

LITERATURE REVIEW OF FUTURE DEVELOPMENTS IN THE TELECOMMUNICATIONS SECTOR

Introduction

Fixed-line incumbent operators around Europe have been relying upon a legacy network that in the last 30 years has served them well without the need for major technological upgrades and investments.

When, in the mid-nineties, the Internet world came to life, the emergence of xDSL technologies has allowed incumbent operators to offer internet access using the traditional twisted copper pair, and very scalable DSLAMs, providing most customers with the desired level of service, given their bandwidth demand. In the so-called access network (the “last mile”), copper cables that had been laid down forty-fifty years ago discovered a second rush of life.

On their side, incumbent operators have been successful, to different extents, fencing off competition (thanks to their first-mover advantage) and have managed to build a solid broadband customer base, and a windfall of profits in the process. The Unbundling of the Local Loop (LLU) has only now started bringing the benefits (in terms of competition in the retail sector) that regulators originally hoped for when they started the process at the beginning of the century. Wireless technologies and co-axial cables have been the other platforms, mainly used by alternative operators, to compete on the wholesale and retail market of broadband connection.

On the traffic side, customers have benefited from substantial real price reductions, mainly due to:

- 1 the re-balancing of tariffs from subsidising traffic charges, especially for international calls, to subsidised access charges, i.e. the monthly line rental; and
- 2 effective regulation, which in turn has favoured the introduction of competition. The setting of efficiency-enhancing price caps for wholesale interconnection charges and pro-competition measures like Carrier (Pre-) Selection and Number Portability have played the lion share in this respect.

However, traffic has mainly stayed (and being charged for) on the incumbent operators' networks, with a constant stream of revenues assured.

All this up until now. Today, things are changing, and they are changing thick and fast. In particular:

1. Customers seem more and more hungry for bandwidth and the traditional copper pair might soon start struggling. This might take the first-mover advantage away from the incumbents; they, as anybody else in the business, will need to dig the roads again.
2. VoIP applications like Skype are taking revenues away from the incumbents by the buckets and the situation is only deemed to get worse (for the incumbents) by the day.

3. Packet-switching technologies are gradually substituting the traditional circuit switching ones, implying substantial cost reductions. All traffic, including voice traffic, will soon (perhaps over the next 5-10 years) travel entirely in packets (voice traffic has so far traditionally travelled over the network on end-to-end circuits, held alive for the duration of the conversation).
4. Platforms are becoming more and more integrated and convergence seems, finally, to be a real working, prospect.

In this literature review we have examined a considerable number of news clips, documents produced by regulatory bodies and international organisations and industry papers. In a world dominated by the speed of change, we have not drawn on academic papers. We hope that we have made up for this by relying on our economic know-how and experience. We have also held talks with industry experts.

This chapter is organised as follows: the supply side, the demand side and the regulatory side¹ are analysed separately; conclusions are then drawn.

The supply side

Technologies

Let's start our review by providing an explanation of quite a fashionable concept: convergence. For this purpose, we quote the Economist:²

What this [convergence] means, roughly, is the coming together of previously separate communications and entertainment services: fixed and mobile telephony, broadband internet access and television.

[...]

In fact, although the industry likes to depict convergence as a great boon for customers, it actually involves a technological shift that, in the first instance at least, will primarily benefit network operators. At its heart, convergence is the result of the telecoms industry's embrace of internet technology, which provides a cheaper, more efficient way to move data around on networks. On the internet everything travels in the form of "packets" of data, encoded using internet protocol, or IP. The same system can also be used to encode phone conversations, text and photo messages, video calls and television channels—and indeed anything else.

[...]

This convergence affects not only wireline networks, but wireless ones too. Today, operators run separate but interconnected networks for fixed and mobile phones. But the new converged networks are "access agnostic". In short, a single core network may have a variety of devices connected to its edges via different technologies. Traditional fixed-line

¹ *The Good, the Bad and the Ugly*, in whichever order the reader thinks is most appropriate.

² Your television is ringing - Economist 12th October 2006.

phones might be connected via wires; mobile phones via base-stations; and televisions or computers via broadband telephone lines or Wi-Fi links.

Access agnosticism should enable a mobile phone, say, to connect to the core network via Wi-Fi in the home and then switch seamlessly to a traditional cellular connection outdoors. The core network remains untouched as new access technologies (such as fibre-optic links or new kinds of high-speed wireless data technology) are added to its edges. In an industry that loves obscure acronyms, the framework for linking everything up in this way is known as IMS, TISpan or NGN.

“IP in a converged world enables one network, many services, any access,” says Robert Lloyd of Cisco. A converged, all-IP network of this kind has two immediate technical advantages for network operators, he says. The first is that it costs less to run, thanks to its far simpler architecture and the economies of scale associated with internet standards. BT, a firm widely regarded as a pioneer in the switch to next-generation networks, expects its operating expenses to fall by 30% once its new “21st Century Network” (21CN) is completed in 2009. “By 2010 you will have to look very hard to find a fixed or mobile operator that is not running its traffic over an IP core,” says Mr Lloyd.

The second advantage is that in theory, new services can be added far more quickly and easily, without the need to add any new network infrastructure. Adding a new service amounts to little more than adding software to the core of the network and perhaps some new access technologies around the edges.

So, along with a plethora of “access technologies” that will provide fast, and possibly mobile, connections of subscribers to the core network, there is one technological concept that is central to them all, i.e. Next Generation Network (NGN). In the remainder of this section, we provide a brief technical description of Next Generation Core Network and of some of the “access technologies” around its edges.

NGN

According to ITU-T, the definition is:

A Next Generation Network (NGN) is a packet-based network able to provide services including Telecommunication Services and able to make use of multiple broadband, QoS-enabled transport technologies and in which service-related functions are independent from underlying transport-related technologies. It offers unrestricted access by users to different service providers. It supports generalized mobility which will allow consistent and ubiquitous provision of services to users.³

Whereas the definition provided above encompasses the whole network of a fully integrated, convergent, telecommunications operator, Wikipedia provides the following technical insight of what Next Generation means for the Core part of the Network, which is the subject of this section.⁴

³ http://www.itu.int/ITU-T/studygroups/com13/ngn2004/working_definition.html

⁴ <http://en.wikipedia.org>

In the core network, NGN implies a consolidation of several (dedicated or overlay) transport networks each historically built for a different service into one core transport network (often based on IP or Ethernet). It implies amongst others the migration of voice from a switched architecture (PSTN) to VoIP, and also migration of legacy services such as X.25, Frame Relay (either commercial migration of the customer to a new service like IP VPN, or technical emigration by emulation of the "legacy service" on the NGN).

Simplifying to a certain extent, a traditional circuit-switched core network can be considered as encompassing a plethora of assets that could be grouped in the following four major "categories": switching equipment (i.e. the nodes of the network responsible for switching voice calls with the aim of creating the end-to-end circuit where the call is eventually carried); transmission electronic equipment (i.e. equipment responsible for handling capacity, eventually used by different services, over the network); transmission infrastructure equipment (i.e. the means of transport of all traffic on the network, usually optical fiber cable); and Network and Service Management platforms.

From a practical point of view, the migration from such a network to an equivalent Next Generation one, will imply the following:

- Gradual substitution of circuit switches with packet ones (Ethernet switches and IP routers).
- Introduction of equipment that will be able to handle the migration of traffic from one protocol to another (i.e. Media Gateways).
- Scrapping of transmission electronic equipment, not needed in a NGN (optical fiber cable will continue to be used as the major means of transport of all traffic).
- Simplification of Network and Service Management platforms.

Easier said than done.

Wi-fi

From the BBC website:⁵

Wi-fi is the acronym for Wireless Fidelity, essentially a set of standards for transmitting data over a wireless network.

To understand the technology behind wi-fi, imagine using a walkie-talkie. Your voice is picked up by a microphone, encoded onto a radio frequency and transmitted with the antenna to another walkie-talkie, which decodes your voice.

Wi-fi works in broadly in the same way, but using a better radio that is capable of handling a lot more data per second.

⁵ <http://www.bbc.co.uk/>

Wi-Fi is essentially a wireless broadband connection which does a good job of giving high speed access in tight locations.

Britain, for example, is currently in the grip of a Wi-Fi revolution with offices, homes and classrooms going wireless. Entire cities have become what are known as wireless hotspots. However, recent concerns about the health risks that the technology could carry might seriously limit its future.

From the BBC News as of 20 May 2007:

The Government insists Wi-Fi is safe, but a Panorama investigation shows that radio frequency radiation levels in some schools are up to three times the level found in the main beam of intensity from mobile phone masts.

Wimax (Worldwide Interoperability for Microwave Access)

Wikipedia defines it in the following way:

... WiMAX aims to provide wireless data over long distances, in a variety of different ways, from point to point links to full mobile cellular type access. In practical terms this enables a user, for example, to browse the Internet on a laptop computer without physically connecting the laptop to a wall jack. The Forum describes WiMAX as "a standards-based technology enabling the delivery of last mile wireless broadband access as an alternative to cable and DSL.

In a few words: as Wi-Fi, Wimax is wireless broadband connection. Theoretically it can provide data rates of up to 70 mbps (Mbit per second) over distances of up to 50 Km,⁶ although its actual range is dictated by many variables, including topography, environmental conditions and network capacity.

An OECD report published in March 2006 states:⁷

Because of this ability to provide broadband speeds to a relatively large population of users, Wimax has been widely promoted as the "proper" replacement for wi-fi which offers higher speeds but typically only over a few tens of metres.

[...]

However, the authors of the OECD report took a more cautious line and said there were numerous uncertainties that meant Wimax was not guaranteed a rosy future.

Setting up a nationwide Wimax network in the US was likely to cost in excess of \$3 billion (£1.74 billion), said the report.

⁶ These figures should be considered with a pinch of salt, given the variety of ranges and speeds currently present in the public domain.

⁷ The Implications of Wimax for competition and regulation – OECD publication DSTI/ICCP/TISP(2005)4/FINAL, 02 March 2006.

"Third-generation mobile operators have incurred great expense to roll out new networks and the prospect of starting again with a new Wimax network is not appealing," wrote the authors.

By contrast, it said, mobile operators were more likely to upgrade their existing networks with technologies such as High Speed Downlink Packet Access.

The report also stressed that Wimax should not be seen as a replacement for wi-fi which does a good job of giving high speed access in tight locations. The two technologies were likely to be complementary, said the report with Wimax used to link islands of wi-fi together. Alternatively, Wimax may find a role as a service that can reach rural and remote areas where it is too expensive to run cables or upgrade exchanges to support broadband.

Initially hyped by many as a successor to Wi-Fi and a possible substitute platform of more traditional broadband platforms, most industry experts are now more sceptical about the role of Wimax and see it as hole-filler, plugging gaps left by DSL and providing a lifeline to those in rural areas and countries with poor fixed communications infrastructure.

Wibro (wireless broadband)

Wi-Fi and Wimax allow wireless broadband connection, with different ranges of connections' speeds and distances, at a given location.

A good technical description is, once again, provided in Wikipedia:

WiBro is a wireless broadband Internet technology being developed by the Korean telecoms industry.

WiBro was devised to overcome the data rate limitation of mobile phones (for example CDMA 1x) and to add mobility to broadband Internet access (for example ADSL or Wireless LAN). In February 2002, the Korean government allocated 100 MHz of electromagnetic spectrum in the 2.3 - 2.4 GHz band [...]. Two Korean Telco (KT, SKT) launched commercial service in June 2006, and the tariff is around 30 US\$.

WiBro base stations will offer an aggregate data throughput of 30 to 50 Mbit/s and cover a radius of 1-5 km allowing for the use of portable internet usage. In detail, it will provide mobility for moving devices up to 120 km/h (74.5 miles/h) compared to Wireless LAN having mobility up to walking speed and Mobile Phone having mobility up to 250 km/h.

BBC News casts some doubts about its future development in European countries:

What role will wireless broadband play? It is hard to see quite why it is needed in a country where you can already get fast broadband at home, and use 3G phones to get data on the move.

"What will it allow me to do that I can't do now?" I asked a senior manager at KT, the telecoms firm which is building the wibro network.

He stared at me for a full 10 seconds, apparently completely stumped by my question. Then he sprang into life.

"You'll be able to watch TV on the move, while e-mailing and downloading big files at the same time," he replied triumphantly.

South Korea hopes to export its wireless broadband expertise to other countries. The question is whether everybody else will be quite so keen on connectivity as the Koreans.

Indeed!

HSDPA (High Speed Downlink Packet Access)

Wikipedia:

High-Speed Downlink Packet Access (HSDPA) (Sometimes known as **High-Speed Downlink Protocol Access**) is a 3G mobile telephony protocol in the HSPA family, which provides a roadmap for UMTS-based networks to increase their data transfer speeds and capacity. Current HSDPA deployments now support 1.8 Mbit/s, 3.6 Mbit/s, 7.2 Mbit/s and 14.4 Mbit/s in downlink.

Further speed grades are planned for the near future

[...]

As of May 25 2007, 102 HSDPA networks have commercially launched mobile broadband services in 55 countries. Near to 40 HSDPA networks support 3.6 Mbit/s peak data throughput (downlink direction). A growing number are delivering 7.2 Mbit/s peak data throughput, leveraging new higher-speed devices coming into the market. One network has been declared as "14.4 Mbit/s (peak) ready" while several additional networks will have this capability by end 2007. The first commercial HSUPA (uplink direction) network is launched, with several more set to follow in 2007.

This protocol is a relatively simple upgrade where UMTS is already deployed.

The main difference between this platform and Wibro is that, as indicated above, HSDPA is an upgrade of a mobile platform. This BBC News clip, as of November 2006, sheds further light.

Seoul is just starting to roll out Wibro, which stands for wireless broadband.

Imagine a city enmeshed in a veil of super-powerful wireless hotspots, each beaming out the internet at broadband speed to everyone in the city, wherever they may be.

[...]

Local residents are given a hands-on demo of the virtues of Wibro's impressive capabilities, happily browsing and watching streams of last night's football at the respectable broadband speeds of several megabits a second, all while being chauffeured around the city.

Unfortunately, out in the real world Koreans cannot actually use Wibro on their phones because no-one has figured out how to cram in the bulky and power-hungry Wibro chipsets, and make what is essentially a data service work alongside voice calls.

Technical gremlins mean the connection keeps dropping when users move between Wibro base stations, and it is only available in five districts of Seoul.

Wibro may have arrived in this world-beating mobile metropolis, but it is just that little bit too early.

Fibre to the home (or building or street cabinet)

From Wikipedia:

Fiber to the premises (FTTP) is a form of fiber-optic communication delivery in which an optical fiber is run directly onto the customers' premises. This contrasts with other fiber-optic communication delivery strategies such as fiber to the node (FTTN), fiber to the curb (FTTC), or hybrid fibre-coaxial (HFC), all of which depend upon more traditional methods such as copper wires or coaxial cable for "last mile" delivery.

Fiber to the premises can be further categorized according to where the optical fiber ends:

FTTH (fiber to the home) is a form of fiber optic communication delivery in which the optical signal reaches the end user's living or office space.

FTTB (fiber to the building, also called fiber to the basement) is a form of fiber optic communication delivery in which the optical signal reaches the premises but stops short of the end user's living or office space.

A typical example of FTTH is where the fiber connects to a single-residence house. A typical example of FTTB is where the fiber connects to an office building (or apartment building) which is itself equipped with category 5 cable. (The category 5 cable would then carry the signal the rest of the way to the end user's office or living space.) However, if the office building instead carried the signal to the end user's office space by means of its *own* fiber optic network, then this would be *FTTH*. This is true even though no "home" is involved.

Peter Cartwright, of LoopScorpio, a small broadband provider in Gloucestershire, argues as follows in his Interconnect Cost manual (3rd Edition):⁸

Within the Access network I would argue that NGN largely means getting rid of the legacy copper infrastructure and replacing it with fibre optic cables.

When asked to expand further he explains:

The challenge for such a rollout is the huge investment required for this (to say nothing of the disruption resulting from having to dig up almost the entire road infrastructure in a country!). Incumbents will be asked (expected even) to invest billions of euros in a new access network, whilst the end users will no doubt be very reluctant to spend more money per month in order to pay for it.

⁸ Interconnect Costing 3rd Edition - The transition to NGN by Peter Cartwright; BWCS publication.

Put simply, from the incumbent's view point: huge investment but no revenue gain.

The operators

Given the changes in technology described above, how are operators in the telecoms industry reacting? From the Economist:⁹

Because of the convergence on IP networks, companies that used to be in separate industries—telephone operators, internet-service providers and cable-TV firms—suddenly find themselves in the same business. Cable companies now offer broadband internet and voice services over networks that used to carry just television, and telecoms firms have upgraded their networks to carry television signals. In the new converged world any firm that can deliver an IP stream to customers over its network can offer any or all of these services. And offering several of them together, many operators believe, is a winning strategy.

Hence the current scramble to offer the “quadruple play”—the name given to the combination of fixed and mobile telephony, broadband internet access and multichannel television. This explains many of the deals that have taken place in recent months. AT&T, which is already rolling out a fast new network to carry TV signals, bought BellSouth in order to win full control of Cingular, its wireless joint venture, and complete the quadruple-play package. Softbank, which already offers television, voice calling and internet access over fixed broadband links under the Yahoo! BB brand, bought Vodafone Japan to add mobile to the mix. Similarly, NTL bought Virgin Mobile, and America's big cable operators last year struck a deal with Sprint Nextel, a wireless operator.

The desire to offer a one-stop shop for quadruple-play services has also prompted several national incumbent operators to reabsorb their previously separate wireless operations. And it has hastened consolidation among telecoms-equipment vendors, such as the Alcatel-Lucent and Nokia-Siemens deals.

[...]

Operators claim that selling all four services together as a bundle makes life easier and more convenient for customers. “Customers in our experience really want that,” says Ed Whitacre, the swashbuckling Texan boss of AT&T and one of the most vocal proponents of the merits of bundling, “and we can give them a better price.” The average American household spends \$176 a month on telephone, broadband and television services, according to figures from Parks Associates, a consultancy. Mr Whitacre's stated aim is to reduce costs by building a converged network, and to offer the quadruple play for as little as \$100 a month.

[...]

Another benefit of bundling everything together is that it reduces advertising, customer-acquisition and other marketing costs, because all the services can be advertised together under a single brand. That is why France Telecom recently rebranded its Wanadoo broadband division and Equant corporate-networks division to align them with

⁹ Your television is ringing - Economist 12th October 2006.

Orange, its far stronger mobile-phone brand. This will allow the company to sell bundles of services to both consumers and businesses under a single brand.

[...]

For the incumbent telecoms operators, however, the quadruple play is all about protecting their core business of fixed-line voice calls, which still accounts for the bulk of their revenues.

Their problem is that fixed-line subscribers are being lured away by cable operators and voice-over-internet firms, or are getting rid of their fixed lines in favour of mobile phones. During 2005, for example, the number of fixed telephone lines operated by Verizon, America's second-largest telecoms firm, declined by 8%. Its losses were greatest in the New York metropolitan area, where it faces the most competition from cable operators offering voice services, says Stephan Beckert of TeleGeography, a market-research firm.

As cable operators offer customers the "triple play" of voice, broadband and television, telecoms operators have concluded that their best defence is to respond in kind and also to throw in wireless, which many cable operators are not yet able to offer.

The same article, though, casts some doubts on the consensus of "quadruple" play in a industry well known for its previous flops (see the 100 billion euros spent by European operators to buy 3G licenses).

Vodafone, for example, remains skeptical about the idea and keeps its main focus on the mobile business, despite some recent acquisitions into the fixed-line broadband market in Britain, Germany and Italy. We quote Arun Sarin, the chief executive of Vodafone:

"It's very early days," says Mr Sarin. "We are dubious that customers really want all the things that people are imagining that they want." In particular, it is wrong to assume that everyone wants quadruple play, he thinks: "We're not saying that there are no customers who demand this—we're saying it's a very small fraction of customers."¹⁰

Deutsche Telekom, which is going through the same erosion of traditional stream of fixed-line revenues (more than half a million customers have left in the first six months of 2007 to join cheaper rivals), recently (29 May 2007) bought Jajah, an internet telephone company providing VoIP; by the same token, its mobile arm launched a phone in the US which allows users to make VoIP calls in areas with wireless internet.

The German giant has coupled this move with quite a significant cost-cutting exercise, securing a deal with unions in June 2007 after six weeks of bitter negotiations that will see 50,000 support centre workers accept both lower pay and longer working hours. The affected staff, at the firm's main fixed-line unit, will now see their pay cut by 6.5 per cent, while their working week will go up by four hours to 38 hours. In return, they will gain job security until the end of 2012.

¹⁰ See footnote 8.

Carphone Warehouse, a UK mobile phone retailer, started in April 2006 offering free broadband access for customers who would sign to its landline services. Subscriptions proved to be much higher than anticipated and Carphone struggled to cope with connecting customers. Carphone said the launch of its TalkTalk integrated broadband and phone offer had been “highly successful”. It has received 625,000 applications for the service, but about 200,000 broadband customers still remain unconnected as of November 2006.

BT is undertaking a substantial program for upgrading its network to bring it to NGN standards.

On the access front, after a long dispute with Ofcom (the regulator in the UK) who has threatened the telecom giant of separating its whole company into different business units, BT has finally relented some control over their local loops by setting up BT Openreach, a spin-off company set to deal with the process of unbundling in a fair and transparent way.

In November 2006, British Telecom has been celebrating a somewhat unusual milestone: handing over control of one million of its telephone lines to its competitors. The euphoria was justified by the fact that when BT will have handed over 1.5 million lines, it will be allowed to cut broadband retail prices. Worth noting that, back in 2005, BT has been under Ofcom’s investigation for anti-competitive behavior (price squeeze) in relation to their broadband retail offers.

Telecom Italia is gradually substituting their circuit-switches transit exchanges (at the top of their switching hierarchy) with IP routers.

On the access front, they have started ambitious investment plans to take: i) *Fiber to the Building* (Fttb) in the big conglomerates (covering up to 15-20 per cent of the connections); and ii) *Fiber to the Cabinet* (FttCab) in the rest of the country. By 2008, they foresee 50 per cent of the fixed-line subscribers being connected to the network via broadband.

In an interview for their own internal bulletin,¹¹ Stefano Pileri, responsible for TI’s Technology department, voices the need to sit at the same table with Agcom, the Italian NRA, since “such an ambitious investment plan needs a clear regulatory framework that, given the speed of change of the technologies involved, is not there yet”.

The same kind of issues seem to worry Mr Trujillo, Chief Executive at Telstra, the Australian incumbent; from the Economist as of November 2006:¹²

Mr Trujillo bemoans an overbearing government which is both his firm’s main shareholder and its regulator.

In recent months, Mr Trujillo has grappled with the government over board nominations; his A\$8.7m (\$6.7m) pay packet; and, most seriously, a thicket of regulations designed to ensure that the former monopoly continues to provide rural telephone services across a vast country with the world’s sixth-largest landmass but only the 52nd-largest population.

¹¹ Noi magazine (TI Group magazine): November/December 2006 edition.

¹² Mood music (Economist 9th November 2006).

[...]

Regulation is Mr Trujillo's main gripe with the government. In August Telstra abandoned a flagship project to build a high-speed fibre-optic network in the country's five largest cities after a poisonous regulatory dispute with the Australian Competition and Consumer Commission. Agreement could not be reached on how much the company could charge competitors for access to its new network. Telstra grumbles that it is forced to offer rivals, such as Optus, cheaper access to its networks in cities than in rural areas. This places Telstra at a disadvantage when competing for profitable urban customers.

Mr Trujillo seems to have kept his word. In May 2006, he has stated:¹³

“Those who risk capital to earn returns shouldn't have to subsidise those that don't.” Worried that giving rivals a free ride would undermine his profits, Mr Trujillo is threatening not to lay the fibre: “My duty is to our shareholders—including 1.6m ordinary Australians. I will only invest where I can earn an economic return.”

He argues that Australia risks emulating the “parasitic competition” that prevailed in America in the mid-1990s when the Baby Bells (such as US West) were forced to open their local networks to newer carriers. The result, he argues, was that nobody invested and America lost its global lead in broadband deployment. America, however, saw its mistake, recognised the need for scale in the telecoms industry and is now allowing mergers that amount to a recreation of the old AT&T.

The demand-side

In an industry whose leaders most famously expected people to embrace video-telephony, which flopped, but failed to anticipate the success of text-messaging, making predications is a daunting exercise. The scope of this section will be limited to collect and make some sparse observations on convergence and broadband penetration.

The telecommunication industry has been talking of convergence for the best part of the last five years, yet very little of it has so far materialised.

“What problem is convergence solving?” asks Andrew Odlyzko, an expert in the economic history of telecoms at the University of Minnesota. “It is solving complexity issues for service providers, but it is not actually solving much for consumers.”

On the other hand, there is evidence that customers do like the discounts associated with bundles and the convenience of a single bill. But: what discount levels would be needed to encourage a sufficient number of end-users to ask for the four-play bundled products?

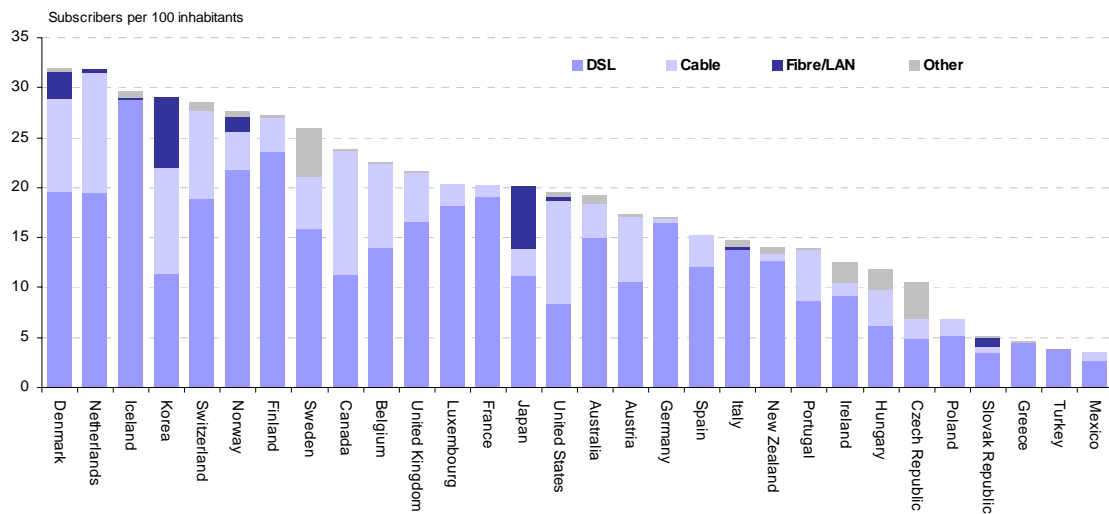
Moreover, four-play convergence seem to have more of a role in the US (where relevant mergers are happening) than in Europe; two main reasons for this: i) cable operators, and their TV offerings, have traditionally played a much bigger part in the US than in Europe; and ii) the

¹³ Calling Canberra (Economist 11th May 2006).

enthusiasm of customers in the US for bundled products may not be matched by their European counterparts, traditionally less prone to offers of this kind.

Whereas full convergence is less of a given on the demand-side than it is on the supply side, at least in Europe, broadband penetration, and its growing path in the last few years, shows that end-users do like high speed connection to the internet and are willing to pay a reasonable price for it, uniform across the platforms this is delivered through.

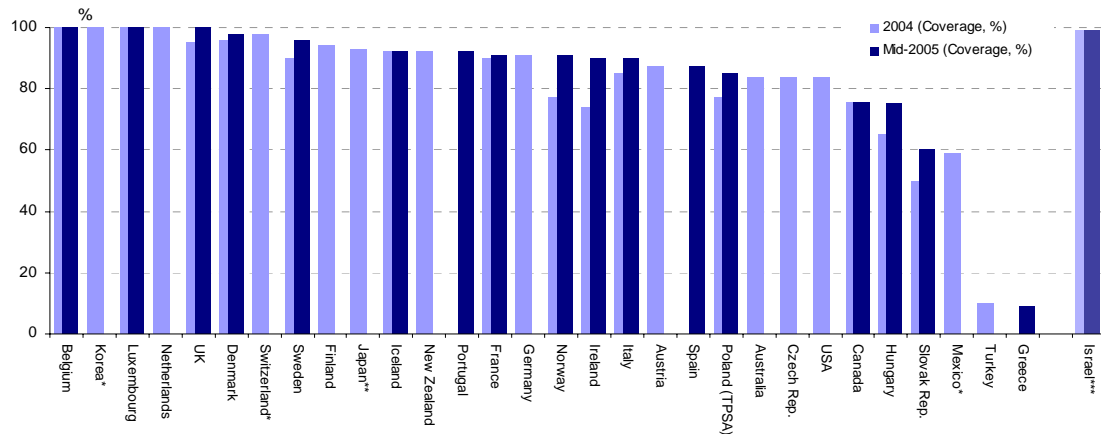
The chart below shows broadband penetration in December 2006 in OECD.



Source: OECD website

According to the same source, the number of broadband subscriptions in OECD economies rose from 157 million, or 13.5 per 100 people, in December 2005 to 197 million, or 16.9 per 100 people, a year later. Denmark and the Netherlands top the chart, with more than 30 subscriptions per 100 people. In 2006 these two countries overtook South Korea, the leader for several years, and Iceland. Connections to fibre now account for 7 per cent of the OECD total. South Korea boasts seven fibre-using subscriptions per 100 people and Japan has 6.2. Both countries are seeing a decline in DSL, commonly the leading access technology elsewhere. Cable is the most commonly used method in America and Canada.

The following chart shows availability of Digital Subscriber Lines (DSL) in OECD countries.



Source: OECD website

This chart is indicative of the fact that broadband take-up is not necessarily related to the availability of the product itself. Value for money considerations do still play a strong role.

With retail price falling on one hand and the availability of applications like Skype that allow free VoIP on the other, the future looks bright for broadband providers and customers alike.

The Regulator

In this section, we examine the regulatory framework in the EU, as we believe it is the one that can provide the most useful guidance to possible regulatory approaches for the telecommunications sector in Switzerland.

The European regulatory framework is centered around three directives, published on 7 March 2002:

- 2002/21/EC – The Framework Directive
- 2002/19/EC – The Access Directive
- 2002/22/EC – The Universal Service Directive

The aim of the Framework Directive was to establish a harmonised framework for the regulation of electronic communication networks and services (and also of associated facilities and services). It lays down specific tasks to be undertaken by the national regulatory authorities and establishes a set of procedures, the aim of which is to ensure the harmonised application of the regulatory framework throughout the Community.

The Directives impose obligations on the national regulatory authorities to examine a number of markets defined in a subsequent Recommendation (2003/311/EC, published 11 February 2003) for evidence of Significant Market Power by one or more of the players.

Where Significant Market Power is found to exist, the national regulatory authorities are provided with a set of remedies that can be imposed on the relevant players. The authorities must only impose remedies that are both proportionate and justified. The available remedies are:

- Transparency
- Non-Discrimination
- Accounting Separation
- Access
- Price Control and Cost Orientation

For those markets where a SMP is not found to exist, market regulation should follow the provisions of competition law.

Although the framework established in 2002 has considerably shifted the focus from *ex ante*, sector specific regulation to *ex post*, competition policy regulation, there is still a considerable role to be played by sector regulators around Europe.

We believe that regulatory decisions can, more than ever, play a significant part in the development of the industry, especially when it will come to those decisions involving access prices to the infrastructure of all operators (and not just of the incumbent).

So far, decisions on, and the setting of, access prices have had an impact on how much incumbent operators have been able to charge for the use, by other operators and by their own retail arms, of legacy assets. This obviously has in turn had an impact on the level of investment made by other operators facing “build/buy” decisions. However, for the first time those access prices will now have a big impact on the investment decisions of the incumbents themselves, and they are those in the industry with the deepest pockets.

We have seen in the section above how regulatory decisions might affect, for the right or wrong reasons, investment decisions of operators like Telstra.

The European Regulators Group (ERG), a body set up by the Commission “to provide a suitable mechanism for encouraging cooperation and coordination between national regulatory authorities and the Commission”, provides useful information on the way the Commission would like to see NRAs take decisions in this respect.

From their document ERG (06) 33:¹⁴

In order to promote sustainable, infrastructure-based competition, NRAs have to set investment incentives such that the dominant undertaking's infrastructure is replicated

¹⁴ Revised ERG Common Position on the approach to Appropriate remedies in the ECNS regulatory framework (European Regulatory Group publications; ERG (06) 33; May 2006).

wherever this is technically feasible and economically efficient within a reasonable period of time. Investment incentives are particularly relevant in the context of access regulation. By the decision as to if and on which level of the infrastructure access has to be provided by the SMP undertaking and by setting the access price, NRAs will influence investment incentives of both the SMP undertaking and alternative operators.

Given that the cost structure and investment incentives of alternative operators are likely to change over time as they develop their trademark and a customer base, NRAs may consider to give them the possibility to take their investments in a step-by-step manner.

[...]

Where uncertainty about replicability exists, NRAs will have to weigh the benefits of infrastructure competition against the risk of inefficient duplication and the risk of having neither infrastructure nor service competition in the end, if replication does not occur. Wherever the latter is likely to prevail, NRAs should adopt a more 'neutral' approach, set the prices for the relevant access products at some measure of costs, monitor the market outcome and keep up discussion with the industry. Investment incentives may also change over time due to market dynamics, leading to replication without additional regulatory incentives. In segments where infrastructure competition is unlikely to develop, NRAs should set the access price such that the incumbent has incentives to maintain and upgrade its network while at the same time ensuring efficient entry at the retail level.

Setting access prices, therefore, is not an easy task and requires, first and foremost, clear and independent judgment. Only a fully independent third party, in Europe a role played by the National Regulatory Authorities, can set access prices (provided that the infrastructure they give access to is deemed to be subject to such a remedy).

Another hot issue is the uniformity of tariffs, imposed up until now on Local Loop prices and Wholesale Line Rental. Again, in a market where the economies of investments do vary with the geography and topology of the areas in question, it might be sensible to allow for wholesale, and retail, prices to differ by geo-types (usually defined in terms of line density). This would set the right incentives for operators (and not only the incumbent) to invest in rural areas and, at the same time, avoid cream-skimming practices by operators with no Universal Service Obligations (the uniform tariff would allow these operators to offer at lower prices where costs per customer are inherently lower).

Conclusions

Whereas it still not clear whether end-users will eventually ask for bundled products at a discount that will make three- or even four-play operators emerge, there are clear indications that demand for broadband is increasing and will steadily, if not exponentially, do so in the next decade.

With customers hungry for more and more bandwidth, taking fibre cable closer to the consumer seems to make more and more sense (at least up until now in Europe, when wireless technologies have not proven their mettle yet and where cable operators are less widespread than in the US).

In the core part of the networks, packet switching technologies provide incentives, in terms of long run cost reductions, that are too strong for incumbents, and alternative operators as well, to miss.

All in all, it is potentially the right time in the EU for huge investments.

So, if governments around Europe want to keep maintaining control of their incumbent telecommunications operators and, at the same time, develop them into 21st century infrastructure operators crucial to the economic development of their countries, they will have to be ready to:

- Invest considerable financial resources in order to undergo significant upgrades of the network.
- Keep the National Regulatory Authorities independent and assess their performance against the overall objective of long term benefits to the end-users (residential and business alike).
- Support the idea of engaging with the NRA, and the industry as a whole, to ensure that access prices are set so that returns from their investments warrant their risk on one side, but do not allow recovery of inefficiently incurred costs on the other.
- Being open to the idea of price differentiation on geo-types for wholesale broadband connections, while safeguarding USO, and uniform tariffs, for more basic services.

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