Western European Broadband Markets
Operator-owned infrastructure key for success
The European broadband markets have seen a tremendous development over the past few years. The competition between Cable, DSL and even Fiber players has spurred strong growth and attractive margins. As the markets mature, the conditions are changing: continuing price decline, high subscriber acquisition costs and increasing churn put a strong pressure on margins and payback times. New questions arise: Who will drive the future broadband penetration, which broadband access models are future-proof, and who will be able to earn money with them.

This study tries to give some answers as it looks at the key drivers of broadband penetration, compares the economies of the key broadband access models (DSL incumbents and alternative DSL providers, Cable and FTTH) and, using this as a basis for discourse, evaluates the broadband market situation in all Western European markets.

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EXECUTIVE SUMMARY

In this study 15 Western European countries are assessed with regard to the situation of their broadband markets and the importance and profitability of various broadband access forms.

Key market findings

■ Today, 11 of 15 Western European markets have broadband penetrations of >50%
■ However, in 2008, a decline in new customer additions can be observed
■ Infrastructure-based competition is one of the core drivers of broadband penetration
■ Business model economics vary largely among the broadband access models: High margins require infrastructure investments. DSL Resale no longer economically viable
■ Despite increasing broadband speeds and extension of services, in many Western European countries “double play” prices have fallen below €30
■ In 8 of 15 Western European countries payback periods exceed 24 months
■ Deteriorating economics is fueling industry consolidation. Industry end game scenario forecasts not more than 3-4 remaining players per market

Implications

■ In times of heavy competition, it is key to offer superior service experience, master the broadband delivery process (frictionless delivery) and offer adequate customer service
■ Broadband providers should try to stabilize ARPU’s by expanding double play offers with IPTV/VoD, mobile or adjacent services such as hosting, web-mail
■ DSL incumbents have to successfully migrate their legacy networks to high speed next generation networks which would allow them to defend their shrinking customer bases
■ Alternative DSL providers have to find the right strategy and balance between Opex and Capex when climbing up the “ladder of investment” (from DSL Resale via LLU to FTTH)
■ Cable operators have to invest in EuroDocsis 3.0 technology in order to keep up their speed advantage over DSL/VDSL
■ FTTH carriers have to find cost-efficient ways to roll-out fiber networks, ideally using existing ducts or taking advantage of new builds activities
■ Private equity investors should try to increase scale of their existing assets by further driving industry consolidation
■ Regulators will have to develop appropriate ways to encourage next generation network investments (e.g. VDSL), while at the same time fostering competition (e.g. open access)

Structure of this study

In the first chapter the development of Western European broadband markets and the role of various broadband access models are assessed. This is followed by an in depth look at the business economics of the individual broadband access models and a comparison of LLU (Local Loop Unbundling) payback times across Western Europe. At the end of the study detailed background information on each of the analyzed broadband markets is given.
Western European BB market penetration

Spurred by strong price decreases, the emergence of attractive bundle offers and the increasing demand for higher bandwidth (e.g. popularity of YouTube, IPTV), Western European broadband markets experienced large growth in the last years. Overall, Western European broadband penetration reached roughly 55% in 2007, and only a few countries remain with penetration levels of below 50% (namely Italy, Greece, Austria and Portugal).

Countries already leading the European bandwidth wagon in 2005 (the Netherlands, Switzerland and Denmark) continued their double-digit penetration increase and passed the 70% mark in 2007. However, countries lagging behind in the past (e.g. Germany and Spain) also made significant progress and achieved penetration rates of more than 50%.

Looking at the reasons for the varying speeds in broadband uptake, one can realize that besides technological savvy (e.g. Scandinavian countries) and high GDP per capita (e.g. Switzerland) the existence of a strong infrastructure competition has especially played a major role. Thus, many markets with strong competition from Cable (e.g. the Netherlands, Belgium) and/or LAN (e.g. Denmark, Sweden) achieved high broadband penetration rates very early. In markets dominated by DSL it was not until an extensive roll-out of LLU that the broadband market moved ahead (e.g. France, Germany).

Given the already relatively high Broadband penetration, we expect that in the next years broadband growth will slow down in many Western European countries. Looking at the largest European broadband markets, this trend has already materialized in the first half of 2008. For instance the UK’s net adds have fallen from ~1.3m in H1/07 to ~0.9m in H1/08, France’s from ~1.0m to ~0.7m and the Netherlands from ~0.3m to ~0.2m. Also Germany’s net adds have also slightly fallen from ~2.2m to ~2.0m, yet in light of its still relatively low
penetration and the recent success of Cable broadband (increase of 0.2m net adds compared to H1/07) we expect more momentum for Germany than for the UK or France.

In a market environment with shrinking net adds, only those companies will be successful in the long run that manage to offer a superior service experience (e.g. high data speeds, frictionless delivery, value-added services) at competitive prices. Besides mastery of the broadband delivery process, adequate customer service and scale, in particular the chosen broadband access model will play a key role for the success of tomorrow’s leading broadband companies.
Broadband access models

This study will focus on Western Europe’s leading broadband access technologies, namely DSL, Cable and upcoming FTTH or LAN (Sweden, Denmark). We believe that these three technologies will continue to dominate as the leading primary forms of broadband access in Western Europe.

While fixed broadband access technologies will remain the dominating primary access for households, we expect that mobile broadband will see tremendous uptake mainly as a second form of access. For instance, mobile broadband take up is already significant in Sweden, Austria or Portugal. Yet also in Germany, the latest market data indicate that mobile Internet usage is strongly increasing and today exceeds already 10m users.

Depending on the technology deployed, considerable investments of various magnitudes are needed for entering the broadband market. While Cable and FTTH demand for significant infrastructure investments in the local access network, DSL Resale players can enter the broadband market with almost no own network equipment.

DSL – Incumbent

The term incumbent is used for formerly state-owned telecommunication providers who for a long time operated as regulated monopolies. After having offered only narrowband Internet access for some years, Western European incumbents invested in the late 90ies into DSL technologies and began to offer DSL (e.g. Deutsche Telekom started to offer T-DSL in 58 larger local networks in ’99). In light of the ongoing deregulation efforts at that time, most incumbents where not only forced to allow alternative providers to sell volume-based “ISP-contracts” but also give them access to their networks (e.g. access to PoPs and/or local exchanges). Today, incumbents throughout Europe invest into next generation IP networks. By moving their local exchanges closer to customers (i.e. VDSL investments), incumbents try to differentiate by offering higher speeds and IPTV service. As incumbents try to protect their investments and are often not willing to open their new networks to alternative carriers, Western European regulators face a challenging task.

DSL – National Resale offer

The National Resale offer represents ERG’s (European Regulator Group) option 4 in the framework of defining Bitstream. It marks the borderline between Bitstream and simple Resale. From a technical point of view the National Resale offer cannot be considered as Bitstream, as the alternative carriers can not change the technical parameters of the products in such a way that they differ from the incumbent’s products. The ISP buys only the incumbent’s end-to-end link and markets it under its own name and with its own billing, without actually controlling any technical parameter.

From an economic perspective National Resale is relatively similar to Bitstream and will therefore not be considered separately in the next chapters.

DSL – Bitstream

In the case of Bitstream, the incumbent installs an ADSL link to the customer and makes this link available to alternative carriers to enable them to provide broadband services to
customers. As the incumbent operates the DSLAM, the alternative carrier has no possibility to technically alter the ADSL access link.

Besides the access link, the incumbent provides also transmission (backhaul) services to carry traffic to a higher level in the network where the alternative carrier may have a point of presence. The alternative carrier then has the possibility to differentiate its services by altering technical characteristics and/or use its own network.

The ERG proposed four different access options for Bitstream. Among these, ATM and IP Bitstream are the most commonly used options in Europe. While ATM Bitstream with hand-over at regional ATM-PoPs allows for a relatively high degree of service differentiation (e.g. different overbooking in ATM backbone, BRAS configuration), IP Bitstream with hand-over at either regional or national IP-PoPs enables only some retail product differentiation through own choice of national backhaul or Internet connectivity provider.

In some EU countries (e.g. France, Italy) carriers can also pay a higher Bitstream fee and offer their customers naked DSL, allowing them to cancel their incumbent voice line.

**DSL – Local Loop Unbundling**

Local loop unbundling is the term used for alternative carriers connecting their own networks to the incumbent’s local loops. In doing so, alternative carriers collocate their access infrastructure equipment (i.e. DSLAMs) inside the incumbent’s local exchange buildings and take over (unbundle) the incumbent’s local loop wires which are terminated on a MDF (Main Distribution Frame). While LLU city carriers (e.g. Versatel in Germany) connect the local exchanges via their own city rings to regional rings or backbone, national carriers (e.g. Arcor in Germany) often have to rent city networks from the incumbent or city carriers in order to connect the local exchanges to their network. Within the local exchange, regulation typically foresees two basic types of unbundled lines:

- **Full unbundling:** In case of full local loop unbundling the alternative carrier takes complete control of the last mile from the incumbent (he is the only one connected to the loop). In consequence, the customer does not need a voice subscription with the incumbent any more, but gets voice services solely from the alternative carrier, either in the form of VoIP or TDM.

- **Shared access:** The alternative carrier only controls the high frequency part of the last mile, while the incumbent continues to operate the low frequency part and provides traditional switched voice services to the user. Typically, the incumbent also loses the voice traffic, as the alternative carrier tries to migrate the customer to (high frequency) VoIP. In some EU countries (e.g. Denmark, Belgium) carriers can also pay a higher shared access fee and offer their customers “naked DSL”, allowing them to cancel their incumbent voice line.

In both cases the alternative carrier deploys its own DSLAMs in the local exchange building and has full control over the technical characteristics of the offered broadband service.

**FTTH**

FTTH is a form of fiber-optic broadband delivery in which a fiber line is run directly to the subscriber’s home. It differs from other forms of fiber deployment such as FTTN (Fiber To The Node), which depend on more traditional methods for last-mile delivery such as copper...
or coax. In particular, extensive bandwidth advantages and the lapse of the monthly line rental charges justify FTTH roll-outs in urban areas, despite heavy infrastructure investments.

Cable

Cable operators can use the existing CATV infrastructure to offer broadband. Consequently, Cable operators have direct access to their customers and do not have to rent the local loop. Depending on their topology and network equipment used, Cable systems have a huge capacity. Technically, most Western European Cable providers can currently offer speeds of up to 50 Mbps. By upgrading to the new EuroDocsis 3.0 standard the offered speeds could theoretically increase beyond 200 Mbps. Yet in contrast to DSL, bandwidth has to be shared between users within a neighborhood. Its availability depends largely on the CATV footprint within a country and the two-way readiness of the network. Although most Cable operators have (recently) upgraded their networks, new build activities are rather limited.

Ladder of investment: From Resale via LLU to FTTH

In many Western European countries quite a few players have entered the broadband market starting with less capital-intense National Resale or Bitstream offers and invested into own LLU infrastructure once they have attracted a sizeable customer base. Some operators (e.g. Neuf and Free in France) are now going even a step further and investing into their own local access infrastructure (FTTH) and thus climb the ultimate step on the “ladder of investment”.

### Ladder of investment

**Schematic overview**

![Ladder of investment diagram](image)

- **Cable**
  - Own infrastructure*
- **FTTH**
  - Own infrastructure*
- **DSL**
  - LLU, Own infrastructure*
  - Bitstream, Own infrastructure*
  - National resale offer, Own infrastructure*
- **DSL (incumbent)**
  - Own infrastructure

* Either own infrastructure or infrastructure which can be rented from someone else as incumbent

Source: Solon
Clear trend to infrastructure-based competition in WE

In general, Western Europe can be segmented into countries with a relatively high share of non-DSL infrastructure-based access models (multi-platform focus) and countries where DSL is the predominant form of access (DSL focus).

<table>
<thead>
<tr>
<th>Country</th>
<th>FTTH &amp; Other</th>
<th>Cable</th>
<th>LLU</th>
<th>Resale/Bitstream</th>
<th>Incumbent DSL</th>
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| Market share of DSL varies largely in Western Europe

Countries with multi-platform focus: Providers climbed “ladder of investment” early

Early and relatively widespread availability of broadband Cable has allowed Cable to become a serious competitor of DSL. In some countries (e.g. Denmark and Sweden) the early roll-out of fiber LAN and FTTH technologies has led to the emergence of another challenging infrastructure.

In many countries (e.g. Austria, Netherlands) Cable was for some years the leading broadband technology. Yet, due to Cable’s lower coverage and increasing number of DSL players, it has lost its leading position to DSL.

With regard to DSL, countries with multi-platform focus are in general characterized by a relatively low share of Resale/Bitstream. In light of the relatively high competition from infrastructure-based players, new DSL entrants often opted for an unbundling approach. Besides a higher control of product characteristics and quality, the decision for a LLU model was also impacted by better business economics of LLU vs. Resale/Bitstream.

The only two countries in Western Europe where, despite high multi-platform competition, Resale/Bitstream could gain significant market share are Belgium and Switzerland. In both countries this is a result of highly ineffective regulation of LLU. Yet, as regulators have recently improved LLU conditions, a migration of customers from Resale/Bitstream to LLU is expected to set in soon.
Countries with DSL focus: DSL Resale was very popular for a long time

In countries where Cable coverage is rare (e.g. Greece, Italy) or where Cable has only recently been upgraded for broadband services (e.g. Germany), DSL had always been the dominant broadband access technology.

Despite the lack of significant competition from Cable or other broadband infrastructures, not all incumbents managed to maintain above-average market shares. In particular BT, France Télécom and Deutsche Telekom have lost significant market share to alternative DSL providers.

In the beginning, Resale/Bitstream was the preferred access model for many DSL entrants. Thus in 2005, 96% of the UK’s alternative DSL provider customers were connected via Resale. A similar picture was also seen in France or in Germany, where customers initially did not even get a typical Resale product but had to buy Deutsche Telekom’s T-DSL via the resellers.

This has dramatically changed in the last few years, as in almost every country a number of LLU providers has emerged. Starting in highly populated areas, alternative DSL infrastructure providers have continuously expanded their coverage area (e.g. Free in France, Arcor in Germany). In addition, LLU is further pushed by many former resellers now investing into their own infrastructure (e.g. Tiscali and Orange in UK) or cooperating with LLU wholesalers (e.g. United Internet, Alice with QSC / Telefónica in Germany). Those companies are not only connecting new customers via LLU but are also actively trying to migrate their Resale/Bitstream customers to LLU offers.

Thus, we expect that Resale/Bitstream will also become marginal soon also in countries with DSL focus and only be used by LLU providers in less populated areas where they do not have their own access infrastructure.
ECONOMICS OF BROADBAND ACCESS MODELS

Economic drivers of broadband access models

Besides the existence of alternative broadband infrastructures and regulatory pressure, the business economics especially play an important role in the development of the various broadband access models. Generally, there is a huge trade-off between network investment and gross margin. For instance, FTTH deployments demand extensive capital resources, yet provide much higher margins than DSL Bitstream. Thus, coming from the “ladder of investment” concept, alternative carriers might use DSL Bitstream to grow subscriber size rapidly and only start to invest into own infrastructure once they have reached significant scale.

With regard to the various DSL models the regulator largely determines their economic attractiveness. Thus, fostered by low access prices for LLU, infrastructure investments in some countries took up early.

Revenues: Continued price pressure across all infrastructures and speeds

In some European countries retail prices for broadband double play offers including unlimited national calls and Internet usage have fallen below €30 incl. VAT. Many European providers currently try to offset some of the price decline through offering higher priced, high bandwidth bundles (e.g. 16 Mbps offers). Yet, on the one hand bandwidth of 16 Mbps and beyond are only necessary for watching multiple SD TV or HD TV streams, a usage scenario which is still rather rare in Western Europe. On the other hand, operators already use “higher speeds for the same price” to differentiate from competition (e.g. French provider Free currently already with same price for FTTH as for DSL). However, it appears to be questionable that in the future a large portion of subscribers will be willing to pay premium prices for higher speeds.

Bandwidth capabilities of the various broadband infrastructures

Exemplary

Medium-term, high-bandwidth applications will certainly become more popular, and we expect that FTTh providers will use their high bandwidth capacities to upsell premium SD/HD
TV or VoD and generate additional content revenue. Overall, we assume that an equal
double play price will level out for the various infrastructure-based broadband offers and that
high bandwidth is used to stimulate some content upselling.

Resale offers rate on average about €5 below the infrastructure-based offers, as they do not
include line rental and customers still have to subscribe to the incumbent’s retail offer.

In addition to the fixed basic monthly fee, broadband providers increase their revenues
through various monthly variable fees. Most prominently are variable telephony usage fees.
Assuming an average of 50 minutes of calls to mobile and international destinations and an
average retail price of €0.20 per minutes, broadband providers can add another €10 incl.
VAT to the customer’s monthly bill. Although not considered in this economic analysis,
extensions of double play offers such as IPTV, mobile and cross-selling of adjacent web
services like web & mail security or hosting can further stimulate revenues.

**COGS especially low for FTTH and Cable**

While monthly double play revenues for the various broadband access models are very
similar, underlying costs differ largely. Cable and FTTH have the lowest COGS, as they
benefit from running their own infrastructure into customers’ premises and thus do not have
to pay last mile access or Bitstream fees to the incumbent. Taking into account backbone, IP
traffic and telephony interconnection cost, Cable and FTTH providers’ monthly COGS reach
roughly €11-12 per user.

This is significantly below the cost of an LLU provider, whose COGS range in between €19-
28 depending on the regulated last-mile access fee (€7.8 -15.8 in Western Europe) and the
availability of own city rings connecting the local exchanges (in case of rent additional COGS
of up to €2).

Out of all broadband access models resellers have the weakest cost position as they rely
mostly on the incumbent’s infrastructure, for which they pay large parts of their revenues.
Fees paid to the incumbent are often on a retail-minus basis and allow for gross margins of
only 15-25%.

**Capex highest for FTTH followed by Cable**

Having most favorable gross margins, does not come without a price. All infrastructure-
based broadband access models require significant infrastructure investments which are
likely to burden financials in the initial years.

Whereas LLU network investments reach about €200-300 per user (mainly for local
exchange infrastructure, CPE and installation) adding another Cable user costs about €300-
400 per user. Higher Cable investments are a result of additional upgrade needs at the
customer premises, where two-way ready active components and multi-media sockets have
to be installed and often also the in-house wiring has to be exchanged.

In the case of FTTH a complete new last-mile infrastructure has to be rolled-out. FTTH
investments are therefore the most expensive and will only be economically viable in dense
areas. Investments in active components, fiber optic cables, in-building installation and in-
house connection already total €800-1,000 per user. Ideally, operators can use existing
ducts or take part in new home building activities. Yet, in case that addition civil work for duct
building is needed, another €1,000 or more per user might have to be added.
The size of other SACs (i.e. sales and marketing expenses) depends highly on the strategy a company is following and how aggressively it acts in the market. Marketing and commission spendings of €200-250 per gross add are quite common.

To summarize, with €800-2,250 FTTH providers have to invest the most per gross add. Cable and LLU provider follow with €500-650 and €400-550. The least investments are necessary for resellers who spend about €250-300 for CPE, marketing and commissions.
Payback comparison of broadband access models – German example

Heavy competition, intensified roll-out of LLU through several retail (e.g. Arcor, Versatel) and wholesale players (i.e. QSC, Telefónica) and cutthroat price cuts by Germany’s largest reseller (i.e. 1&1) have turned Germany into one of the cheapest markets in Europe. Together with increased marketing and sales commission spendings these price cuts have put strong pressure on margins and significantly prolonged payback periods for new customers.

While in 2006 most German DSL providers still managed to achieve positive paybacks within 24 months, this period has almost doubled. With prices of below €40 incl. VAT (including variable voice) for 6 Mbps offers, there is simply not enough margin left to cover upfront investments within the common contract period.

Cable, benefiting from its own last mile infrastructure, can still achieve a positive payback within 25 months. Yet, its gross margin per new customers (not taking into account customers who are still on higher-margin old tariffs) has dropped from roughly 65% in 2006 to 55% in 2008.

Due to relatively low upfront investments, resellers were formerly used to attain positive payback relatively quickly. Now, with gross margins for new customers having plummeted to levels of as low as 17%, it takes resellers about 45 months to cover their initial investments. Consequently, major resellers (i.e. 1&1, Freenet and AOL/Alice) began to shy away from the low-margin resale model and started to launch LLU-type offers. Therefore, they either stroked partnerships with wholesale LLU providers (e.g. QSC, Telefónica), or even invested into their own LLU infrastructure.
Despite bearing slightly lower upfront investments, LLU providers with own city-rings (e.g. Versatel) need 42 months to achieve positive payback, which is 17 months longer than Cable providers. This is due to their significantly lower gross margin per new customers (28% vs. 55%), stemming mostly from the fact that LLU providers have to give €10.50 of the monthly retail price to the incumbent for last-mile rental.

With upfront investments of at least €1,200 FTTH is the access model with the longest payback period (57 months). The payback period might easily exceed 10 years, when taking into account the fact that the FTTH roll-out might also need some digging. In exchange, once initial investments are covered, FTTH shows the same economics as Cable, with a gross margin per new customer of 55%. In addition and contrary to LLU, FTTH providers can outmatch Cable providers with regards to speed, even when the latter will have rolled out their higher speed EuroDocsis 3.0 offers.

LLU payback comparison Western Europe

Besides Germany, 7 other Western European markets (incl. UK, France, Italy) have payback periods of longer than 24 months. Thereby, it is noteworthy that a retail double-play price (incl. variable voice revenues) of slightly below €40 incl. VAT appears to be a quite common price floor. In many of these low price countries the price for the first months of subscription is even cheaper as many carriers in the pursuit of low headline prices offer significant discounts for the initial contract period (e.g. Tele 2 Austria or Alice Germany with discounts of €10 during the first 12 months).

In these highly contested markets gross margins can easily plummet to values of 30% and below. Thus, it is elementary for broadband operators to strictly contain their operational and marketing/sales expenditures. Iliad's Free is a good example here, as by keeping SACs low and organizational overhead slim, Free managed to keep its EBITDA margin as high as 37% in 2007/08. Other French operators (e.g. Alice France) are already faced with gross margins of below 30%.

Given the deteriorating economics, it is not surprising that especially in countries with high pressure on margins consolidation is ongoing. While in France Iliad has recently bought Telecom Italia’s French subsidiary Alice, Germany’s Freeenet and Tiscali UK are still for sale. Also Germany’s second largest alternative player Alice is rumored to be for sale. Overall, we believe that in the mid-term in most Western European markets no more than 3-4 alternative players will remain.
However, not everywhere in Europe is competition on price as intense as in the above mentioned countries. In particular, Scandinavian broadband providers managed to keep prices above €50 (incl. VAT) and gross margins between 40-50%. In most cases these operators do not even have to give their customers discounts on first months of contract, which further helps to achieve positive paybacks within a relatively short time. But also in countries where despite relatively high prices, initial discounts are already popular (e.g. Belgium, the Netherlands, Italy with discounts of up to €100), and payback periods are still within 24-month contract periods.
INSIGHT – DETAILED COUNTRY ANALYSIS

Austria: LLU most rapidly growing model in formerly Cable-dominated market

When Telekom Austria launched its own DSL service in November 1999, Cable operator UPC Telekabel had already been active for three years. Out of this pioneering position and its significant presence in urban areas, Cable was the main driver of Austria’s broadband market. However, due to its low footprint of only 42% and high market share in its footprint, Cable is increasingly challenged and continuously loses market share to ADSL.

Having accounted for only 11% of primary broadband lines in 2005, LLU made up for already 18% in 2007. A continuation of growth is expected after main LLU providers Tele2 and UPC, which has acquired DSL provider Inode in 2006, have invested heavily in LLU roll-out and cover now about 63% of population. Despite offering several connectivity options for xDSL bitstream (incl. naked DSL via bitstream), Resale/Bitstream could never exceed a market share of higher 10% and in future might only be used by LLU providers to reach customers outside of their coverage area.

While Wimax, after the withdrawal of Telekom Austria in 2007, appears not to be a short-term threat to the dominating broadband technologies, competition from mobile broadband is intensifying. In 2007 already more than 50% of new broadband connections were mobile (mostly used as second access). A development which is in particular fostered by relatively cheap tariffs, the availability of mobile broadband prepaid tariffs and innovative contracts such as e.g. A1’s combined ADSL/HSDPA flatrate.

Also first steps towards a fiber infrastructure are undertaken, as Wien-Energie has started to roll-out first parts of its Open-Access network under its brand Blizznet in Vienna and plans to connect by 2009 50k homes to its FTTH services via resellers.

Belgium: Belgacom and Telenet (Cable) dominating the market

Belgium’s broadband market is characterized by a strong Cable segment which accounts for 37% of primary broadband lines. The two main actors Belgacom on the DSL and Telenet on the Cable side hold more than 80% of total broadband market and behave as rational competitors, competing on speed rather than price.

While Bitstream always had a relatively high share in Belgium’s DSL market, LLU never materialized. Main problem was certainly a relatively ineffective regulation, which, for example, has led to an average LLU waiting time of 12 weeks. Yet, the EU Commission has recently asked Belgian regulator IBPT to make regulation more effective. Besides close following of Belgacom with regard to unbundling processes, IBPT will also oblige Belgacom to give competitors access (Bitstream and LLU) to its newly rolled-out VDSL infrastructure.

Favored by an improved LLU regulation, the three main alternative DSL providers (Scarlet, Tele2, Movistar) are expected to take some share from Belgacom and move some of their subscribers from Bitstream to LLU access.
**Denmark: Infrastructure competition pushed penetration above 75%**

Excellent availability of DSL (99%), Cable (57%), Fixed Wireless Access (97%) and fiber (11%) have made Denmark to one of the world's highest penetrated broadband markets. Competition is almost fully infrastructure-based and market share of DSL (59%), Cable (33%) and other broadband infrastructures (9%) are relatively stable.

Continuing investments of power companies (e.g. ComX, Dong Energy) into fiber broadband and increasing popularity of Wimax in less densely populated areas is further spurring infrastructure competition.

Within DSL, incumbent TDC has a relatively high market share and managed to maintain comparatively high price levels through increasing speeds and launching IPTV offers relatively early. Competition from alternative DSL carriers, which so far mainly use LLU, remained rather low, yet could take up now after Telenor’s acquisition of Cybercity in 2005 and Tele2 in 2007.

**Finland: 40 regional incumbents in the DSL-dominated market**

DSL dominates the Finnish broadband market, but Cable is present in urban areas. LAN has gained some importance, as in other Scandinavian countries.

Finland’s DSL market is unique in Europe as it is fragmented with 40 regional incumbents. The largest operators are TeliaSonera, Elisa and Finnet which operates more than 30 locally operating telephony companies. As those regional incumbents also use LLU in other areas, LLU gained some importance. Yet, due to higher margins in the local home market, local incumbents still consider retaining market share in their core regions as their key strategy. Bistream never took up significantly.

With regard to new technologies we expect that Finland will have the world’s first national Wimax network in 2009. Concerning FTTH, TeliaSonera is making advances towards fiber deployment which might in particular increase competition in Helsinki, historically Elisa’s region.

**France: Leading LLU players investing in FTTH**

Broadband Cable has never played an important role in the French broadband market. This might change now, as after significant consolidation (Numéricable, UPC France, Noos), the leading French Cable company Numéricable is heavily investing into FTTH (€4 bn within 5 years). Besides broadband Cable’s sudden emergence, the DSL dominance is expected to be also threatened by the 3 major DSL players France Télécom/Orange, Iliad and NeufCegetel which are now investing into extensive FTTH programs in urban areas.

Despite having been offered since 2000, LLU didn't take off until 2004, when the shared access offer, in particular, was made more attractive. In the meantime most challengers used France Télécom’s National IP Resale offer. LLU lines first exceeded IP Resale in 2005 and account today for almost one-third of total broadband lines. Despite having favored shared LLU in the beginning, today most LLU customers are connected via full unbundling. In 2007, alternative operators covered (with partial overlap) in total more than 2,600 local exchanges
or 65% of population with LLU. Iliad and NeufCegetel have ongoing projects to increase their individual reach to 2,200 local exchanges by year-end 2008, an increase of almost 100% compared to 2006. Also the launch of LLU offers by mobile operator Bouygues and Cable operator Numéricable, both based on the Completel network (~620 local exchanges), will further stimulate LLU growth.

Regarding Bitstream, French regulator ARCEP is regulating prices in such an extent that there remains always sizeable incentive to invest into LLU. As such, naked DSL via Bitstream which has been introduced in July 2006 is about to become the preferred access form, gaining mostly from National IP and traditional Bitstream offers.

Seeking total independence from France Télécom’s network Iliad and Neuf Cegetel are both heavily investing in FTTH – e.g. Neuf Cegetel’s new owner SFR (Vivendi) has recently announced the investment of more than €1 bn in fiber optics. Together with France Télécom’s FTTH roll-out, roughly 10% of French homes will be reached by FTTH in the next 3 years.

Greece: Long-time ineffective regulation kept BB penetration below 30%

Due to absence of Cable operators and the long delayed introduction of regulation, Greece’s broadband penetration is today by far the lowest in Western Europe. It was not until 2006 that the EU framework for Electronic Communications was transposed into Greek law and effective regulation on LLU was introduced.

Thus until 2006, Greece’s incumbent OTE successfully managed to keep down LLU threat and lost customers only partly to Resale DSL. Yet after regulation became effective, LLU provider Forthnet rapidly gained subscribers (e.g. tripled its LLU subscribers within 12 months to ~150k in June ’08) and is expected to continue to do so after having heavily invested in LLU roll-out to 165 exchanges reaching 85% of subscriber lines. Also the merger of mobile operator Wind Hellas with fixed-line service provider Hellas, and the regional expansion of LLU provider On Telecoms is expected to stimulate the growth of LLU.

Besides the expected strong uptake of LLU, strong investments into FTTx will shape Greece’s broadband future. Out of a total broadband investment budget of €4.4 bn over the next five years, government intends to invest €2.5 bn into fiber-optic networks in order to reach at least 2 m homes with high-speed broadband. Additional investments include MANs in 75 municipalities and wireless local loops in 120 towns.

Germany: Strong LLU gets further push as German resellers migrate to LLU

DSL is by far the dominating broadband platform in Germany. For a long time Cable has struggled with its fragmented structure. After heavy network investments and market consolidation it is just reaching a position where it can effectively compete with DSL players.

While Germany was one of the first countries to introduce LLU at the beginning of 1998, regulation of Bitstream access is still somewhat ineffective. Before Deutsche Telekom voluntarily introduced a T-DSL Resale offer in 2004, competitors of Deutsche Telekom had for a long time sold DSL access and connectivity separately using two contracts. The “Bitstream Light” offer which was introduced in 2004 experienced a tremendous uptake which was also spurred by resellers migrating their existing clients from T-DSL Resale to the
new access offers. A new wave of migration of customers is expected for 2nd half of 2008 when a regulated naked DSL via Bitstream offer will be introduced.

Bolstered by early infrastructure investments into DSLAM locations through Arcor and many city carriers (incl. Versatel, Hansenet/Alice), LLU became widespread in Germany. This already relatively high importance of LLU is expected to further increase as the major ISPs United Internet, Freenet and AOL/Alice historically focusing on Resale have switched to an unbundling strategy cooperating with infrastructure providers QSC and Telefónica.

Movement to FTTH is relatively scarce in Germany. Deutsche Telekom is focusing more on FTTN/VDSL roll-outs and alternative carriers currently offering 100 Mbps speeds are very limited (e.g. locally limited offers of Netcologne in Cologne, M-Net in Munich and Wilhelm.tel in Hamburg).

**Italy: Swisscom’s acquisition of Fastweb puts pressure on still dominating Ti**

In absence of Cable networks, DSL maintained a market share of almost 95%. The only viable access alternative is fiber, which has been rolled-out by Fastweb in Milan as early as 2000.

In the DSL market, incumbent Telecom Italia managed with 62% to retain the highest market share among Western European incumbents. In essence it was not so much a lack of effective regulation but mainly the absence of strong national competitors that helped Telecom Italia to lose customers only slowly to competition. For a long time, its main challenger Fastweb focused on FTTH in the Milan region and didn’t switch to a national LLU strategy until 2005. Today, Fastweb has a national coverage of 45%, followed by Wind with 39% and Tiscali with 30% of homes. Yet, after Swisscom’s acquisition of Fastweb in 2007, additional investments into coverage built-out are announced and are likely to fuel the LLU market.

Although regulator AGCOM considers LLU as the preferred form of access, also Bitstream access gained some importance with 11% of lines. Yet, in order to foster LLU roll-out, Bitstream was only available at non-unbundled local exchanges.

Having been introduced very early in Milan, FTTH is continuing to be deployed in particular in new-built apartment blocks in very dense areas. Yet, due to Italy’s good copper infrastructure with 80-90% of population within 2km of the MDF, Telecom Italia considers it sufficient to invest only in VDSL instead of FTTH.

**The Netherlands: Strong LLU and Cable segment**

The presence of a strong Cable segment, aggressive regulation and widespread local initiatives to push broadband have made the Netherlands with a penetration of 74% one of the most penetrated broadband markets worldwide.

As in other markets with a strong Cable segment, broadband has been pioneered by Cable operators as early as 1998. Since the introduction of DSL in 2001 Cable has continuously lost market share and today accounts for roughly 35% of total broadband lines.
Low quality (consumer) Bitstream is not regulated in the Netherlands but offered by KPN on a voluntary basis. Yet, it could never attain significant market share and was in contrast to LLU not regarded as a crucial step for rapid broadband uptake. Today, alternative DSL operators rely almost exclusively on full LLU (e.g. Tele2, Scarlet). As a consequence, shared LLU has lost its long-time dominance, resulting from Europe’s lowest shared access tariffs, to full LLU.

Until 2010 KPN plans to switch off its legacy network and migrate to an All-IP VDSL network. Thereby, most of its exchanges will be dismantled and alternative carriers will get access to KPN’s network via wholesale broadband access or subloop unbundling at street cabinet level.

In the years to come FTTH will gain significant importance as numerous roll-out projects are about to take place. Besides, a planned roll-out of FTTH to 400k homes in Amsterdam, hundreds of small scale local FTTx projects have been launched.

Norway: Telenor dominates through its DSL and Cable ventures

Despite the Norwegian incumbent Telenor, being active in both the Cable (Canal Digital) and the DSL market, broadband penetration, has developed well. Today, DSL dominates the market with roughly 80%. For the years to come it will lose some of its share to rapidly developing fiber and wireless broadband accesses (incl. WiMax) as well as to Cable, which is expected to further upgrade its network.

Through early introduction of Bitstream in 2001, which was later extended by a naked DSL option, Bitstream gained some importance materializing in market shares of continuously above 10%. Yet, it was always strongly rivaled by LLU which maintained a market share of roughly 22% in the last four years.

Portugal: PT’s spin-off of its Cable unit expected to heat up competition

Rapid broadband penetration uptake was long-time impeded by Portugal Telecom’s control of both the DSL and Cable market. Until 2002, Portugal Telecom was only promoting broadband access through its Cable subsidiary TV Cabo/ZON. While DSL surpassed Cable in market share in 2005 and accounted for 64% of total lines in 2007, Portugal Telecom still controlled in mid-2007 almost 65% of the total broadband market. Through the spin-off of its Cable subsidiary at the end of 2007 this share has now decreased to 44%, and inter-platform competition is expected to intensify.

For a long time, neither regulation of Bitstream nor LLU was effective enough to allow for a significant uptake of DSL offers of alternative providers. After some intervention of regulator ANACOM (incl. LLU price reductions) at least LLU started to take-off in 2005. In particular Sonaecom’s Clix with its price and speed aggressive offer mix is expected to take significant market share of Portugal Telecom in the next years.

Sonaecom has recently launched a fiber investment program (€240 m within 3 years) with which it plans to cover 1 million homes (25% of population). Once fiber network is in place, migration its existing Clix customer base should substantially improve economics.
Spain: Important in the beginning, Resale lost most of its share to LLU

The first broadband offers were launched by Cable in 1998, followed by DSL from Telefónica and its ISPs in 1999. In the last five years broadband market share of DSL and Cable was almost constantly at 78% vs. 22%.

Bitstream was introduced as early as 2001 and due to its aggressive retail minus pricing (40% margin) very popular and accounted for 20% of all broadband lines in 2002. Due to difficulties in dimensioning of collocation rooms, LLU did not really take-off. Only after a revision of LLU regulation in 2004, the number of full and in particular shared unbundled loops increased significantly. Today, LLU is the preferred access option of alternative DSL providers (e.g. Ya.com, Tele2) and many of those are now migrating resale subscribers to more lucrative LLU.

Sweden: Early fiber LAN roll-outs led to strong infrastructure competition

As in all other Western European countries DSL is the dominant broadband technology with 63% of all access lines. Yet, inter-infrastructure competition developed early in Sweden and led to widespread availability of alternative infrastructures. Besides Cable (21% market share), fiber LAN in particular is very successful with roughly 15% share in broadband access lines.

Despite some competition problems related to the provision of LLU (e.g. no equal access to information system, limited capacity of MDFs), LLU today accounts for almost one fourth of total lines. Thereby, the number of shared access lines is almost four times higher than full unbundled lines. Aside from early investments into LLU (e.g. B2, Glocalnet), Resale has long-time suffered due to a missing regulated Bitstream offer and reduced geographical availability of Skanova's Bredband ADSL Resale offer. After the recent introduction of a regulated Bitstream offer (incl. naked DSL) some uptake of Bitstream in scarcely populated areas not covered by LLU is expected.

With regard to fiber, continued investments of TeliaSonera, and in particular Telenor's B2 are expected. Together with Cable they will increasingly compete for long-term (5+ years) contracts with multi-dwelling units. After the functional separation of Skanova Access (cf. BT Openreach) from TeliaSonera in 2008, also the introduction of an open fiber network (incl. publicly financed alternative carriers’ fiber networks) becomes more likely.

Switzerland: Strong Cable and relatively ineffective LLU regulation

Switzerland’s broadband market is characterized by a strong competition between DSL and Cable. After having lost significant market share until 2004, Cable is now stabilizing at around 35% of total lines.

Competition within the DSL market has been impeded by the lack of a regulated Bitstream and LLU offer for some time. Until the beginning of 2007 Resale of Swisscom products was the only available offer for alternative DSL providers and thus has led to a relatively high share of Resale (17%). The introduction of Bitstream at the end of 2007 and its expansion to naked DSL in April 2008 is expected to result in a migration from Resale access lines to Bitstream. Uptake of the January 2007 introduced LLU offer is still discouraged by very high
LLU prices (77% above EU average). This may change soon as integrated fixed-mobile carrier Sunrise has claimed against the high LLU charge (decision expected for Q4/08) and is currently investing heavily in own LLU footprint (~150 exchanges EoY 2008, population coverage of 80% EoY 2010).

With Swisscom focusing on VDSL deployment and so far very limited DSL infrastructure based competition, there has been little movement towards a fiber infrastructure. Yet, this might change as municipalities (e.g. Zurich) want to follow the French/Dutch model of deploying FTTH in larger cities.

**United Kingdom: Strong success of Resale severely hit BT’s market share**

With 23% market share British Telecom has the lowest broadband service market share of all Western European incumbents. Its relatively weak position is partly due to a formerly strong position of Cable and the huge success of Resale DSL providers. While Cable with the only remaining major provider Virgin is still strongly under pressure (e.g. aggressive DSL/Pay-TV offers of arch-rival BSkyB), DSL Resale providers are now migrating customers to LLU offers.

Within the DSL market, most of BT’s competitors are resellers. Fostered by the functional separation of BT’s wholesale division (BT Openreach) and a reduction in monthly LLU prices, LLU finally took up from 2006 on. Today, already 80% of homes have access to a LLU provider. The impact of LLU is expected to significantly increase medium term as the major competitors (e.g. Tiscali, Orange, Sky, and CPW) have significantly invested in LLU roll-outs.

In July 2008 BT has announced a €1.8 bn investment program to roll-out FTTH/FTTC to up to 10m homes by 2012. While FTTH (speeds of up to 100 Mbps) will be focused primarily on new build sites, FTTC (speeds of up to 40 Mbps) will be more prevalent elsewhere. Another push for FTTx might come from LLU operators that can unbundle at the street level as well as at the exchange and could use FTTH rather than copper to do this.
## GLOSSARY

4G  
Fourth Generation Mobile Communication System

ADSL  
Asymmetric Digital Subscriber Line

ATM  
Asynchronous Transfer Mode

BB  
Broadband

BRAS  
Broadband Remote Access Server

CATV  
Cable Television

CC  
Customer Care

COGS  
Cost Of Goods Sold

CPE  
Customer Premise Equipment

DSL  
Digital Subscriber Line

DSLAM  
Digital Subscriber Line Access Multiplexer

ERG  
European Regulators Group

FTTH  
Fiber To The Home

FTTN  
Fiber To The Node

GDP  
Gross Domestic Product

HD TV  
High Definition Television

IPTV  
Internet Protocol Television

ISP  
Internet Service Provider

LAN  
Local Access Network

LLU  
Local Loop Unbundling

MAN  
Metropolitan Area Network

MDF  
Main Distribution Frame

PoP  
Point of Presence

SAC  
Subscriber Acquisition Cost

SD TV  
Standard Definition Television

TDM  
Time Division Multiplexing

VDSL  
Very high speed Digital Subscriber Line

VoIP  
Voice over Internet Protocol

Wimax  
Worldwide Interoperability for Microwave Access
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