FTTH Council Europe

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- **FTTH Deployment** - When and why?
- **The World Broadband Access Market**
- **Telecoms in Europe** - Indicators and benchmark
- **Unbundling in Europe** - Trends, strategies and impact

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FTTH deployment panorama - EU 28 (3rd edition)

European Commission

Broadband coverage and take-up in EU 25

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FTTH network deployment scenarios in France

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FTTH, FTTN+VDSL forecasts for Europe 2006-2015

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Executive Summary

FTTH Deployment:

When and why?

Based on an analysis covering the technical aspects, key factors in deployment and positioning of players, IDATE has identified various FTTH development scenarios

The panorama of current FTTx (FFTx means here Fiber to the Home or FTT Building or FTT Node) deployment shows the diversity of initiatives between the primary geographic areas, the cost of deployment and the regulatory framework are key factors in the position of operators.

Today, few applications and services justify providing bandwith greater than 20 Mbps, but the expectation is set because needs should at least grow due to the usage overlap and the growth in equipment purchases.

Several deployment scenarios can be identified, reaching home coverage rates of 20 to 80% by 2015, based on several criteria and the country.

Project Manager
VALERIE CHAILLOU
v.chaillou@idate.org

The success of broadband access around the world (more than 200 million subscribers listed at the end of 2005) is based on a combination of competitive policies with, on one hand, investment by operators in modifying telephony loops or cable networks, and service innovations (divided between web portals and players, and on the other hand, triple play offerings from operators).
Bandwith offered by DSL or cable modem technologies have increased considerably over the last 5 years, typically ranging between 512 kbps to more than 12 Mbps. However, the limitations of current infrastructures are beginning to be felt, as much on the level of maximum performance as on the effective eligibility of the population for higher bandwith. **It is in this context that there is renewed interest in significant deployment of access networks that are totally (FTTH) or partially (FTTN) based on optical technologies** and capable of offering very high speed access, which we will define as exceeding the limits of DSL technologies (20 Mbps).
The questions still remaining include: what optical technologies are available and what is their maturity level? What are the truly large deployments around the world? What are the applications most likely to benefit from very high speed access? What are the main parameters that influence the economics of FTTx deployments? Are there alternatives to optical technologies to provide very high speed access offerings?

FTTx Solutions: from a technical maturity viewpoint

First, it is important to distinguish between FTTN (Fibre To The Node) solutions and FTTH (Fibre To The Home) options.
FTTN deploys fibre optic cable all the way to an intermediate node located between the operator's central office and the user terminal[1]. The termination of the connection over the last mile is then generally based on the telephone line copper infrastructure and xDSL equipment, especially VDSL2. Such a configuration offers very high speeds, based on how close the node is to the user's building (up to 100 Mbps at less than 300 meters from the distribution node for VDSL2). When the intermediate node is a street cabinet, problems of coexistence then occur (signal disruption) with ADSL equipment installed by other operators and present complex scenarios if the VDSL line is unbundled. A variant on FTTN architecture consists of using radio technology in the final segment.
As for FTTH, it is a solution that uses fibre optic cable from end to end between the central office and the user's building. FTTH networks could be deployed using two distinct configurations: point-to-multipoint (fibre optic cable not dedicated to users but shared upstream of an intermediate node) or Point-to-point (each user has dedicated fibre optic cable from end to end). In point-to-multipoint options, it is important to distinguish between passive[2], or PON (for Passive Optical Network), and active networks like double star Ethernet. Point-to-point networks are generally based on Ethernet technology.
PON networks include several international standards (APON, BPON, EPON, GPON). Each of these standards has specific characteristics, especially in terms of performances. As such, GPON, adopted at the end of 2005, reaches maximum speeds of 2.4 Gbps downstream, to 1.5 Gbps upstream. It is also multiprotocol, which means that it supports ATM or IP as well as Ethernet, and also can manage up to 64 users per tree (compared to 32 for other PON standards). As far as EPON, it has the advantage of having symmetrical speeds (1.25 Gbps).

[1] In the case of a building, the node can be located in the basement of the building.

[2] A network is called passive when the intermediate equipment installed does not require electrical power or maintenance. In contrast, a network is active when the intermediate equipment is an active Ethernet switch.

Actual deployments are still limited but announcements are increasing.

Asia is a pioneer in this area, with large scale deployments by traditional Japanese and Korean operators. NTT pushed fibre optic cable deep into its network early on, with its two regional subsidiaries providing FTTH access based on PON technologies (EPON). KT and Korean operators mostly rely on fibre optic cable access in the basement of buildings extended by LAN (Ethernet) or VDSL. The Japanese and Korean advances can be explained by the support of public authorities as well as characteristics such as population density in the large metropolitan areas of Tokyo and Seoul, high rise buildings, and aerial connections, which are very favourable to the economics of optical projects. On the other hand, there appear to be no regulatory conditions or the success of certain services that explains this advance. Also, heavy copyright constraints limit offering television programs on high or very high speed access in these two countries.

In the United States, optical network deployments were at first limited to pilot building activities or performed by a few municipalities. But over the last two years, investments have been made by the RBOCs, Verizon and AT&T (ex SBC). Outdistanced in the broadband market by cable operators, handicapped when compared to European telcos by copper loops that are often very long, Verizon and AT&T rely on the deployment of new infrastructure to retake market share and offer video services. Their initiatives have taken advantage of legal and FCC decisions that avoid the requirement to unbundle their new infrastructure. They remain, however, still blocked by the requirement, in most parts of the United States, to negotiate franchise rights with each municipality. Note that Verizon (FiOS) opted for BPON FTTH technology. It was estimated that, in the first quarter of 2006, the number of FiOS subscribers was on the order of 400,000 on nearly 3.6 million home passed installed. At the end of 2006, Verizon could reach 900,000 subscribers on 6 million outlets installed. AT&T (Project Lightspeed) relies on FTTN solutions (for 17 million homes) based on ADSL2+ or VDSL, except in greenfield areas (representing 1 million FTTH households.

In Europe, the situation is different: precursor countries, such as Sweden and Italy, owe their advance to initiatives by private operators, B2 and Fastweb respectively. It is important to note that these operators have had a tendency over the last few months to return to ADSL2+ and to unbundle telephone lines to extend their customer base, rather than extending their optical networks. Elsewhere, the few very high speed access network deployments are often due to the involvement of local bodies (Denmark, Netherlands) that install infrastructure open to the various access providers ("open access"). Only recently, traditional operators have gotten involved in fibre optic cable access networks. Deutsche Telekom was the first to announce a large scale plan (investment of 3 billion EUR and objective to deploy very high speed access infrastructure based on VDSL2 in 10 cities by the end of 2006, and 50 cities by the end of 2007). There is, however, a conflict with Brussels that, contrary to an agreement negotiated with the German authorities, requires opening Telekom's infrastructure to third parties. As well as Deutsche Telekom, Swisscom will open commercial VDSL2 services during the summer 2006 and plans to cover with his DSL offer half of Swiss hourseholds by 2007. KPN and Belgacom have also chose FTTn + VDSL solutions to offer Very High Speed Internet accesses. France Telecom started in June 2006 to test a pure FTTH solution (based on GPON) in Paris and his suburbs (a few thousand subscribers).

Number of FTTx Subscribers at the end of 05 (in thousands)

Japan	South Korea	North America	Sweden	Italy
4 640	1 620	500	321	257

*including FTTN + Ethernet LAN subscribers
Source: IDATE

Regulations: should they require opening up new infrastructure?

In Europe, the debate rages in a context marked not only by the Deutsche Telecom initiative but also by the 2002 regulatory revision period (the Review). The current regulatory framework includes the regulation dated December 2000 which requires unbundling of the metallic loop if only a portion of this loop is used. As a result, FTTN/VDSL solutions (Deutsche Telecom) fall into the category of existing framework, even if the price can be calculated taking into account the innovation risk. So, other traditional operators, like France Telecom, have preferred to wait to deploy experimental infrastructure and opt instead for fibre optic cable all the way to the subscriber. If the infrastructure is completely new, the regulation of December 2000 no longer applies. It remains that services supported by this new infrastructure, as well as prices, should differentiate themselves significantly from services supported by ADSL access in the case where the operator is considered powerful in the broadband market. If this is the case, the operator's investment could be managed as an emerging market and not be subject to an ex ante regulation imposing access at a controlled price. But for the moment, nothing indicates that the large European operators are getting significant flexibility from the regulatory changes to the current regulatory framework coming from the Review.

What applications currently justify very high speed access deployment?

With business districts and the main headquarters of large companies most often being served already by fibre optic cable access, the problem with deploying FTTH/FTTN networks applies to the residential sector and to Small and Medium Enterprises/Very Small Enterprises, which are often dispersed.

At first glance, no application on its own seems to truly justify today bandwith greater the 20 Mbps (theoretical available by ADSL2+ downstream being very close from the local exchange). Nevertheless, the emergence of HDTV could represent a significant constraint, even with the upcoming implementation of MPEG4 compression techniques that reduce the speed required (6 to 8 Mbps required per HD channel by 2007-2008 versus 1 to 3 Mbps for a SDTV channel). The prospect of offering two HD channels simultaneously clearly requires speeds greater than the capabilities of ADSL2+. Other specific services, P2P, enhanced instant messaging, videoblogs, games online, etc., that are undergoing growth particularly within the framework of Web 2.0, could impact upstream speeds.
Elsewhere, without being able to identify specific applications for which an FTTH network must be deployed, take into consideration overlapping usage (several users of online services in the same home), growth of applications supported by the operator's "boxes" and the increase in multimedia equipment (digital cameras, high definition televisions, DVR, webcam, MP3 players, etc.).
In the Small to Medium Enterprise market, general applications are somewhat less demanding in terms of speed. Two main parameters must be taken into account:

- the widespread use of computers connected to the Internet that leads to a growing need for speed;
- the existence of business applications, that are bandwidth hogs: computer aided design, medical imagery, scientific calculations, online education, etc.

Finally, for very high speed access needs, it should be underscored that if ADSL especially in its most developed version, ADSL2+, reaches 20 Mbps, the characteristics of telephone lines ensure that this speed is theoretical and can not be reached by a significant percentage of subscribers. Thus, in France where ADSL2+ was widespread, it is assumed that one line out of two will not get 10 Mbps in speed required for a triple play offering (and even in Paris, one line in 5 will not be eligible). This situation could exert heavy pressure in support of FTTH/FTTN as the number of triple play subscribers eventually grows.

Is fibre optic cable the best solution?

But is fibre optic cable the only response to the issue? FTTH, which certainly offers the best performance, seems to be the preferred option to substitute for the copper telephony network and provides very high speeds. But the costs of deployment remain significant: AT&T and Verizon report costs on the order of 1,000 to 1,100 USD per FTTH connection (with a drop however of about 10% per year over the next few years).
FTTN/VDSL could constitute a less difficult option, where some part of the telephone loop is retained between the intermediate node, most often a street cabinet, and the subscriber. It only is truly interesting if this part of the network is less than 400 m long to retain a speed actually greater than that of ADSL2+ (in France, it is estimated that the average distance between distribution frame/subscriber is 800 m, on which France Telecom probably based its decision in favour of FTTH. (In Germany, the same distance us aroud 900m)
70% of the cost of deployment being in civil works, the main alternative to FTTH/FTTN architectures resides in the development of cable networks, naturally where this network already exists. The combination of DOCSIS 3.0 cable modems and architectures including more and more fibre optic cable (up to the last amplifier for coaxial pockets of several tens of subscribers) should make it possible for cable operators to propose this year speeds at some sites that exceed those of ADSL2+. (30 Mbps offers are already available by cable and operators in thus)
For rural areas, other technologies, less difficult to deploy than fibre optic cable, could be used, in particular wireless technologies (WiMAX, BWA at 20 or 40 GHz, 4G, or WiFi which is the theoretical performance of the future 802.11n standard).

How to select which technology to deploy? The main criteria are associated with need for civil works:
telephone line characteristics,

- opportunity to use existing cable runs (metro, sewers…) or to share infrastructure,
- possibility of aerial placement,
- population density and the number of high-rise buildings

Add to these considerations:

- methods to use to limit fixed costs by carefully targeting the set of buildings involved,
- the power of public authorities. This is potentially huge. It could be applied to promote access to infrastructure (civil works), to help pre-equip new districts or with negotiations with the building managers, to promote pilot testing new services and finalizing network technologies, and naturally, clarification of regulatory provisions.

What strategy for what type of player?

Players directly involved in the deployment of very high speed access networks can be divided into several categories:

- alternative operators that made FTTH/FTTN access a differentiator. They were able to take advantage of agreements with cities and their suburbs to limit the barriers to entry that civil works represent (Fastweb in Milan). They can find in the cities and their suburbs favorable opportunities by using the metro and sewers and taking advantage of population density. Note Citefibre and Erenis in Paris that carefully target favorable sets of buildings on the network map for access and service penetration. Other operators could specialize in residences with a rich population sensitive to quality access to the Internet and television. It is not sure that these alternative operators will remain independent in the upcoming years, but they can hope to offer, over the next three to four years, an attractive infrastructure to internet access market consolidators.
- traditional telephone operators. They do not all have a strategic plan for renovating their local networks, such as NTT which made it a priority long ago, or Verizon and AT&T which have been overtaken by the large cable operators. In any event, even in Europe, our conviction is that the large operators will have to prepare themselves to invest in FTTH/FTTN before the end of the decade;
- cable operators, in view of consolidation in several markets, will pursue upgrading their infrastructure where they are already present;
- local bodies could create PPP partnerships to accelerate equipping their area by making very high speed open access infrastructure available to operators;
- power companies could take advantage of distribution networks they have to diversify their activity by proposing very high speed access services or by creating partnerships.

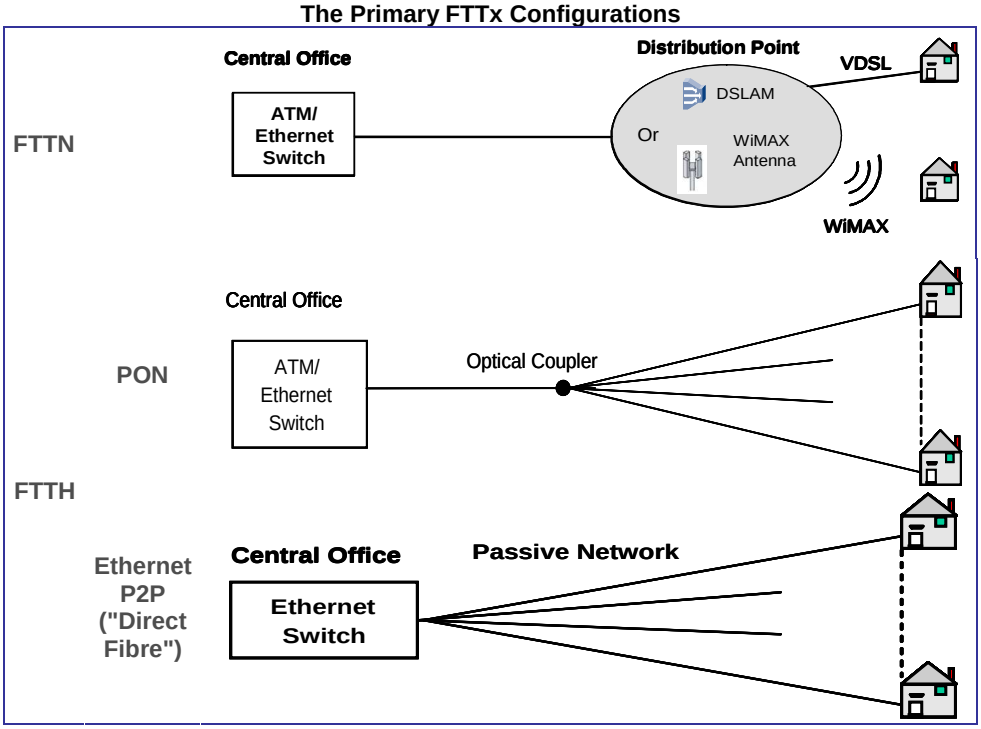
When can we see large scale deployment?

Three possible scenarios by 2015.
The costs of FTTH deployment are one of the first brakes on very high speed access development. But other criteria should also be considered as previously indicated: the evolution of the broadband market and associated service offerings such as HDTV, the regulatory situation, the degree of competition between technology platforms, structural factors such as population density, the involvement of public authorities in general and local cooperatives in particular, etc. The development of each of these criteria will have some impact on the deployment strategies of the various categories of players.

There are, therefore, **three distinct scenarios around which the combination of key deployment factors creates an environment more or less favourable to very high speed access development:**

- In the first scenario, very high speed access is considered a necessity by the large traditional operators that all are starting their first deployments before 2010. Their investment will be completed by the involvement of public authorities that want to enlarge to the maximum the geographic areas involved. In this scenario, a high home coverage rate is expected in developed markets, on the order of 60 to 80% by 2015;
- in the second scenario, the first deployments have been completed on the initiative of alternative operators seeking to benefit from competitive differentiation. In parallel, some cooperatives have decided to create PPP partnerships with the final objective of creating very high speed open access infrastructure;
- Finally, in the third scenario, consider that only a few private players are involved in very high speed access, limiting deployment to areas with high market potential. Coverage is, in the end, very different within national boundaries. Traditional operators are limited to pilot or very targeted deployments and public authorities, for their part, do not consider very high speed access a priority.

The Primary FTTx Configurations



Source: IDATE

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Executive Summary

The world broadband access market

9th edition

270 million broadband subscribers worldwide in mid-2006, enjoying a steady growth momentum.

DSL confirms its place as broadband's chief driving force, ahead of cable modem.

Ultra-broadband a reality in South Korea and Japan, while over in the United States, the RBOCs have begun rolling out FTTx infrastructures.

Project Manager
Loïc Le Floch
l.lefloch@idate.org

Analysis by geographical zone

Asia-Pacific still the frontrunner, while Europe maintains its lead over North America

Asia-Pacific still leads the way in terms of broadband access and remains home to the largest user base, accounting for more than 40% of the world's broadband subscribers. Meanwhile, Europe has further consolidated its position, after having overtaken North America for the first time in 2005. But the gap with the Asia-Pacific block is expected to widen, as the user base in China and India continues to grow.

China on the verge of becoming the world's largest broadband base

China (home to 47 million broadband connections as of mid-2006) is expected to have overtaken the United States by the end of 2006. Among the large developing countries, Brazil, and Russia and India to a lesser degree, have finally entered the broadband fray and are reporting very healthy growth rates. Over in Europe, after a very good year, Germany (12.6 million broadband users as of mid-2006) moved ahead of the UK (11.6 million) and France (11.1 million), though still reporting a lower penetration rate.

South Korea is no longer the sole benchmark in terms of broadband penetration

Europe's frontrunners (the Netherlands and Denmark with more than 28 broadband connections per 100 inhabitants) have taken a slight lead over South Korea, long home to the highest broadband penetration rate in the globe. Elsewhere in Europe, the UK and France are both reporting higher penetration rates than the United States, and are now neck and neck with Japan (at roughly 19%).

Analysis by access technology

Inexorable decline of dial-up

Users continue to switch to broadband, although narrowband does still account for a sizeable portion of the base – and so a growth reservoir – in some countries (Germany, the US).

DSL still broadband's chief driving force

DSL continues to be responsible for the broadband base's ongoing expansion, even in the US (although cable was still in the lead there in mid-2006). Such is also the case in Europe, even in the UK and the Netherlands where cable had dominated the market until very recently.

The cable modem alternative

North America continues to stand out as the only region where cable modem still dominates the broadband access market, thanks to exceptional service coverage and the involvement of heavyweight players (Comcast, TWC).

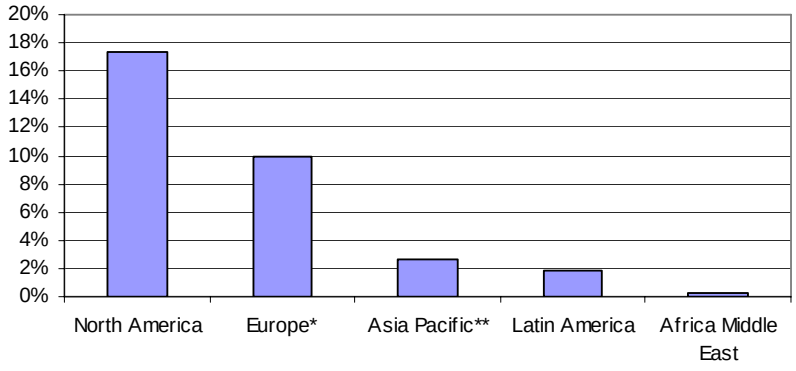
The advent of very high-speed (VHS)

Enjoying government support and enabled by highly concentrated populations in major cities, the migration to VHS is stepping up in Japan and South Korea. Japan is now reporting more new FTTx/ETTx subscribers than new DSL subscribers, and was home to more than 6 million FTTx/ETTx subscribers in mid-2006.

In the US, very high-speed is gradually becoming a reality now that unbundling obligations have been lifted from optical fibre, and so providing RBOCs with the incentive to roll out FTTx infrastructure.

In Europe, most ultra-broadband projects thus far have been instigated either by municipalities or utilities, while fibre network operators, such as FastWeb in Italy or B2 in Sweden, are tending to expand their footprint using DSL.

Broadband penetration in the world's major regions as of mid-2006 (connections/100 inhabitants)



* 14.7% on average in the European Union
** 19.1% in Japan and 26.2% in South Korea

Source : IDATE

Lasting competition taking hold in the broadband sector, as revealed by incumbent telcos' shrinking market share.

Competition dynamics nevertheless vary considerably between Asia, North America and Europe. Even inside Europe, despite certain common trends, the situation in each country varies a great deal, depending on cable's place in the landscape, the incumbent's aggressiveness and the degree to which wholesale DSL and unbundling have developed.

Europe's leading providers are nonetheless gradually defining a migration strategy that goes either by way of VDSL (Deutsche Telekom, Telefónica, KPN) or by adopting FTTH solutions directly (France Telecom). Several top ISPs, such as Free in France, have also announced plans to invest in large cities but the issue of the ultimate regulatory status of optical fibre (FTTx) infrastructures, particularly with respect to unbundling, remains a major stumbling block.

Rise of unbundling in Europe

■ **Wide range of situations**

There is still very little facilities-based competition in Europe, except in the Benelux countries, the UK (where cable penetration is high) and in Sweden.

Although European incumbents enjoy greater market dominance than their counterparts in the US, competition is more fierce in Europe's DSL markets, particularly in those countries where unbundling is on the rise.

■ **From a model based on wholesale DSL to one based on unbundling**

Very little used by alternative operators up until 2003, unbundling has now become a central part of alternative operators' and ISPs' broadband growth strategies. And in countries where unbundling has made the greatest strides (France, Sweden), it has become regulators' prime focus for expanding broadband coverage.

■ **From shared access to full unbundling**

Although the situation still varies widely from country to country, we are seeing a tendency is several new markets to give priority to full unbundling, even in those countries where shared access was once more widely used. In some of the most advanced countries (notably Sweden and the Netherlands), local sub-loop unbundling is also expected to constitute a growth path for unbundling operators in 2007.

Open networks enabled swift broadband deployment in South Korea

Benefiting from a population concentrated in collective buildings (which own the local loop) and from cities with dense optical fibre and open cable infrastructures, South Korean ISPs were able to roll out their services very quickly, under a neutral model (same ISP using DSL, cable modem and Ethernet LAN).

Japan, unbundling's champion

The Japanese market is now among the most competitive in the world. In mid-2006, NTT East and NTT West's combined share of the DSL subscriber market was only 40%. Very affordable shared access (1 EUR a month), along with the ability to unbundle dark fibre to connect to local access points, have allowed alternative providers to become very competitive. And now NTT is stepping up its FTTx/ETTx rollouts – providing the country's users with very high-speed offers at very low prices.

The singular US market

■ **Strong facilities-based competition**

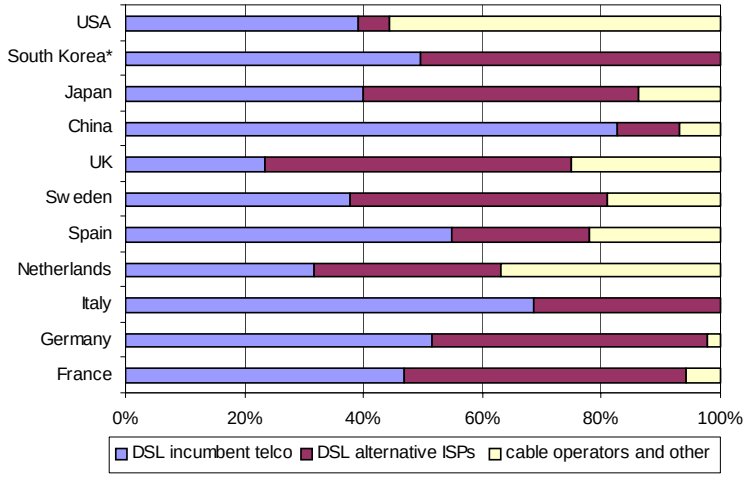
In the US, cable still accounts for the majority of broadband connections, with a 54% share of the market in mid-2006. But the newly reconsolidated RBOCs are using DSL and FTTx to regain market share, even if cablecos still have the edge with their triple play bundles. Poorly positioned in the broadband market and now destabilised by changes to unbundling regulation, pure ISPs are working to find new growth outlets.

Stakes surrounding naked DSL

A naked DSL offer gives users the option of having just the DSL without having to pay for a phone subscription. Combined with VoIP or mobile telephony, this type of offer could enjoy growing popularity, and is becoming increasingly available, notably in Western Europe.

In the US, Qwest and Verizon have launched a naked DSL option in some of their markets, seeking to counter service bundles with an entry-level offer.

Broadband access market share by operator/technology



- Operators in South Korea all offer several access technologies

Source: IDATE

As unbundling becomes increasingly widespread, the key to success in the broadband market goes by way of a broadband operator model.

This means achieving critical and making massive investments, in view of the crucial nature of economies of scale at the expected pace of innovation. As a result, the market is expected to become even more concentrated in the coming months, with some players electing to channel their energies into their core markets, while mobile telcos may well be tempted to take control of broadband providers.

Recent changes in player strategies

- **Incumbent telcos**

As landline revenues continue to slide and broadband becomes increasingly ubiquitous, operators have been making the internet the centrepiece of their strategies. Initially created as start-ups, incumbent carriers have been reintegrating their ISPs into the parent company, allowing them to create and market service bundles.

- **Alternative operators/ISPs**

As unbundling becomes increasingly prevalent, ISPs with no infrastructure of their own have been transforming themselves into broadband operators, which can be achieved in one of two ways: either by investing in building their own network, or by taking over another operator that already has its own infrastructures.

- **Cablecos**

We have witnessed a series of mergers and acquisitions in the cable industry in recent months, particularly in Europe where cablecos are working to achieve critical mass. Once case in point is the recent merger of NTL and Telewest in the UK while, over in France, the new Noos-Numericable entity is due to launch a service running at 100 Mbps before the end of the year.

Player concentration confirmed

Achieving critical mass (subscriber base) and the capacity to make massive investments have become key to success in the broadband market – as a result of which the market's consolidation will likely continue. Some players have elected to channel their energies into their core markets (AOL has pulled out of the European access market to focus on its portal offer; Tiscali is now present only in Italy and the UK; Tele2 has sold off its French subsidiary…) while, at the same time, mobile operators wanting to get a foothold in the quadruple play may well be tempted to take control of a landline telco or an ISP.

Momentum and positioning in 2005

- **Ongoing price cuts now slowing down as a result of the sector's growing maturity**

After having dropped sharply and steadily over the years, broadband access prices are now levelling off, and we are seeing a price alignment in most entry level DSL and broadband cable offers.

Even though Asia-Pacific has the lowest access tariffs in the world, particularly given the bitrates on offer, European operators do market very competitive offers, particularly in France, the Netherlands, the UK and Sweden.

- **Speed race likely to continue**

The trend of offering ever-increasing bitrates, spurred by growing competition and the technologies' performance (ADSL2+, VDSL, and DOCSIS2 for cable), fuelled the emergence of the triple play model, which combines internet access and telephony with a TV and video offering.

To be able to market a bundled offer, telcos in the US, notably SBC and Verizon, have been investing in FTTx networks which will prove decisive in their bid to market TV services (ex: FiOS TV).

Growth of unbundled DSL in Europe (K)

At the end of:	2003	2004	2005	/2006
Germany	465	870	2 490	3 275
% of DSL	10%	13%	24%	27%
Spain	16	114	435	678
% of DSL	1%	4%	11%	15%
France	273	1 591	2 827	3 335
% of DSL	8%	25%	30%	30%
Italy	240	450	763	950
% of DSL	11%	10%	12%	13%
Netherlands	232	462	740	855
% of DSL	24%	25%	30%	30%
United Kingdom	8	47	192	673
% of DSL	0%	1%	3%	8%
Sweden	30	210	374	450
% of DSL	5%	24%	30%	32%

Source: IDATE

Broadband access prices levelled off in 2005, with providers opting for ever-increasing bitrates and a growing array of services.

All of the broadband market's players are moving towards the triple play (internet, voice, TV), at a time when fixed-mobile convergence strategies are beginning to take shape.

The future of access prices will depend on the players' very high-speed strategies.

In Europe, future deployments are expected to be built on an FTTH/FTTN + VDSL2 architecture in major cities, and on ADSL2+ in the rest of the country, to be able to market triple play bundles nationwide.

In Asia, notably in Japan and South Korea, the migration to ultra-broadband will continue, with the goal of delivering a service running at 1 Gbps per subscriber.

■ **Triple play for all!**

For DSL providers, adding a TV offer puts them head to head with satellite and cable pay-TV providers, added to which IPTV is still burdened by questions of quality and requires agreements to be signed with TV channels or rights holders.

Several IPTV services have been launched on DSL networks in Europe (France, Italy, Sweden), confirming the shift from experimental to commercial offers. Despite regulatory uncertainties, Asia remains a hotbed of IPTV development, largely thanks to the high bandwidth available to users in South Korea and Japan in particular. In the US, the RBOCs are announcing their pioneer TV service rollouts, but the law requires them to secure agreements with local authorities in each town where they want to market their service.

VoIP's development is equally heterogeneous, having become a killer app in Japan (where close to one in two broadband users subscribes to VoIP). In the US, VoIP is being promoted chiefly by cablecos which see it as an attractive growth outlet. In Europe, meanwhile, several incumbent telcos have introduced an IP telephony service in response to existing offers launched by the competition (France, Italy, The UK).

■ **Advent of the quadruple play**

Operators are now working to create quadruple play offers, adding mobile telephony to the mix.

The United States are proving the pioneers in this area, with the RBOCs being the first to roll out a quadruple play either under via their mobile subsidiary or by becoming an MVNO. The next stage is fixed-mobile broadband convergence.

BT led the way in Europe with their BT Fusion offer whereby, thanks to an MVNO agreement with Vodafone, the mobile handsets are equipped with a DSL connection interface. Other incumbent and alternative telcos have since followed suit.

In Asia, meanwhile, things are moving forward thanks to ambitious government programmes. In Japan, for instance, the u-Japan project aims to achieve fixed-mobile convergence to provide users with seamless switching from one network to the other, using any kind of device.

For now, all of these services are nevertheless more elements of differentiation and ways to cement customer loyalty than a means of increasing ARPU.

IPTV service development in the major European markets

	Subscriber base < 50,000	50,000 < subscriber base < 150,000	Subscriber base > 150,000
Germany	●		
Belgium	●		
Spain		●	
Finland	●		
France			●
Italy			●
Norway	●		
The Netherlands	●		
The UK	●		
Sweden	●		
Switzerland	●		

●operational service ○ launch planned

Source: IDATE

Telecoms in Europe

Indicators and benchmark

At a time when telecom services are undergoing a rapid transformation (spread of broadband, emergence of VoIP, triple play diffusion and fixed-mobile convergence), this report offers a detailed snapshot of the current state of telecom services markets in Europe.

European telecom services market revenues estimated 310 billion EUR in 2005, with annual growth reaching 5.9%, compared to 7.3% in 2004. Growth has dropped to 3.6% in Western Europe. Total growth for 2006 across the Continent should reach 4.5%.

The number of "traditional" landline connections shrunk by 3.8 million in 2005.

At the end of 2005, there were 90 mobile subscribers per 100 inhabitants, on average. Density has exceeded the 100% mark in 13 European countries. The 3G market is now taking off in earnest, accounting for 6% of all mobile subscribers in Western Europe.

With close to 15 broadband subscribers per 100 inhabitants at the end of 2005, Western Europe has caught up with the US, and is nearing the Japanese average. Broadband begins to spread across Eastern Europe as well.

Project manager
Sophie BISMUT
s.bismut@idate.org

Telecoms in Europe: a detailed look at the European telecommunications market

This report examines the central developments in telecom markets in 33 countries, the disparities between these national markets and the challenges at hand.
The report contains:

- Key data for each country for 2001 to 2005 (plus 2006 estimates for the key indicators): access (fixed, mobile, internet and broadband), market value (for the fixed, mobile and internet segments);
- Data on national market structure and the leading operators;
- National market rankings with respect to the chief indicators;
- Overriding trends in 2005/2006.

Slowing growth

Revenues in the telecom services market have been on the decline since 2002, as competition heats up and diffusion rates of services increase. In 2005, the market encompassing the 33 countries being examined in this report was worth an estimated 307 billion EUR – up 5.9% on the previous year, compared to 7.3% growth in 2003. In the EU-25, which accounts for 85% of the European total with 263 billion EUR in revenues, growth has dropped to 3.6% as the decline begun in 2002 continues.
The situation in each country nonetheless differs a great deal.

- Turkey, Ukraine, Russia and Romania are all reporting growth rates of over 20%. Their weight in the total still represents only 10%.
- A second group of markets continues to enjoy healthy growth rates of between 7% and 10%. These are essentially Eastern European countries while, over in Western Europe, only Greece and Spain are still reporting comparable progress. The continued high growth of mobile services turnover (+13% in Greece, +10% in Spain) is offsetting to a large extent the slight decline being felt in the landline market. Mobile services growth is also steady in Italy, Austria, Hungary and the Czech Republic, but its impact on the sector as a whole is tempered by a sharp drop in fixed telephony revenues.
- Elsewhere around Europe, declining growth is becoming increasingly pronounced, with rates falling below 3%. Landline telephony's downward spiral, which has been getting worse since 2003, is being compensated less and less by mobile services. In Germany, for instance, the mobile market is now growing by only 3%, compared to 8% in 2004. In France, growth is down to 6% versus more than 9% in 2004. These stalled growth markets are all located in Western Europe, with the notable exception of Poland, which reported a brutal drop in fixed telephony revenues in 2005, as a result of drop in tariffs.

Landline telephony's ongoing decline

Fixed telephony, which has suffered the combined effect of a drop in users, traffic and prices, now accounts for only 32% of the European telecom services market, in terms of value. Most countries are reporting a shrinking landline market, with growth rates exceeding 1.5% in only five countries: Malta, Greece, Turkey, Romania and Russia.
In 2005, the total number of access lines (including digital channels) in the whole of Europe shrunk by 3.8 million, while the year before it was still expanding by 800,000 lines. Only three countries (Russia, Ukraine, Poland) are enjoying a significant increase in landline connections. Everywhere else, even in Eastern Europe where fixed density was already low, the "classic" landline base is stagnating or shrinking, in some cases dramatically (Norway, Finland, Sweden, UK).
Fixed-mobile substitution is meaning less traffic on traditional landline networks, which are also feeling the impact of increasingly popular VoIP in a number of countries. Average traffic per line has dropped in a great many places.

3G out of the starting gate

At the end of 2005, Europe was home to 689 million mobile subscribers, or 90 subscribers per 100 inhabitants. Density had reached 102% in Western countries and 77% in Eastern Europe (87% on average in new EU Member States), and 127 million new subscribers signed on during the year. This healthy growth (+23%) is due in large part to the growing ubiquity of mobile services in emerging markets. Russia, Ukraine and Turkey combined accounted for 60% of new subscribers. But growth in developed markets too is still respectable (10% on average in Western Europe, compared to +9% in 2004), even in those countries where mobile density is at its highest. In Italy, the UK, Ireland and Greece, subscriber bases grew by another 10% in 2005, even though density exceeded 100% at the end of 2004. In Sweden and Norway, on the other hand, the market's saturation has meant a clear decline in subscriber growth – a trend which is due in part to the fact that prepaid has a much lower market share there than the 67% European average.

Following a series of network rollouts in 2004 and 2005, 3G mobile was at last out of the starting gate last year. 3G services accounted for close to half of all new subscribers, and for 6% of the total user base at the end of the year in Western Europe. Italy (15% 3G subscribers) and the UK (8%) are still the frontrunners and, with control of 40% of all of Europe's 3G subscribers, Hutchison Whampoa ("3") is the leading third generation telco. In Eastern Europe, 3G is still in its early stages, and has thus had on only muted impact on the market.

Mobile services: voice under pressure

Mobile revenues are rising very little, despite an ever-larger subscriber base. Growth in Western Europe totalled only 6.6% in 2005, compared to nearly 10% in 2004. The most marked decreases were found in Germany (+3%), in Belgium (+3%), in Switzerland (+1%) and especially in Finland and in Sweden (where net growth was negative). Voices revenues rose by an average of only 5% in Western Europe, but data revenues were up (17%). Data services now account for 15% of mobile services value. The drop in average revenues per user (ARPU) – roughly 3% growth on average in Western Europe and 15% in Eastern Europe – can be put down to two things in particular:

- Growing competitive pressure on prices in mature markets, accentuated in some cases by the arrival of a new operator (notably "3" in several countries) and/or by the emergence of virtual operators. MVNOs' presence is currently confined to northern Europe (notably Germany, the UK and, since 2005, France) but is tending to spread;
- In many countries, regulators' orders to cut fixed to mobile call termination tariffs resulted in a sharp drop in operators' revenues.

The decline in ARPU is only slightly offset by the fact that prepaid users' share of subscriber bases has stabilised.

Broadband's growing ubiquity

The data and internet services market continued to rise steadily, posting a more than 10% increase in 2005. Rising volumes in the data services segment are being partially offset by increasingly lower prices and substitution by broadband access solutions. The internet market's value, on the contrary, is up another 20%.

The number of broadband subscribers rose by 18 million in 2004 to reach 43 million by the end of the year in the 33 European countries being examined. Europe was home to an additional 23 million broadband subscribers in 2005, bringing the total base to 66 million, or an average density in Europe of 8.7% (compared to 5.7% in 2004 and 3.3% in 2002). This expansion of broadband subscriber bases is due in part to users switching from narrowband access, whose total base in Europe shrunk from 71 million at the end of 2003 to 52 million at the end of 2005.

Even through growth is high across the Continent, there are still major disparities from country to country.

- With a broadband density of 14.8%, Western Europe has caught up to the US and now nearing the Japanese average (16%). The European frontrunners here are the Netherlands (which, with a 26% density, has overtaken long-time leader South Korea), followed by the rest of Scandinavia, Denmark and Switzerland. Among the other countries in Western Europe, Ireland (7%) and especially Greece (under 2%) are at the bottom end of the spectrum.
- With the exception of Estonia (16% density) and Slovenia (11%), most Eastern European markets still have a way to go, with average broadband density totalling only 2% – although 2005 did mark the true beginning for broadband in the new EU Member States.

Broadband: little facilities-based competition & the rise of unbundling

DSL is the chief driving force behind broadband's development in Europe, accounting for close to 80% of connections, on average, at the end of 2005. It is the most-widely used access technology in all European countries, including those where cable modem long held the lead (the UK, the Netherlands, Portugal). Competition in the DSL market first developed thanks to incumbent telcos' wholesale offers, but unbundling is making major strides across Western Europe. In 2005, the base of unbundled lines doubled to reach 9 million (of which 8.5 million used for DSL). Unbundled lines represented an average 18% of DSL connections at the end of 2005, compared to 8% at the end of 2003. In terms of net increase, unbundled lines well outnumbered wholesale lines in 2005, marking a full reversal of the situation in 2004. But the state of unbundling still varies a great deal from country to country: now accounting for roughly 30% of the DSL base in France, Norway, Sweden and the Netherlands, but for less than 5% in the UK (where it is nonetheless rising significantly), Ireland and Belgium.

In emerging broadband markets too (chiefly Eastern Europe) DSL is the leading access technology. With bitstream access offers being little developed, and unbundling even less so, incumbent carriers still enjoy massive dominance in these markets. But cable does constitute a potentially serious rival, as do new wireless access technologies, and WiMAX in particular.

Market consolidation

With competition increasing and growth on the decline, even in the mobile market, operators are working to beef up their positions in their existing markets and, in some cases, to expand into new markets and segments. As a result, we have witnessed a series of mergers and acquisitions since the start of 2006: the merger of alternative carriers operating in the same market (e.g. NTL/Telewest in the UK, neuf telecom and Cegetel in France); operator takeovers in view of an integrated strategy (France Telecom's takeover of Amena) along with expansion strategies (Telefónica's acquisition of Cesky Telecom and O_2).

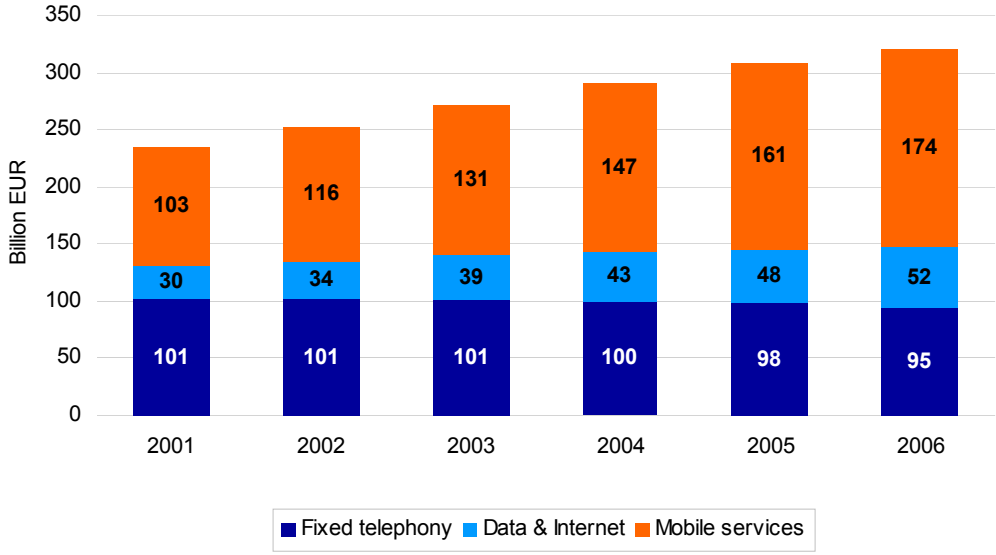
European telcos' growth strategies are increasingly emblematic of the need to develop convergent fixed-mobile services. They are positioning themselves with triple and even quadruple play bundles, combining landline calling, mobile services, broadband access services and TV. They are entering the television market by offering TV over ADSL services, but having an only marginal impact so far: accounting for 3 million subscribers at the end of 2005 in Western Europe out of a total 153 million TV households (of which 48 million cable TV subscribers and 44 million satellite TV subscribers).

With the exception of Vodafone, Europe's number three telco in terms of revenues, the top-ranking spots are still held by incumbent carriers. But rankings have been shaken up to a degree by telcos' increasing internationalisation. While the incumbents in Germany, France and Spain generate over a third of their turnover outside their domestic market, their counterparts in the UK and Italy continue to focus above all on business at home, with foreign revenues accounting for less than 15% of their turnover.

Trends in 2006

The trends that marked the first half of 2006 have confirmed that growth in European telecom markets continues to slow, with forecasts pointing to a roughly 4.5% increase for the year. Landline telephony is expected to drop even further in value, feeling the increasing impact of VoIP, while mobile and internet services will likely continue as the prime growth drivers. As increasing competition and decreases in fixed to mobile call termination tariffs will continue to weigh on mobile operators' in Western Europe, growth on the Continent as a whole will depend a great deal on the progress made in Eastern Europe.

Growth of telecom services markets in Europe by segment, 2001-2006



Data for 2006 are estimates.
Source: IDATE

Europe's telecom services market: Key data for 2005

Country/zone	Population	Density (1)			Market value (2)		
	Million	Fixed	Mobile	Broadband	Billion EUR	Growth 2005	Growth 2006
Western Europe							
Germany	82	66%	96%	13%	53	2.1%	0.5%
Spain	40	49%	107%	13%	23	10.5%	5.6%
France	61	55%	77%	16%	35	3.4%	2.4%
Italy	58	45%	123%	12%	34	5.1%	3.5%
Netherlands	16	58%	99%	26%	13	2.7%	2.0%
UK	60	54%	113%	16%	41	2.4%	2.5%
Other countries	77	55%	103%	15%	56	2.8%	3.0%
Total Western Europe	**396**	**55%**	**102%**	**15%**	**255**	**3.6%**	**2.6%**
Eastern Europe							
Poland	39	33%	76%	4%	8	2.0%	5.1%
Russia	143	28%	87%	1%	13	22.8%	18.5%
Turkey	70	27%	62%	2%	11	43.7%	20.0%
Ukraine	47	27%	64%	0%	4	31.6%	27.3%
Other countries	69	28%	83%	4%	17	9.5%	7.6%
Total Eastern Europe	**368**	**28%**	**77%**	**2%**	**52**	**18.6%**	**13.9%**
Total European Union	**457**	**51%**	**100%**	**13%**	**263**	**3.8%**	**2.8%**
Total Europe	**763**	**42%**	**90%**	**9%**	**307**	**5.9%**	**4.5%**

(1) Number of subscribers/lines per 100 inhabitants at end 2005.
(2) Revenues for 2005 are consolidated.
Data for 2006 are estimates.
Source: IDATE

Unbundling in Europe

Trends, strategies & impact

Over 9 million unbundled lines in Western Europe at the end of 2005, of which two-thirds in France and Germany alone. 18% of all DSL are unbundled lines.

An option increasingly used by alternative operators for delivering internet services, and which is fuelling the rise of VoIP.

Widely disparate rates of development in the various national markets.

23 million unbundled lines expected by the end of 2010 (27% of DSL lines).

Over the past few years, a radical change has come about in the role of the copper local loop that connects subscribers to their operator's local exchange. No longer used solely for telephony, it now also allows subscribers to access internet, TV, IP telephony and video on demand services, all over the same phone line.
Falling into step with European Union regulations, the majority of EU member countries began implementing local loop unbundling in 2000-2001. By requiring incumbent telcos to make their local phone loop available to third-parties, and at cost-oriented prices, the goal was to allow competition to emerge in the calling market, and later in the DSL access market. It was indeed recognised that there was little facilities-based competition (cable, FTTx, wireless) in the broadband market, and that it was economically impossible for new entrants to replicate the phone line ("essential facility" notion).
By turning to unbundling for serving their own customers, alternative operators can gain full control of the network that connects them to their client base, and so differentiate their services from those offered by the incumbent carrier. This marks a major break from ISPs simply reselling the incumbents DSL offers, or marketing bitstream offers. But unbundling also requires a greater investment from these operators, since they have to install their own equipment in the exchanges, and so forces the drive for critical mass.

Unbundling on the rise in Europe since mid-2004

After a rather sluggish start, unbundling's rate of progress has been picking up steam since mid-2004. The net rate of increase in the number of unbundled lines in all Western European countries combined has gone from fewer than 800,000 lines in the first half of 2004 to more than 2 million in subsequent 6-month periods. The unbundled line base doubled in 2005, stepping over the 9 million mark (of which a fraction are used solely for voice services). This solid take-off can also be measured in the percentage of unbundled lines in the PSTN base, rising from 1% at the end of 2003 to 6% at the end of 2005.

Alternative operators are turning more and more to unbundling for supplying internet services, and turning away from the incumbent's wholesale offers (bitstream and simple resale). Unbundled lines accounted for an average 18% of DSL connections at the end of 2005, compared to 8% at the end of 2003. The net increase in unbundled lines in fact outweighed that of wholesale lines in 2005 (4.4 million new unbundled lines compared to 2.7 million lines wholesale), marking a stunning reversal from 2004 (2.7 million new unbundled lines compared to 3.4 million new wholesale lines).
Several factors have contributed to this growing unbundling trend: decrease in rental and connection tariffs, improved procedures following regulator intervention, drop in the price of equipment, alternative operator's expansion.

Disparate rates of development across countries

The development of unbundling is nonetheless progressing at a very different pace in the various national markets. The base of unbundled DSL has surged in France, Germany, Scandinavia and in the Netherlands. France, which is home to Europe's largest DSL base (2.8 million lines), has made a substantial contribution to unbundling's expansion. Between mid-2004 and mid-2005, France reported an increase of more than 2 million new unbundled lines, accounting for 43% of the net increase in Europe as a whole.
In a number of other countries (the UK, Portugal, Belgium) unbundling has, on the contrary, remained a muted phenomenon, and is not yet even a reality in Switzerland where unbundling obligations have remained at the project stage. Austria, Denmark, Italy and Spain are at an intermediate stage, with unbundled lines representing from 10% to 15% of the DSL base.

Project Manager
Sophie BISMUT
s.bismut@idate.org

National markets also differ in the percentage of lines that are fully unbundled (equal or close to 100% in Germany and in Austria, for instance) and those which are only partially unbundled – i.e. shared access lines (close to or over 80% in France, Sweden, Spain and the Netherlands).
These differences are symptomatic of each market's particular features:

- Existence or not of bitstream offers (non-existent in Germany until 2004, for instance);
- Existence or not of solid competition from alternative technologies (chiefly cable): a healthy cable market in the UK and in Scandinavia (including FTTx providers in Sweden);
- Full and partial unbundling tariffs: in Italy, which is home to the lowest full unbundling tariffs in Europe, most operators opted for full unbundling. In the Netherlands, where the situation is reversed (lowest shared access tariffs in Europe), only 12% of unbundled lines are fully unbundled.
- Structure of unbundling and wholesale offer tariffs: up until 2005 unbundling tariffs were much higher than wholesale tariffs in Sweden and the UK;
- Evolution of collocation conditions;
- Telephone network structure (size of the exchanges), either enabling or hindering DSL technology deployment.

Regulator intervention

As part of their responsibility to analyse and monitor their markets, national regulatory authorities (NRA) have played an important role in laying down the terms of unbundling's implementation, through a variety of actions:

- By imposing a significant decrease in tariffs (notably in the Netherlands, in Germany and in the UK);
- By intervening on the technical side (delivery times, collocation terms).
- By regulating the tariff structures of the different intermediate market offers, to prevent price squeezes.

Up until now, application of the 2002 directives has not led to any deep-seated change in Europe's unbundling regulations. Pursuant to the directives, NRAs can impose obligations to remedy an SMP situation. The 14 NRAs which notified their analysis of the unbundled access market in February 2006, had all imposed price control and cost-oriented pricing obligations.

Operator strategies

Since 2004, unbundling has become one of the prime strategic growth paths for internet service providers (ISP) in Europe's broadband market. The development of traffic collection infrastructures, and the drop in tariffs have boosted the appeal of business models based on unbundling substantially.
These various changes have spurred the spread of DSL access and strengthened the technology's lead over its rivals (cable modem, FTTx). The economic incentive which has driven a host of European operators to invest in unbundling can also be seen as the result of several considerations:

- The economic limitations of fibre-based deployments: B2 in Sweden and FastWeb in Italy, which had initially based their growth strategies in the broadband market by deploying fibre optic networks, later switched their focus to unbundling as a more cost-effective means of expanding their footprint.
- Growing competition between offers: Tele2, which entered the market as a reseller, has nonetheless managed to expand its subscriber base. But it has faced increasing pressure from competing operators marketing enhanced broadband offers (notably triple play bundles). Its recent takeover of a series of operators which had invested in unbundling (Tiscali Denmark, Versatel in Belgium, UTA in Austria) is a clear indication of the operator's new strategy. AOL, with its investments in unbundling in France and in the UK in 2006, provides a further example.
- The markets' reorganisation. In France, the merger of Neuf Telecom and Cegetel radically altered the shape of the wholesale market. Virtually all of the country's ISPs (AOL, Club Internet, Tele2) which had been relying on the two operators' wholesale DSL offers saw their options reduced to Neuf Cegetel and France Telecom. As a result, they have since begun announcing investments to migrate to unbundling and its more attractive business model.

Unbundling's impact on competition

Unbundling has fuelled the rise of competition in the broadband market, with real benefits for consumers in terms of prices and services, particularly in those countries where competition from alternative technologies (chiefly cable) is weak or non-existent.
France is a prime example here, with 94% of broadband connections based on DSL. Competition in the country heated up as wholesale offers developed, and even more so with the growing use of unbundling. As a result, the incumbent's share of the broadband retail market dropped from 70% in 2002 to 47%. Unbundling also allowed alternative operators (beginning with neuf cegetel and Free/Iliad, which are Europe's first unbundlers) to begin innovating with bitrates and services, including IPTV and VoIP.
As a driving force behind competition,

unbundling has been one – though not the only – contributing factor to the European broadband market's growth. The number of broadband subscribers in Europe has indeed climbed from 24 million (6% of population) at the end of 2003 to 59 million (15% of the population) at the end of 2005 – progress so substantial that the Europe has now closed the growth gap with the US.

In the telephony market, on the other hand, unbundling's impact has been much more muted until recently. Incumbent telcos still enjoy clear dominance in the access market, and competition in the calling market still goes largely by way of preselection. Unbundling's business model proved ill-suited to the telephony market, carrying costs that were too high compared to the expected return. But, now with the emergence of VoIP offers, unbundling is also creating competition in the voice market, as demonstrated by the French case.

While the development of unbundling has a very beneficial effect on offers and tariffs, for economic reasons it can also drive some ISPs to ignore areas where unbundling cannot be implemented. The result is the creation of yet another divide between non-unbundled zones and unbundled zones where users have more alternatives than just the incumbent's ISP. Alternative operators are therefore concentrating their investments in urban zones and, in other areas, depending on subsidies from local authorities.

The unbundling debates

A great many debates have been taking place over the long-term benefits of unbundling, and particularly over the disincentives to invest that unbundling regulations may prove to be. One major concern in recent months has been the likelihood that unbundling may quash the leading telcos' incentive to invest in upgrading their access network.

There have been very few optical network deployments in Europe up to now. A handful of incumbent carriers have nonetheless begun announcing plans: Deutsche Telekom which has said that its plans to invest in a VDSL network (combining fibre optic to the curb and VDSL on the copper sub-loop to the subscriber) are contingent on it having exclusive access to the network. The European Commission refused the request, citing application of the regulatory framework that requires access to be provided, even for partial use of the copper loop.

Negotiations are nonetheless still possible over the tariffs that DT can set for access to the network, which will not necessarily be cost-oriented, and could factor in the financial risks being shouldered by the operator. France Telecom too has announced a new infrastructure deployment project, but only on a limited number of sites, and on a purely experimental basis.

In late 2005, debates began around Europe following the European Commission's launch of the review process for evaluating application of the 2002 directives, and for making any eventual changes. These discussions could well lead to modification of the rules governing Europe's broadband market, and unbundling's role in particular (whether or not to uphold copper loop unbundling obligations, application of these obligations to new infrastructures, encouraging facilities-based competition).

The outlook for unbundling

The way that Europe's broadband market, and unbundling in particular, develops over the next few years will likely be affected by the following, interconnected factors:

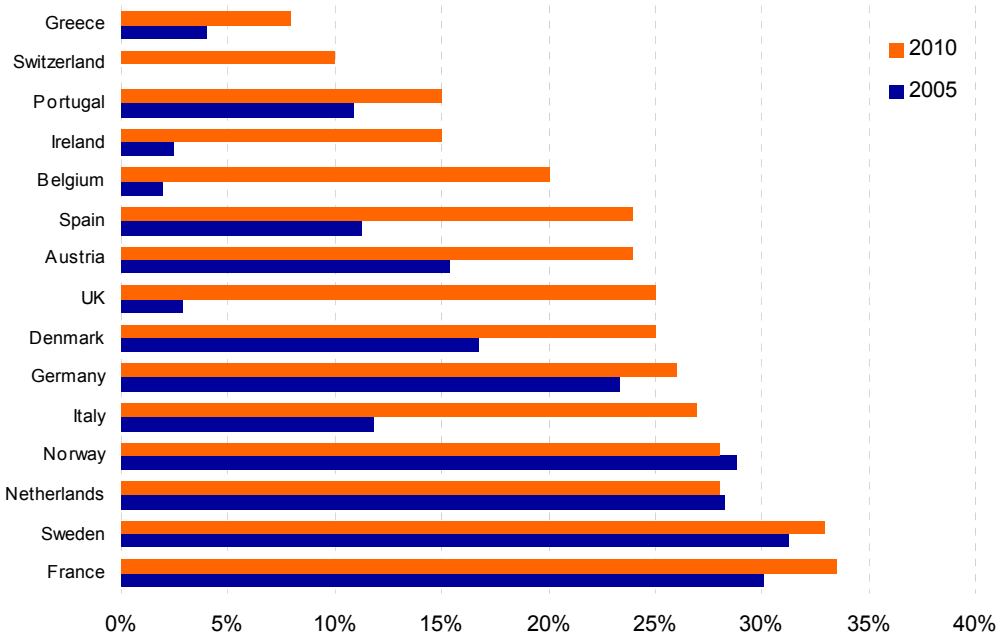
- Degree of broadband take-up and market saturation
- Growth of competition from alternative infrastructures (cable, fibre)
- Network structure, notably the size of the exchanges
- Development of naked DSL offers
- Changes in unbundling and in bitstream offer tariffs, particularly as a result of regulatory decisions
- Market concentration and alternative operators' capacity to invest in infrastructures.

The outstanding trends up to 2010 will be:

- A broadband market likely in excess of 110 million subscribers in the 16 countries being examined, for an average density of 28%.
- Triple the number of unbundled DSL, reaching 23 million (27% of DSL).
- High growth of unbundling in the UK, Italy and Spain where a number of operators are currently investing in unbundling; in France, vast migration from shared access to full unbundling.
- In the Netherlands and in Norway: less spectacular growth for unbundling (which is already well-developed) due to the increasing use of naked DSL offers.

Unbundled lines as % of DSL base in 2005 & forecasts up to 2010

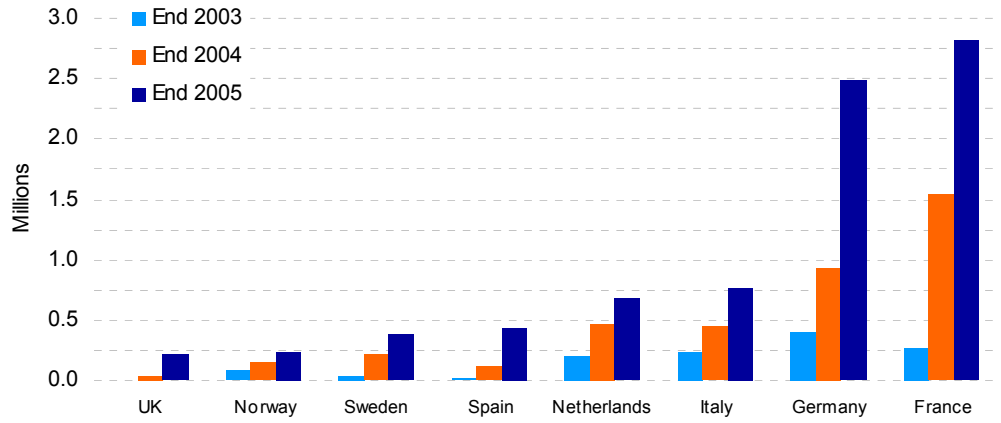
Total unbundled lines as % of DS lines



Source: IDATE

Europe's unbundled lines by country, 2003-2005

Total unbundled lines (fully unbundled and shared access) –
Does not include unbundled lines used for voice only



Source: Operators and NRA, partly estimated figures for 2005

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Understanding the Digital World

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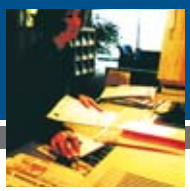
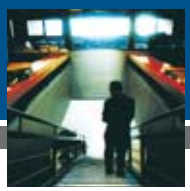


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Contact : Marshall Shrago - tel : +33 (0) 467 144 488 - email : m.shrago@idate.org

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Online :
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Contacts :

Marshall Shrago
English
Tel: +33 467 144 488
m.shrago@idate.org

Isabel Jiménez
Spanish
Tel: +33 467 144 404
i.jimenez@idate.org

Sophie Monjo
German
Tel: +33 467 144 456
s.monjo@idate.org

IDATE
Consulting & Research

www.idate.org

BP 4167 - 34092 Montpellier Cedex 5
Tel : +33(0)467 144 444 - Fax : +33(0)467 144 400 - info@idate.org