speeds.

Apart from faster downloads (and uploads) that make existing services more attractive, and also lead to the introduction of new services, broadband access offers an alternative to traditional telephony in the form of Voice over Internet Protocol (VoIP). The main types of IP-based voice services which are available for end-users are:

1. Voice over Broadband (VoB), managed by a broadband provider (DSL or cable operator);
2. VoB managed by an independent service provider;
3. VoIP as an application on a PC connected to the Internet (e.g. Skype).

Throughout this article, we will simply use "VoIP" for all of these types of IP-based telephony.

Interestingly, to a large extent VoIP still has to be addressed by policy makers, both at the national and European level, as safeguarding the development of this innovative service calls for reviewing legal frameworks. Various EU members states, including Belgium, Germany, Ireland, Spain, Italy, Luxembourg, Austria, Finland and the UK, have already issued or are currently discussing guidelines on the regulatory treatment of VoIP. For example, in Luxembourg and the UK, numbering plans have been changed to eliminate legal constraints on VoIP services. In the last section we will discuss the regulatory challenges that still lie ahead of us in the light of the emergence of VoIP.

*Recent developments in the broadband market*[5]

At the moment, broadband connections are primarily meant for Internet access. Worldwide, (narrowband) dial-up access to the Internet is in decline, as subscribers are migrating to broadband access.[6] DSL is the main force driving this migration, also in countries in which cable modems have traditionally played important roles – we will come back to this issue below. It should be noted here that moving beyond Internet alone, broadband is used more and more for bundles of Internet and fixed telephony (more on this later), possibly with TV added as well ("triple play"). Mobile telephony is being added as well by operators who have the necessary capabilities ("quadruple play").

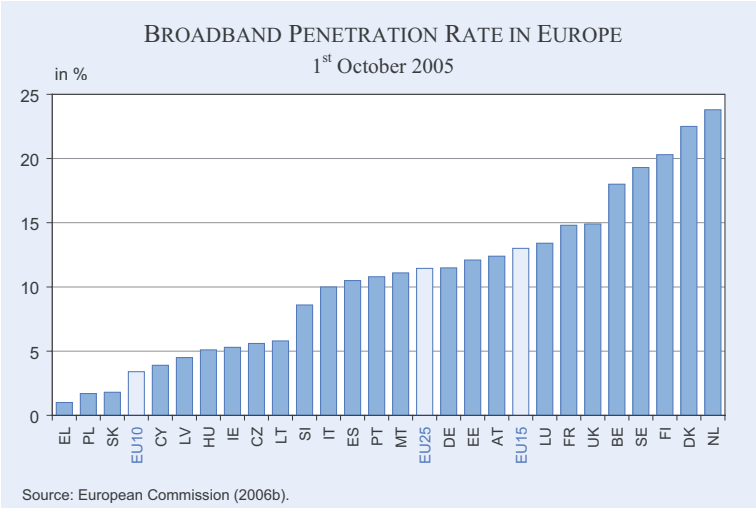
The penetration rate of broadband access is growing at a fast rate. In October 2005, the penetration rate was 11.5 percent of the EU population, amounting to more than 50 million users with a residential connection. One year earlier, it was only 7.3 percent. The

[4] Wifi and WiMAX are standards-based technologies for wireless local area networks (WLAN) and last mile wireless broadband access.

[5] Throughout this section, for EU member states we will use data from the European Commission (2006a, b). For OECD member states outside of the EU, we will use OECD data for December 2005, available at http://www.oecd.org/sti/ict/broadband. Note that these types of data may not be fully comparable: definitions may be somewhat different, and dates of observation are not exactly the same.

[6] Le Floch (2006).

**Figure 1**




Source: European Commission (2006b).

growth has obviously not been the same for all member states, as can be seen in Figure 1; it ranges from 1 percent in Greece to almost 24 percent in the Netherlands.

Outside of the EU, Korea was traditionally in the lead in terms of broadband penetration (25 percent in 2005) but was recently overtaken by Iceland (27 percent in 2005). Note that the EU's frontrunner, the Netherlands, lags behind but not by much. Interestingly, Korea's growth rate has levelled off recently. Based on the declining growth observed in Korea, one may expect that for the leaders in the EU, Denmark and the Netherlands, broadband penetration growth will become substantially less steep in the coming years.

The Table gives an overview of the composition of broadband technologies in the majority of the EU member states. On average in the EU, DSL has a share of 81 percent of fixed broadband connections. Cable is next, with 17 percent. In terms of growth, a similar difference appears: DSL had a growth rate of 61.5 percent, and cable 39.2 percent.[7] Within the EU, there are big differences in the composition of broadband connections. Countries with a strong cable sector are, for instance, the Netherlands (38 percent), Denmark (29 percent), Belgium (38 percent), Austria (41 percent) and Portugal (42 percent).

Looking at the composition of broadband connections related to its overall penetration, OECD data shows that there is a positive correlation between the share of cable and broadband penetration.[8] One interpretation of this relationship is that the (historical) presence of cable networks contributed to the early take-up of broadband, provided that cable operators upgraded their networks. In particular, cable operators providing broadband access constitute competition to dial-up and broadband Internet access offered by telephone operators. As we discuss below, subsequent growth may then partly be due to the presence of DSL in combination with LLU.

Technologies other than DSL and cable currently still have little significance. Some operators are investing in FTTH and WLL. FTTH is in third place in the EU, due to relatively high penetration rates in Sweden, Estonia and Lithuania. WLL is used by entrants in, among others, Lithuania, Ireland and Latvia. Since in some member states, governments are tendering WLL licenses or are planning to do so, WLL is likely to become more important. Another promising technology (or rather, approach) is

**Composition of broadband technologies in different countries**

December 2005 in %

| | DSL | Cable | Other |
|---|---|---|---|
| Netherlands | 62.0 | 38.0 | 0.0 |
| Denmark | 61.3 | 28.9 | 9.8 |
| Finland | 86.8 | 12.7 | 0.6 |
| Norway | 81.3 | 13.2 | 5.5 |
| Sweden | 65.6 | 16.9 | 17.5 |
| Belgium | 61.8 | 38.2 | 0.0 |
| United Kingdom | 72.3 | 27.6 | 0.1 |
| France | 94.0 | 5.9 | 0.1 |
| Luxembourg | 89.1 | 10.6 | 0.3 |
| Austria | 57.4 | 41.3 | 1.3 |
| Germany | 97.1 | 2.2 | 0.6 |
| Italy | 95.1 | 0.0 | 4.9 |
| Spain | 78.4 | 21.1 | 0.5 |
| Portugal | 57.6 | 42.2 | 0.2 |
| Ireland | 74.7 | 9.2 | 16.0 |
| Czech Republic | 47.5 | 21.2 | 31.2 |
| Hungary | 64.6 | 33.2 | 2.3 |
| Slovak Republic | 78.4 | 15.5 | 6.0 |
| Poland | 67.7 | 30.1 | 2.2 |
| Greece | 99.1 | 0.0 | 0.9 |
| **OECD** | **62.0** | **32.3** | **5.7** |
| **EU 15** | **81.3** | **16.9** | **1.8** |

Source: Based on OECD 2006a.

[7] European Commission (2006a, p. 34).
[8] The correlation coefficient is 0.25 for all countries in the set, and 0.36 if Iceland is excluded. Iceland has the highest penetration rate, but a cable share of 0.4 percent. Empirical analyses that control for other factors such as income and population density are e.g. Gruber and Denni (2005) for the US (using state level panel data) and Distaso et al. (2004) for European countries. In these analyses our observation that the degree of facilities-based competition and broadband penetration are positively correlated is confirmed.

"metro Ethernet", which consists of connecting individual apartments by Ethernet cables in order to use jointly a dedicated switch with a broadband link (which may be DSL, cable, FTTH etc.).[9]

It should be noted that according to European Commission (2006a), the EU is not a frontrunner in terms of broadband speed. This is due to the fact that new DSL technologies and new wireless technologies (e.g. WiMAX) are taken up rather slowly, or are still in a trial phase.

Given its strong relative position (see Table), DSL can be seen as the main driving force behind the migration to broadband. The strong growth in DSL lines is possibly driven by (regulated) LLU-based entry, which has stimulated competition in the DSL segment. Interestingly, countries with a high broadband penetration not only have a high share of cable but often are also characterized by well developed regulation of access for LLU and bitstream access.[10]

The view that access regulation is good for competition has been questioned in a number of papers, in particular with respect to more intrusive types of unbundling such as bitstream access and sub-loop unbundling. For instance, Wallsten (2006) ran cross-country regressions for OECD countries from 1999 to 2003 and regressed broadband penetration on variables that represent the current regulatory regime as well as other relevant variables such as population density. At a first look, LLU in the form of full unbundling appears to be significantly correlated with broadband penetration. However, including fixed effects, he found that in the case of LLU, coefficients are, in general, ambiguous and in the case of sub-loop unbundling negative and statistically significant.

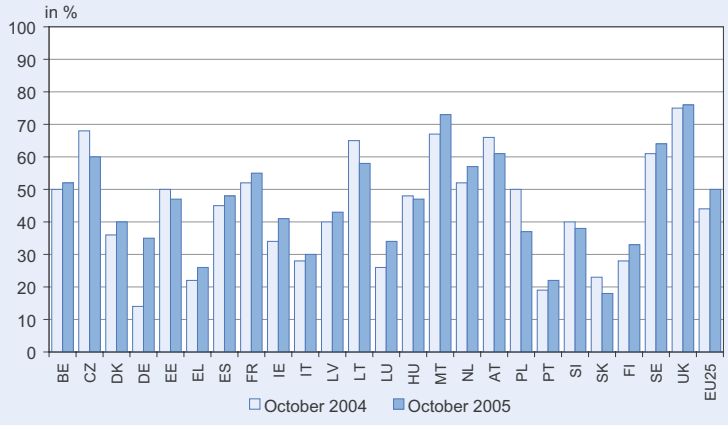
Note that regression results with respects to the regulatory variables have to be interpreted carefully because of an endogeneity problem. For instance, if regression results indicate that the presence of a particular type of regulation, such as bitstream access or sub-loop unbundling, has a statistically significant negative effect, then this does not necessarily mean that the use of such regulation will have a negative effect on broadband penetration. The causality may go the other way, namely in countries in which broadband penetration appears disappointing (for instance because of the lack of feasible facilities-based competition such as cable), policy makers and regulators opt for more intrusive regulation to foster broadband penetration. At this point the empirical evidence appears to us to be inconclusive as to the effect of different types of unbundling regulation on broadband penetration.[11]

An interesting claim in this debate is that cable companies, whose broadband activities tend to be unregulated, invested more quickly in their broadband networks than telephone companies did (see e.g. Hazlett 2005). Indeed in a number of European countries some cable operators were the first to offer broadband connections. However, it is not clear whether this is due to different regulatory regimes or due to the fact that for telephone companies' broadband connections cannibalized on dial-up connections resulting in lower incentives to invest early irrespective of regulation. According to this latter view, once cable companies posed a real threat telephone companies had to react.

The typical regulatory pattern in EU member states that have reviewed the markets notified by the European Commission – which is about half of the member states – has been as follows. In general, in the relevant markets for wholesale unbundled access and wholesale broadband access, national regulatory authorities (NRAs) have established that competition is not yet effective. This triggered various, but not all, NRAs to impose access obligations, in partic-

**Figure 2**

MARKET SHARES OF ENTRANTS IN FIXED BROADBAND RETAIL LINE




Source: European Commission (2006b).

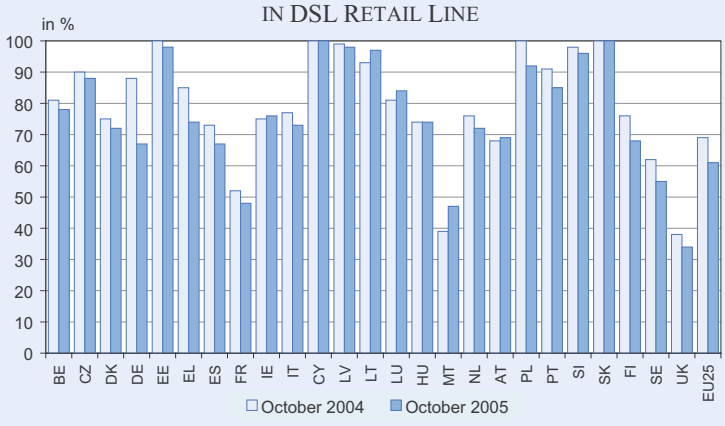
[9] European Commission (2006a).
[10] European Commission (2006a, p. 36).
[11] Apart from a proper treatment of the endogeneity problem we would like to see analyses with more recent data since broadband penetration has increased quite dramatically since 2003.

ular bitstream and LLU. So far there has been no regulation of bitstream access in the Czech Republic, Germany, Estonia, Greece, Luxembourg, Latvia, Malta, Poland, and Slovakia, while the appeal courts in Sweden have suspended the relevant regulation. Interventions aiming at mandatory access are likely to have contributed to substantial increases of entrants' market shares, as depicted in Figure 2. One can see that on average in the EU, the incumbent's market share in the broadband market has declined to about 50 percent in October 2005.

As can be seen from Figure 3, within the DSL segment, the average market share of incumbents is still 61 percent. Thus, in countries where cable networks suitable for broadband are absent or play a minor role, on average, incumbents have been able to maintain stronger positions in the overall broadband market. At the individual level, this is confirmed, for example, by Italy (incumbent's market share in broadband 70 percent) and, to a lesser extent, by Germany, where the reduction of the incumbent's market share is a very recent phenomenon (incumbent's market share in broadband was 86 percent in October 2004 and 65 percent in October 2005).

From the perspective of developing competition, the general observation from Figures 2 and 3 is that incumbents' markets shares are in decline, which may imply that competition is becoming more intense. According to European Commission (2006a), the increase in competition is one of the most important forces behind the rollout and take-up of broadband. However, given that competition (and investments in network infrastructure) are partly affected by regulation, regulatory intervention (in particular, with respect to LLU) may play an important role in industry development, but its net welfare effect is hard to assess.

**Figure 3**




Source: European Commission (2006b).

## Challenges for policy and regulation

Our observations give rise to various policy challenges. Firstly, broadband penetration should not be a goal in itself, given that it is uncertain to what extent consumers wish to have fast broadband connections that can increasingly be used for demanding, innovative services, such as movies on demand and online games. In some countries there may be little demand for such advanced products while consumers are more interested in decent speed at low prices. In other words, policy makers need to develop an understanding of the preferences of end-users, potentially even about services which do not yet exist.

A second challenge is related to the regulation of LLU. As observed above, there may be a link between the fact that DSL entry is stimulated by the regulatory framework in several member states and broadband take-up. This link may make it hard for policy makers to let go of LLU regulation, even though from a dynamic efficiency perspective, that might be desirable. The reason is that LLU is part of the broader issue of infrastructure-based versus retail-based competition: in the longer run, infrastructure-based competition is likely to require less regulatory intervention and, therefore, the social costs of regulation appears to be smaller. What is optimal will depend on the preferences of end-users and the economic costs for undertaking investments in networks, which depend on country factors (e.g. geography, GDP) as well as telecommunications specific factors (e.g. the existence of cable networks).

A third challenge, or rather set of challenges, is due to VoIP (which is, in turn, driven by broadband). Of course, NRAs have to address how they should regulate VoIP (see De Bijl and Peitz 2006). Various countries, including Austria, Belgium, Czech Republic, France, Germany, Hungary, Ireland, Italy, Slovak Republic, Turkey and the US have

imposed minimum or no regulations specific to VoIP services, at least so far.[12] Other countries, including Australia, Canada, Denmark, Finland, Greece, Iceland, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, and the UK, view VoIP services offered to the public as a telecommunications service, which is then subject to regulations as those for traditional PSTN services.[13]

In addition to the issue of regulation of VoIP itself, we want to stress that NRAs have to be aware of potential distortions caused by existing PSTN regulation of the emergence of VoIP. Higher prices for terminating access to the PSTN network slow down the adoption of VoIP and reduce the profits of entrants that exclusively offer exclusively VoIP telephony (De Bijl and Peitz 2006). Thus regulators have to think beyond the framework of "traditionally" defined markets and take interactions between (converging) markets into account in order to avoid interventions that lead to welfare losses.

## References


Bourreau, M. and P. Dogan (2005), "Unbundling the Local Loop", *European Economic Review* 49, 173–99.

De Bijl, P. W. J. and M. Peitz (2002), *Regulation and Entry into Telecommunications Markets,* Cambridge University Press, Cambridge.

De Bijl, P. W. J. and M. Peitz (2005), "Local Loop Unbundling in Europe: Experience, Prospects and Policy Challenges", *Communications & Strategies* 57, 33–57.

De Bijl, P. W. J. and M. Peitz (2006), "Access Regulation and the Adoption of VoIP", *International University in Germany Working Paper* no. 43/2006, available at SSRN: http://ssrn.com/abstract=905535.

Delgado, J., J. Fehrenbach and R. Klotz (2004), "The Price of Access: The Unbundling of the Local Loop in the EU", in P. A. Buigues and P. Rey (eds), *The Economics of Antitrust and Regulation in Telecommunications: Perspectives for the New European Regulatory Framework,* Edward Elgar, Cheltenham, UK and Northhampton, MA, 169–82.

Distaso, W., P. Lupi and F. M. Manenti (2004), "Platform Competition and Broadband Uptake: Theory and Empirical Evidence from the European Union", available at SSRN: http://ssrn.com/abstract=518382.

European Commission (2006a), Commission Staff Working Document, "Annex to the Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions", European Electronic Communications Regulation and Markets 2005 (11TH Report {COM(2006)68 final}, SEC(2006)193, vol. I, Brussels.

European Commission (2006b), Commission Staff Working Document, "Annex to the Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions", European Electronic Communications Regulation and Markets 2005 (11TH Report {COM(2006)68 final}, SEC(2006)193, vol. II, Brussels.

Gruber, H. and M. Denni (2005), "The Diffusion of Broadband Telecommunications: The Role of Competition", available at SSRN: http://ssrn.com/abstract=829504.

Hazlett, T. W. (2005), "Rivalrous Telecommunications Networks With and Without Mandatory Sharing", March, *AEI-Brookings Joint Center Working Paper* no. 05–07, available at SSRN: http://ssrn.com/abstract=707633.

Le Floch, L. (2006), "The World Broadband Access Market", *Communications & Strategies* 61, 163–169.

OECD (2006a), OECD Broadband Statistics, December 2005, available at www.oecd.org/sti/ict/broadband.

OECD (2006b), VoIP: Development in the Market, Working Party on Telecommunication and Information Services Policies, DSTI/ICCP/TISP(2004)3/FINAL, released January 10, 2006.

Wallsten, S. (2006), "Broadband and Unbundling Regulations in OECD Countries", *AEI-Brookings Joint Center Working Paper* no. 06–16, available at SSRN: http://ssrn.com/abstract=906865.


[12] OECD (2006b).
[13] OECD (2006b).