

A THEORY OF EVERYTHING: AN INTEGRAL VISION OF FIXED AND MOBILE BROADBAND

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1. In search of a framework for Broadband.

In the last five years the use of Broadband has widespread reaching 120 millions of clients in the world [Ref. 1]. Because of many reasons -fast Internet access, “always on” feature, prices declining- the technology is growing fast.

However, there is no “framework” or complete description that explains the different penetration rates in various countries, for a given Capex and Opex effort, made by the companies in the communication business – initially Telcos-. Exceptions should be made for the decisive roles played by governments – notably in the more developed Asian economies [Ref. 2].

Some studies have tried to answer this question in terms of elasticity. They argue that users are willing to pay a certain percentage of their total income in broadband. About 2% seems to be a rough estimation that works well in most of these studies for the residential market [Ref. 3]. But this incomplete framework is shaking with the introduction of unexpected variables, such as changes in users downloading patterns, customers expectation, regulation, and the threat of mobile operators or third parties.

How to proceed? In the bibliography there may be found some broadband drivers in common, regardless of specific countries. Although secondary drivers may differ from country to country [Ref. 4] these may be the main drivers for the user:

- Speed (always).
- Content and applications
- Availability of service

According to a Telco –initial mover in Broadband- the logic underlying the process of broadband development is the following:

- Through an investment –say- in DSL equipment, Telcos may increase notably their client’s ARPU. In theory, the traditional voice income may be duplicated.
- Expending in advertising, the potential client can perceive the benefits of broadband
- Given that several barriers –cultural, social, income- allow it, a Telco client eventually contacts a broadband service.
- When a substantial number of clients are achieved, the Telco approaches to the “Triple Play¹”.

¹ In the Triple Play, a single loop system carries the voice, data, and video traffic flow from residential and business customers to remote terminals using standard telephony and DSL interfaces.

- Because of the huge amount of broadband customers, agreement with Content Providers is more likely.

In summary, there is no consistent theory about broadband development, and there are many different points of view for this process. One possible framework is established here, with a little help of Physics.

2. Just a little about Theory of Particles

The title of this paper refers to “theory of everything”. This could sound a little pretentious; it has to do with the wish of describe multiple aspects of broadband, and with a framework taken from Physics.

In the last century, it was necessary a group of new particles to offer a Theory of Everything (TOE). Theories are valid in specifics ranks, and there are glitches out of them. Classic Physics works perfectly in the most known limits of the world (i.e. big distances and slow speeds). Quantum Electrodynamics (QED) is one of the most successful theories of physics, predicting the values of physical properties to very high precision. But, it is not capable of being extended to solve nuclear forces –which happens in very short distances.

Some of the problems of these theories are that they do not provide good predictions, they lack aesthetics or beauty, or they don't build on first principles in physics. The various approaches start with Einstein's General Theory of Relativity, mathematical Group Theory, or QED. These approaches lack cohesiveness between each other and the large scale is at total odds with the subatomic scale.

In small distances or travelling at very fast speed, explanations are somewhat complex. A TOE is one that explains the four fundamental forces and can predict the masses of particles. This model explains how the forces can be related and how, if masses of some particles are known then, the masses of other particles can be solved. What it doesn't do is explain why they have the values that they have. Scientists are hoping to find what they call the Higgs boson. It should be a particle that might give others mass. So there is still a mystery to solve, and therefore it isn't a TOE.

In summary, the study of nature at any scale of distances and speed has determined that most phenomena can be explained with four forces and eighteen particles – one of them pure theory and still waiting for discovery-. The set is called “the standard model”.

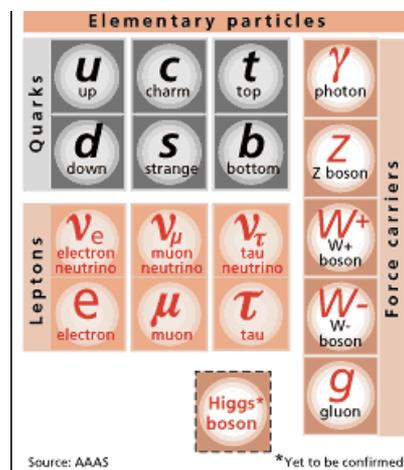


Fig. 1: The Standard Model, a possible description of the world

In this work a sort of consolidation of broadband is mentioned. Following the Physics analogy, I would like to explain what influence broadband development, and how customers and suppliers relationship is affected, whether they are fixed operators (Telcos), mobile operators (Cellcos, in analogy). The aim is to identify the most important patterns –considering Telcos and Cellcos like particles of large mass or electric charge- and catching the glimpse of tiny or hidden effects, which keeps the description uncompleted -like Higgs boson- and makes any broadband market evolution hard to predict.

In many passages DSL access deployed by conventional Telcos is used as a synonym for broadband, given that the ADSL is the hegemonic technology (67% share) of broadband and the one with larger growth (Ref. 5). DSL has begun to be profitable by reducing costs and stress value-added services. Equipment costs are decreasing and supplying has become a more efficient process. Still, competition from HFC and wireless broadband providers drives DSL to improve.

In the following figure Telcos, Cellcos, 3rd companies or 3rdCos² and clients are represented, using Dilbert as a Telco customer’s icon, in a static and reflexive situation in front of his computer. Likewise, a moving individual is the archetype of a Cellco client. On the left there are three variables as mediators of the client-company interaction: culture, price and technology. The events to consider can be of small magnitude – a group of customers in a certain country adopts a broadband service- or violent: acquisitions, hostile take-overs between companies, irruption of new technologies.

Each one of the above elements deserves a separate chapter. At the end of the paper some worthy ideas will be described, hopefully apart from the realm of Physics. The ultimate objective here it is to explore the acquisition of new broadband clients, based in this proposed set of price, culture and technology.

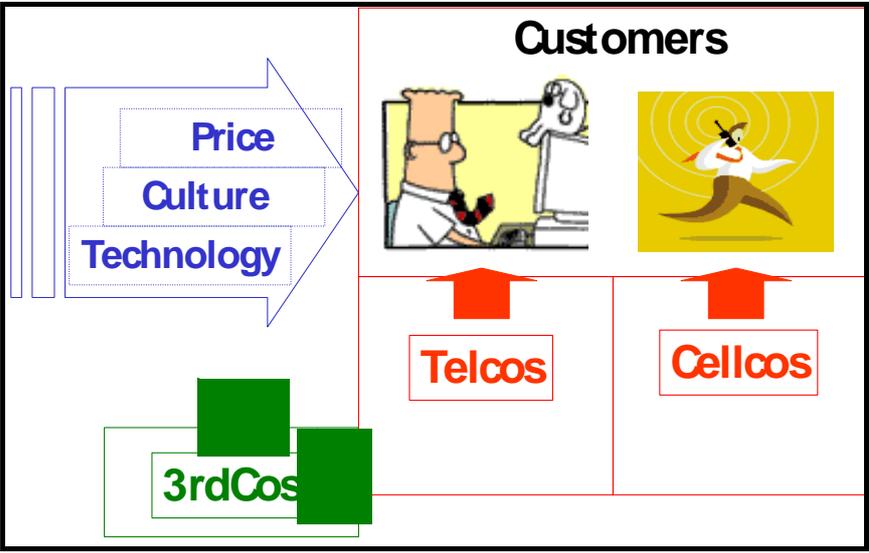


Fig 2: Key Elements of the broadband TOE.

² The neologism means a new type of company, different from Telcos or Cellcos. It may represent HotSpots, WiMax operators, MVNOs, etc.

3. Heavy particles: Telcos and Cellcos

Both Dilbert and the moving hero from the last figure seeks a reasonable trade-off between service quality and price, each one with his company. For instance, Telcos offer a fixed telephone service with no oddities; this technology dates back from a century, and therefore their clients know exactly what to expect in return. Picking up the phone and hearing a tone surprises nobody. The same happens with a real time long distance communication, or a perfectly audible call.

A mobile operator client deals with a technology of about twenty years. The customer is used to certain glitches: moves the handset around while talking to receive a better signal, communications cuts off for instants, and may find small unexpected charges in the bill. He also knows that international roaming is not easy. The high value of mobility allows the growth of cellular telephony; the client is used to glitches and does not expect high performance.

On the other hand, broadband is taking its first steps. High-speed home struggled to get off the ground around 1997. Cable modem was the first broadband option available to many, but only a few hundred thousand subscribed to Internet cable in that first year. In 1999, competition from DSL kicked in, but DSL availability remained quite limited at first.

It took until 2001 for home broadband to enter mainstream usage and begin growing at a faster rate than Internet dial-up services. Although many in the industry remain disappointed in the slow adoption rate of home broadband, initial concerns over reliability of DSL, broadband accessibility in rural areas, and viability of the broadband service providers, have all largely been addressed. The future of home broadband appears quite promising.

Several surveys [Ref. 6] show that the clients outlook is to be able to research, learn and download files more efficiently; in every case broadband duplicates the interest of this activities, compared to similar groups of dial-up access. Although there are several aspects to evaluate, customers put in the first place speed for a given plane fee. Broadband users crave for obtain the maximum of the benefits, interacting to the extremes with the possibilities of technology.

The result of this massive behaviour stuck the networks, and may be seen as other application of Pareto's Law. Heavy users –four columns on the left, about 5.6% of customers- are responsible for 40 % of the total traffic. This phenomenon is not web surfing, is called P2P traffic, and will be discussed later.

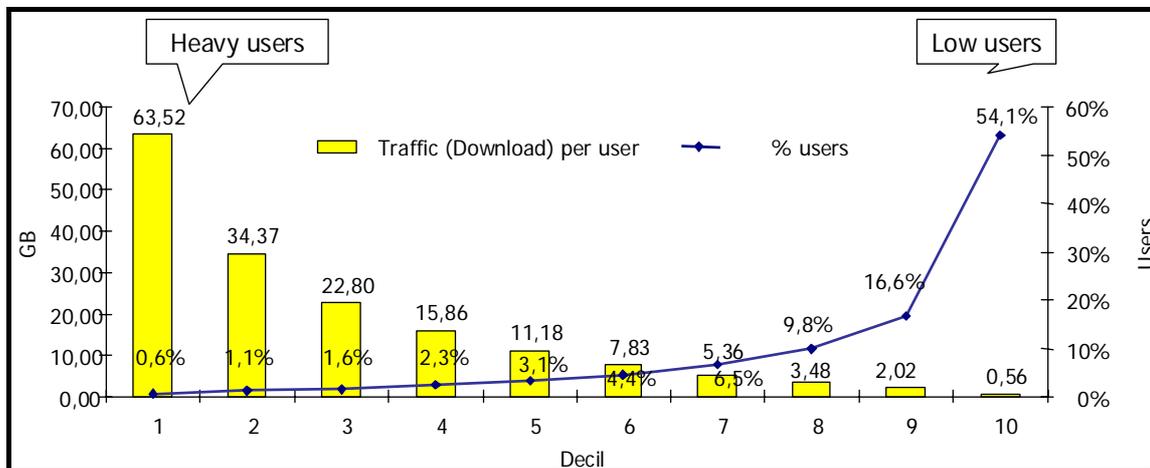


Fig3: Heavy users in Telesp (Sao Paulo)

Cellcos are the next “heavy particle” to investigate. Based on strong growth in Asia and Latin America, it is estimated [Ref. 7] that there will be about 1.6 billion mobile communications subscribers around the globe by year-end 2004, of which 44% of the total will be in the Asia Pacific Region. Between 2004 and 2009, it is expect total mobile subscribers to increase at a CAGR of 8.5%, crossing the limit of the 2 billion mark sometime in the latter half of 2005.

Still the usual business in Cellcos is to provide voice services, and to some extent data. Customers are mostly “on the move”, although mobile phones at home is an increasing trend. In the last years, most Cellcos are getting closer to faster speeds, as is shown in the next figure. The question is if this means broadband.

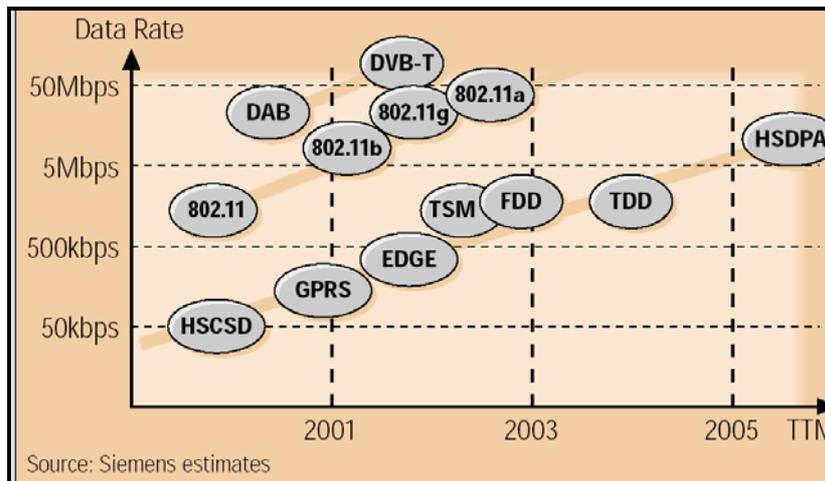


Fig. 4: Different technologies converge to faster speeds

Cellcos can provide data services according to the roll out of 3G networks. Greater data capacity will allow mobile providers to offer audio, video and interactivity to their subscribers. Mobile games and gambling are forecast to take the lion’s share of mobile entertainment revenues³.

Right now ringtones are the most common mobile audio application. In two or three years, mobile devices will provide another distribution channel for online music, although downloading music files from a handset seems rather distant, because of the lack of bandwidth. The convergence of MP3 players and mobile telephony devices will allow these music services.

Most of the references agree that 3G networks will not satisfy some speed requirements for at least the next five years. There were many articles discussing mobile devices and the investments made by European operators to acquire 3G licenses; still, most of 2.5G mobile services provide data speeds of about 20-30 kbps⁴.

Most mobile wireless operators are now upgrading their technologies. GPRS, HSCSD, and EDGE are being rolled out at a limited additional cost to GSM providers. The prospects for GPRS in the short to medium term are good because the packet-based connections alleviate network capacity problems and allow operators to offer greater bandwidth and IP-based

³ However, a real-time betting places great requirements on the mobile infrastructure’s ability to provide reliable and on-line services.

⁴ The success of i-mode in Japan happened at speeds of 9.6kbps.

services and applications to the user. 115kbps are possible with GPRS, but the actual speeds are closer to 20kbps, which will rise to over 60kbps in 2006.

EDGE technology is a further development of current GSM networks, enabling theoretical data speeds of 384kbps. In fact the user will experience about 40 kbps initially, but this will rise to over 80kbps in 2006 {Ref. 8}.

UMTS technologies incorporate several different solutions. Two of them⁵ are W-CDMA and CDMA2000. These 3G technologies have theoretical data speeds of 2Mbps. However, 40 kbps is the actual data speed and may rise to 200kbps in 2006.

While the prospects for mobile broadband are very exciting consumers will probably not see a device that can deliver mobile video streaming at a decent resolution in the next 5 years.

Table 1: Bandwidth expected for outstanding mobile technologies (Ref. 8)

Generation	Mobile technology	Theor. Data Speed (Kbps)	Actual Data Speed (Kbps)	Forecast data speed (2006) (Kbps)	Comments
2G	GSM	14.4	9.6	-	It will disappear before 2006.
2G	HSCSD	36.6	20	30	
2G	CDMA	64	20	-	Not available in 2006.
2.5G	GPRS	115	25	60	
2.75G	EDGE	384	40	80	
3G	UMTS	2 M	40	200	
4G	OFDM	20 M	-	?	Not expected until 2008

4 – Light particles: 3rdCos, MVNOs and wireless oddities.

Telcos and Cellcos are particles of gigantic mass and charge. There are, however, new and seemingly insignificant players that can affect the client perception of broadband through subtle changes or offers. Examples of this are new entities (MVNOs), cheap wireless technologies (i.e. Wi-Fi or WiMax), or smart applications (i.e. Place Lab, AirData).

Newcomers can simply form a partnership with an existing mobile-network operator, connect on their network and resell their service under their own brand. This is a “mobile virtual network operator” (MVNO). Virgin is one example in his British venture Virgin Mobile.

There are several reasons for becoming a MVNO. Network operators have realised that it is always better to wholesale spare network capacity than to leave it unused. Better still, they have also noticed that MVNOs can help them capture customers in segments where their existing brands do not reach, like Virgin Mobile with teenagers, or TracFone (owned by America Movil) for the Hispanic community in the US. Similarly, DBS Communications, another American MVNO, is doing well by appealing to urban blacks.

⁵ The emphasis put in these technologies because they are capable of offering high mobility and meet the criteria set by the ITU for UMTS.

Interest in MVNOs is also being driven by the arrival of 3G mobile networks; Cellcos want to fill them with traffic as quickly as possible to recoup their costs. Allowing MVNOs to resell airtime is another way for operators to fill their rather empty 3G networks.

Finally, regulators in some countries (i.e. Denmark), have forced operators to open their networks to MVNOs in order to boost competition. Moreover, in Hong Kong and Ireland operators were allowed to build 3G networks only if they promised to share their networks with MVNOs.

Retailers may also transform themselves into MVNOs, since they have strong brands and a network of stores through which to distribute handsets and sell airtime. They could not become a complete mobile operator, for they have not the network.⁶

Newcomers may take advantage of Wi-Fi, also. GPS satellite positioning systems often fail in downtown because high buildings block the signals they rely on. But a Wi-Fi based positioning system works best where GPS fails: in cities and inside cavernous complexes like shopping malls. And because cheap Wi-Fi technology is already appearing on a raft of gadgets like PDAs, cellphones and laptops faster than more expensive GPS receivers are, the developers predict that Wi-Fi could become central to new location-based applications.

The key is a software that constantly records the radio signal strengths from nearby base stations. It can identify the origin of the signal from a database giving the location of 26,000 Wi-Fi base stations in the US and the UK. Using the signal strength from at least three base stations, it can then triangulate the user's location. This system, called Place Lab, is not as precise as GPS. It can provide accuracy to within 20 to 30 metres, whereas the GPS average is 8 to 10 metres.

The growth of Wi-Fi means all urban areas should one day have similar blanket coverage. Once a user has Wi-Fi they won't have to buy extra hardware to use Place Lab, and the software can be downloaded for free from the web site.

If Wi-Fi has some limitations, Wi-Max may be the answer. The vast majority of Hot Spots are fed by fixed broadband. In other words, a Telco is the one who sets up the business. It may be a paradox, because HotSpots customers are essentially mobile and it could be argued that they are Cellcos customers. Wi-Fi Hot Spots have their limitations: it is not a last mile solution, but allows a "one hundred meters" solution. WiMax propose to extend the concept

WiMax is a network technology of metropolitan area based in the standards of IEEE 802.16. This wireless technology covers dozens of kilometres and could be an alternative to the connection of the last mile for home or businesses or taking wireless broadband to remote places. While Wi-Fi relates to offices or relatively small places, WiMax offers transference bigger bandwidth and reach. By comparison, the transference rate of Wi-Fi is 11mbps and a distance of 350 meters in open zones. With this characteristic, the service suppliers will not have to physically lie cable to the point of the final user to offer broadband access. But Wi-Max is still in a preliminary stage.

The next figure shows how wireless voice and data technologies combine. Arrows describe progresses –WLAN reaching wider areas, mobile increasing reach and bandwidth. 3G Red curve reflects the advance towards both reach and bandwidth.

⁶ It is interest that Telecoms firms -those that do not own their own wireless networks- may be MVNOs, also. Britain's incumbent operator BT, spun off its wireless arm, which has since been renamed mmO2, and now offers wireless service as an MVNO instead.

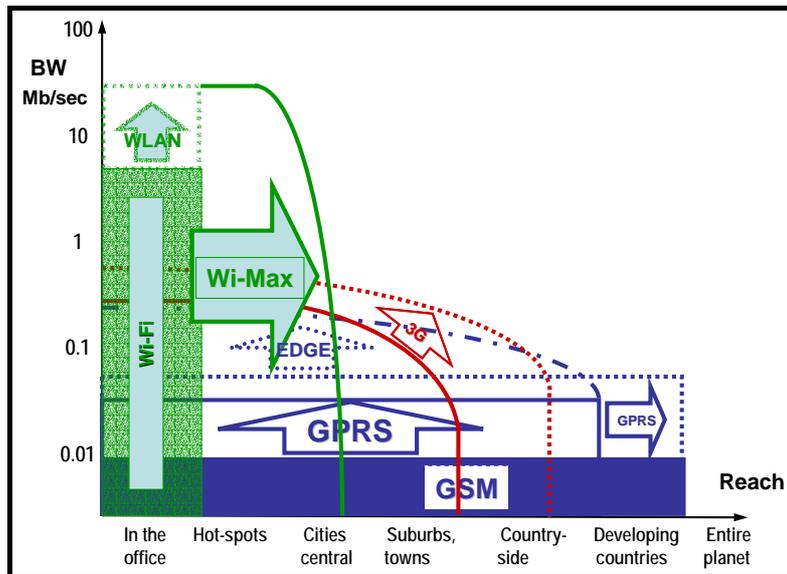


Fig. 5: converging voice and data technologies.(adapted from Ref. 9)

In order to conclude this inventory of light particles, AirData is a new mobile broadband ISP. It may challenge incumbents selling voice and data over fixed and wireless connections. It offers wireless data with DSL-speed (1024 kbps downlink, 128 kbps uplink) at a flat rate comparable to today's fixed DSL flats rates in Germany (30 to 40 euro/month). The technology involved is UMTS from the startup IP Wireless.

In a partnership with AirData, Alcatel installed in Stuttgart 20 IP wireless base stations and covers about 50 km². Functions include streaming video and Skype VoIP. The UMTS standard includes W-CDMA FDD to which the UMTS licenses are bound, and TD-CDMA TDD for which 5 of 6 German MNOs have licenses, too, that they will not use so quickly.⁷

AirData agreed with the regulator to disable inter-cell handover. But this is just to not interfere too much with incumbent MNOs in the beginning. For the users point of view, AirData is enough to enjoy broadband on a laptop or PDA with a wireless flat rate at home, in the park or the office. It is also possible to connect a WLAN Access Point to the IPWireless radio modem and provide a free temporary hotspot to the surroundings.⁸

The fee has a fixed rate of 20 Euros with an added variable for traffic. The threat of this service for a Telco is clear: there is no need for a fixed line. The opportunity is to connect far away places, using broadband at a reasonable rate.

5 – Heavy interactions: technical, price and cultural aspects

In the last two chapters the main characters were introduced. What remains here is to discuss the upper side of Fig. 2. Which forces are either attracting or repelling an individual towards broadband? The following issues will be discussed:

- The technical aspects - those that technology can roughly provide or not-. In particular the main effect of technical aspects, which is speed.

⁷ FDD seems to be optimal for voice and sub-optimal for data. TDD is optimal for data and sub-optimal for voice. VoIP is data and voice at the same time.

⁸ Thus, the WLAN access point becomes a sort of portable hotspot. The access point - manufactured by Swedish company Possio- is another key element in the AirData strategy.

- The cultural issues –usability aspects included-
- The price, as the final barrier to cross in the acquisition of broadband.

In terms of broadband, **speed** is the key technological aspect. Advertising campaigns from the ISPs focuses on speed and performance, which –as was briefly introduced in the chapter three- is frequently blocked by P2P traffic.

Shawn Fanning built in 1999 a piece of software called Napster. Within a few months, it became one of the most popular software applications of all times. Broadband users logged into Napster to freely swap music files in the MP3 digital format. Amazingly, peer networking had existed for decades, but Napster generated new interest in it. All through 2000 and 2001 it was claimed that open music files sharing violated copyright laws. The legal process moved slowly, but eventually the courts shut Napster down.

With Napster shut down, users explored more web sites. In 2002 and 2003 the stars were Kazaa, Bit Torrent, Fast Track and eMule. The attractive of downloading a song or a video for free in minutes became a mass phenomenon.

In the last months thousands of US students are pushing a new service called i2hub which works with the Internet2 network. This is P2P’s paradise, created as an academic tool, but used to download or exchange music. With a T1 connection, each music file can be downloaded in 3 or 4 seconds. To complete the picture, education authorities will not monitor the content, unless there is “excessive use of broadband”. Meanwhile, recording companies association of US (RIAA) does not say whether they would take any legal action about this.

P2P applications, differing from traditional web surfing, can completely occupy the whole of the available bandwidth. P2P takes up to an average of 82% of bandwidth in Telefonica de Argentina, reaching peaks of 90% in the night valley.

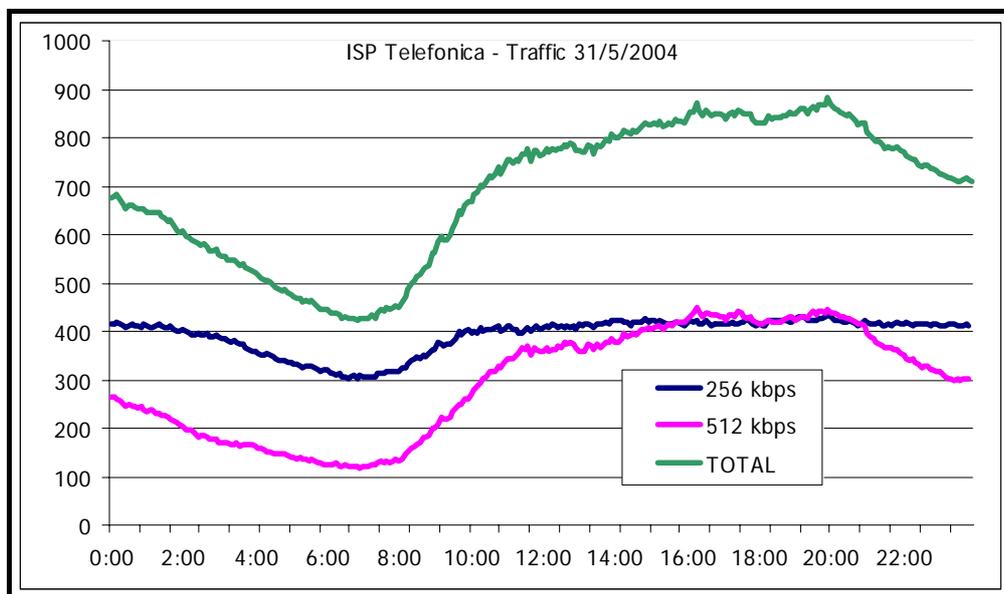


Fig. 6: daily pattern of broadband traffic (Telefonica de Argentina)

In conclusion P2P –although being a new toy for customers- represents the “killer application” for broadband, if there is a poor traffic management. For fixed operators this is a disgusting situation, for they may set up a traffic limit to the whole of the customers.

Since technical limitations to P2P traffic are troublesome and affects ISP image, one approach was to seek broadband non-flat rates of some kind (per time or per bytes). This is the “commercial” solution, although there are available some technical solutions, like set different QoS to several groups –or “tiers”- of customers, thus avoiding the easy idea of blocking the whole of P2P traffic.

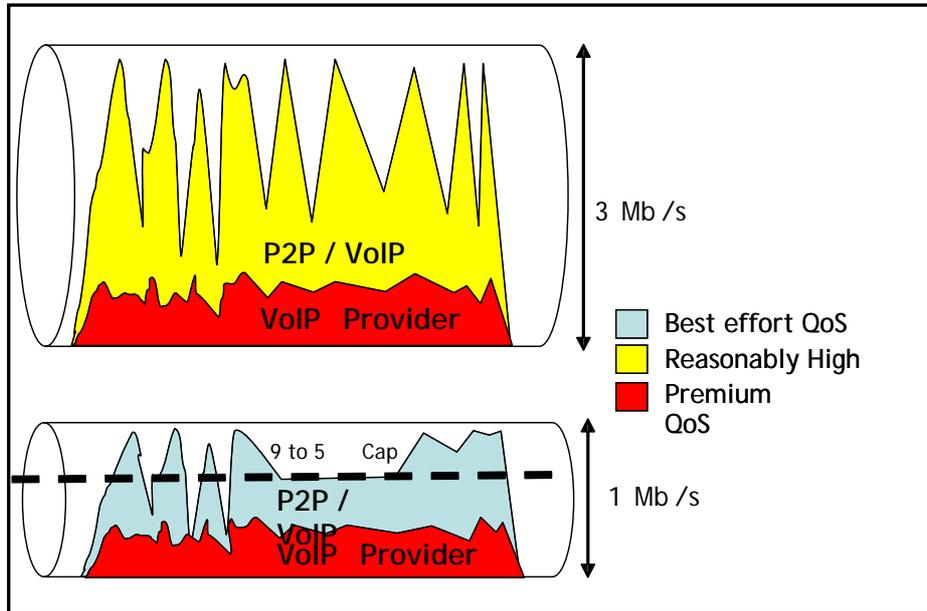


Fig. 7: Instead of blocking P2P traffic, a “Tier Management” is recommended.

An additional negative consequence of the P2P traffic is vulnerability. Millions of broadband customers are open to P2P ports attacks. Virus attacks spread quickly and may affect user perception of broadband. The issue is not longer speed, but PC performance, once virus has infected a personal computer.

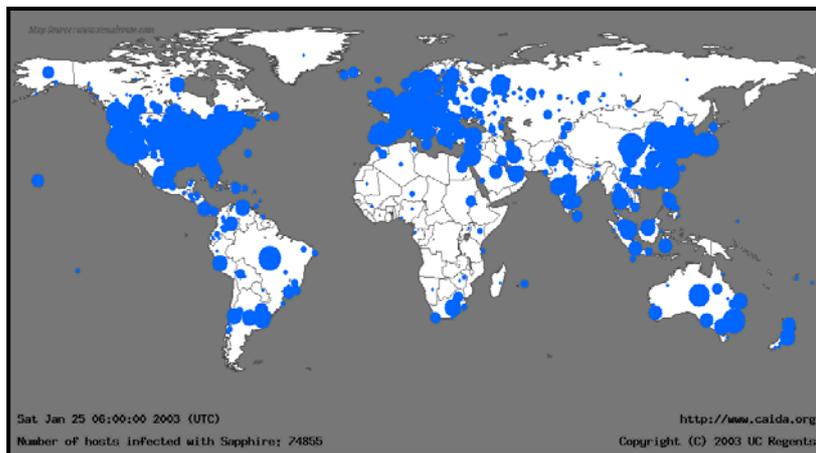


Fig. 8: Sapphire/Slammer (Jan 25, 2003): Infected 90% of the host in about 10 minutes.

P2P is not a problem of bandwidth abuse. It is mostly a **cultural change** –the second element to discuss in this chapter. Here it is useful to recall the total interaction between the individual and the technology, which is considered by a new discipline called Usability [Ref. 10]. In terms of broadband usability means explore how the user interact with applications, if he can connect modems and laptop cards, if he understands functionality of new 3G handsets, etc. The final aim is to set up communications. Broadband needs are related to a certain life style,

context and localisation. What broadband users want has to do with communication. There is a linear, evolutionary perspective on changes in the message in our civilization. The following table is a simple way to describe this evolution, which concludes with messaging (for fixed line broadband) and texting (for 2.5G-3G mobile handsets).

Table 2: Cultural Evolution of speech modes (Ref. 11, 12)

Channel / Medium	Mode	Innovation / Result	Year (aprox)	Comments
Primary Orality	Speech	Language	- 300 000	Information exchange Here and now.
Literacy	Writing	Writing	- 5000	Info exchange beyond the “here & now”.
Alphabetic Literacy	Writing	Phonetic writing	-700	Greek phonemes made writing easier. However, for centuries writing and reading was still an elite privilege.
Silent Literacy	Writing	Silent, private reading	600	British monks added punctuations signs to “Scriptura continua”. Reading aloud became possible.
Print Literacy	Movable type	Mass literacy (books)	1500	Gutenberg’s printing press invention made books less expensive. Reading became popular.
Teleliteracy - Phase 1	Electronic, audio-visual	Mass communication (TV, Radio)	1900	Birth of true “mass communication”. Orality came again, but in the form of waves of electromagnetic energy.
Teleliteracy – Phase 2	Multi-modal	Nonlinearity (Hiptertext, email)	1970	Information available at one click. The text abandon linearity (there is no begginging and end in a text). Writing returns via emails.
Teleliteracy – Phase 3	Multi-modal	Nonlinearity (Messaging, Texting, Blogging)	1995	Both messaging and texting are writing-like speech, both are very cheap. Blogs arrival.

The results of the last stage –messaging, texting, and blogging- demands high interactivity, both in downloading and uploading. Thus broadband seems to be the appropriate vehicle for these expressions. Like in gaming, poor performance means a bad user experience. In particular, emotional involvement in messaging demands speed both in typing (cultural aspect) and in the process of information transmission (the speed issue, again).

Once the technology provides a reasonable speed and P2P seems to be managed, and that the customer is eventually oriented to a given technology, remains the tough part. Going back to Fig.2: given that our Dilbert –or our mobile hero- is broadband-oriented and has surpassed some cultural barriers, he is likely to buy a broadband service. But at what **price**?

Lower, commodity-level pricing can help bring customers in the door. Many succesful DSL providers offer services at prices roughly equivalent to US \$25 - \$ 30 per month for a basic service (i.e. 256 kbps). Profitability may be minimal but the key to understanding this pricing is to examine not the basic service revenue but the total revenue per customer and the future value added services (i.e. Video on Demand) that will be deployed in the next years.

As historical price data for a relatively new service as broadband is largely non-existent, it is difficult to price broadband within the context of fundamental economic principles.

Determining price elasticity requires extensive pricing and demand data, and depends on competition in each country.

However, DSL services are considered price elastic [Ref. 13]. An increase of price would produce a larger decrease in demand, a common P-Q curve. But broadband adoption seems to depend on more than one variable.

The challenge for broadband service providers is to find ways to extend the adoption to homes still without broadband, especially if the slowing growth rate indicates that the early adopters and many of the early majority are already connected and the late majority and laggards need to be addressed. Are the right homes available to be connected? Are the remaining required investments fungible?

The actual mantra for broadband providers is to rise penetration levels. In average, Cable modem and DSL operators cut monthly rentals for services by an average of 14% in the first semester of 2004. The overall average monthly rental (in US dollars) at purchasing power parity (PPP) exchange rates, fell from to \$29.5 for DSL [Ref. 14].

6 – A weak interaction: broadband dynamics in Argentina

The aim of this chapter is to examine in detail the interactions with customers and the evolution of the competitive but rather small broadband market in Argentina. Despite the financial crash of 2002 and not forgetting the problems of both Telcos and Cellcos -income frozen in Argentine pesos, most of the costs in dollars, and with considerable debts-, broadband has almost duplicated installed lines in 2003 and will do the same in 2004.

The economic slump of 2001 and 2002 took place after three years of recession. Much of the growth of the 1990s was wiped out. In 2002, income per head was 22% below its level of 1998. Unemployment soared: at its peak it reached 21%⁹ though it has now fallen to around 15%. More than half of all Argentines dropped below the national poverty line. Economists still argue about why the 1:1 relation between US dollar and Argentine peso¹⁰ fell apart. The conventional wisdom is that Argentina's fiscal policy was incompatible with the currency board and the chronic Argentine's fiscal deficits. Even as the economy grew, public debt swelled from 29% of GDP in 1993 to 41% in 1998.

In hindsight, Convertibility was doomed once Russia's 1998 debt default provoked a stampede of capital from emerging markets. That threw Argentina into recession, aggravated by devaluation in Brazil, its main export market. Unable to devalue, Argentina had to hope that deflation would eventually improve its competitiveness.

The 2001-02 collapse was huge in its severity, although severe economic fluctuations have been the norm in Argentina for decades. Argentina seems to be not a "developing country". Uniquely, it achieved development at the beginning of the 20th century and then lost it again. Credit from the country's banking system to the private sector equalled only 25% of GDP at its peak in the 1990s, low even by Latin American standards. As a result, Argentina's economy is hostage to the in- and outflow of capital.

⁹ Including "Jefes y Jefas de Hogar", an emergency welfare programme.

¹⁰ The 1:1 ratio between US dollar and peso was known as "Convertibilidad".

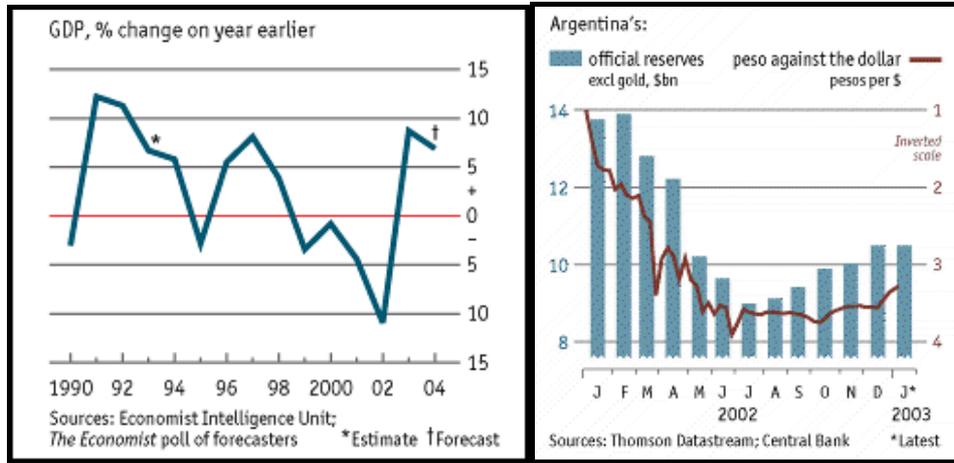


Fig. 9: A closer look to economics in Argentina: GDP in the last 14 years and evolution of reserves and peso during 2002. (The Economist, Ref. 15 and 16)

In March 2002 it was impossible to choose the price for a broadband service because of the changing relation between peso and US dollar. Telefonica stopped selling ADSL for about five months. Meanwhile Fibertel (HFC provider) and Telecom decided to keep selling. It was just a temporary bet: both DSL modems and broadband equipment for switches are investment, 100% in US dollars.

In mid 2002, when the exchange rate stabilised in 1:3, Telefonica assumed the worst part of the crisis was over. Inversion in DSLAM rose a factor 3 each year since then, and a very aggressive plan was developed to increase the ADSL penetration in Buenos Aires and the south part of Argentina. In July of 2002 there were about 90 switches equipped with ADSL, and now there are about 230. Meanwhile, the advertising budget rose amazingly in the attempt to explain to the population what broadband is –a pretty complicated task.

Since then, ADSL income grew steadily from a 1.5% of the total Telco income in 2002 to about a 5% in mid 2004. Even though competition is strong, it seems that ADSL investment proved to be the right choice.

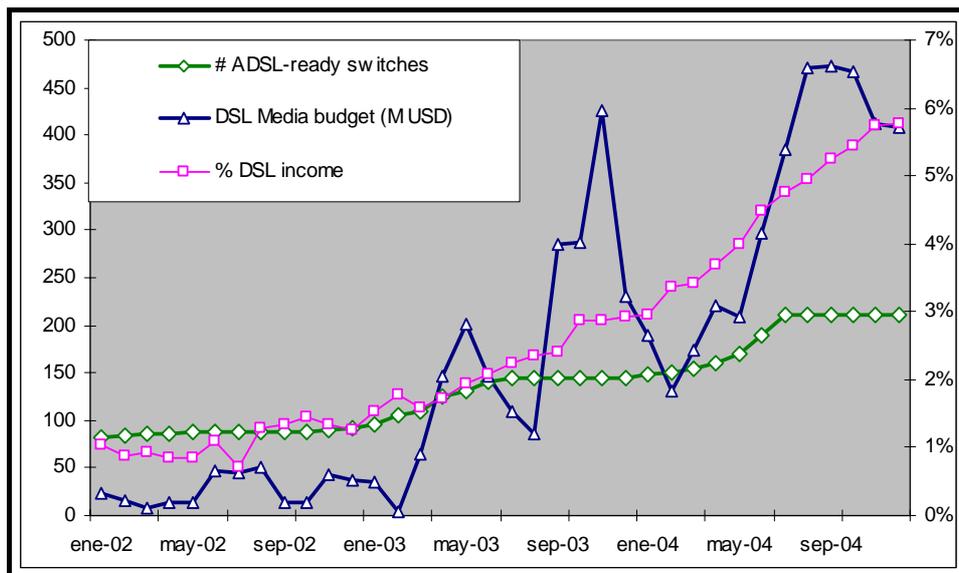


Fig. 10: Cause (investment in ADSL switches + advertising budget) and effect (% DSL income rising)

The next figure shows the map of competitors in Argentina in Jun-04. Telefonica is the incumbent in the south of the country, and so does Telecom in the north. Both of them have a mobile company (Unifon and Personal respectively); two more Cellcos (CTI from Telmex and Movicom Bell South, recently acquired by Telefonica) configure a very dynamic sector. After a series of acquisitions, Telmex (notably AT&T) rise as a third operator in the Latin America region.

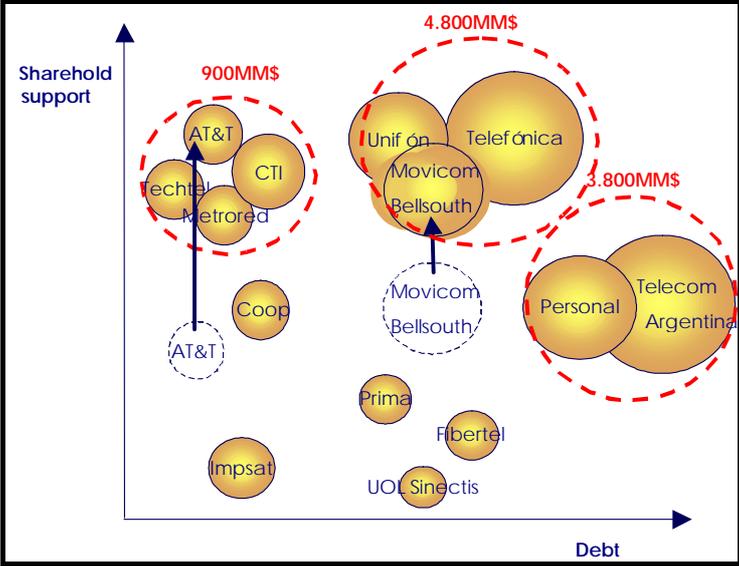


Fig. 11: Major players in Argentina. Arrows indicate acquisitions

The main players in the broadband arena are Speedy from Telefonica, Arnet Highway from Telecom, Fibertel (belonging to Liberty Media, owner also of VTR in Chile and J-Com in Japan). Two smaller players more (Prima and UOL) complete the figure of the most competitive broadband market in Latin America.

Unifon is operating with GSM/ GPRS technology. It offers the possibility to connect a GSM chip to a Nokia D311 card, which is then connected to a customer’s laptop. This is one of the first steps taken in Argentina to mobile broadband, and by no means communication with customers is not easy. Unifon assures speeds “four times faster than in TDMA or GSM” [Ref. 17]. As expected, Unifon charges a “pay as you go” tariff to the customer, allowing an active connection for hours, since the charge is for volume of data.

A final word about complex interactions in Argentina. Telefonica Mobiles has just bought Bell South in Latin America, a CDMA acquisition. For a while, in the same company, CDMA will coexist with GSM-GPRS. Notably, Telefonica Mobiles will not adopt a sole technology. America Moviles, on the other hand, owns only CDMA companies.. According to the experts deploying CDMA is more expensive –because of license costs and handsets prices. In consequence it is very likely that in a couple of years Telefonica Mobiles will converge on EDGE. In the mean time Unifon may offer to their customer the HotSpots deployed by Telefonica Fija.

7 – Conclusions

7.1 - Telcos and Cellcos: The end of the “always on” dream.

Users will prefer to pay 30 US dollars for broadband (average price) and use Kazaa-like applications for downloading files, than paying 15 US for a single CD. This is not going to change while the legal copyright debate goes on, and it doesn't get resolved by shutting down Internet sites. P2P has consequences in the whole broadband provider company.

“Pay as you go” products will contribute to enhance broadband penetration. Thus, the first need of any broadband provider –say Telco, Cellco or 3rdCo- would be satisfied. However, some concerns will remain in relation to their impact in ARPU, difficulties in the communications to the residential customers, and the need of huge changes in the procedures and systems of the company, oriented to broadband flat rate products.

Likewise, Telcos lawyers will need to redefine what “a reasonable use of broadband” is, according to each new product launched. Besides, terms of service of any DSL product should be clearly stated and communicated to any potential customer, for traffic limits will be widely used. Broadband providers must have the skills to manage their clients in groups, taking into account their interest and the income they represent. Some recent applications may help in the traffic control.

The first option –caching – is risky. Wanadoo Netherlands has suddenly dropped Joltid's PeerCache¹¹, software designed to reduce costs of network traffic by caching frequently traded files. The reason is copyright liability.

Wanadoo Netherlands believed the cache was legal, saying that several countries had amended their copyright laws to permit temporary caching and that caching only impacted the load on the ISP's network. The question here is if caching internet traffic means encouraging the use of P2P software for illegal purposes. Along with this, Telcos lawyers also have a task. They should define what is “reasonable use of broadband”.

Table 3: Possibilities in P2P traffic management

	P2P Caching	P2P Blocking	Traffic Shapping	P2P "per group" Management
ISP perspective	⇒ Legal issues (copyright?) ⇒ Reduce BW expenses.	⇒ Increses Churn	⇒ Stops abusive download of heavy users. ⇒ Technical difficulties	⇒ Costs reduction. ⇒ Satisfaction of customers.
Customer perspective	⇒ OK only for low users ⇒ Bottleneck for heavy users	⇒ Negative impact in users. ⇒ Increases claims	⇒ 2% customers involved ⇒ 50% customers complaining.	⇒ Transparent.
P2P content developer perspective	⇒ Uncertainty. ISPs take control of content ?	⇒ No P2P development	⇒ No P2P development	⇒ P2P development may nourish.
Examples	⇒ PeerCache used in Wanadoo Netherlands.	⇒ PlusNet, ETGlobal Solutions	⇒ Netintact, NetEnforcer, PCube.	⇒ Sandvine. Redirect traffic, and the ISP may set up groups.

¹¹ Peercache is built to work for FastTrack, one of the most widely used P2P protocols. Wanadoo's Dutch subsidiary was one of the first ISPs to work with the software. It cached 0.8 terabyte of frequently asked files on local servers, thereby reducing the volume of international traffic by 25%.

Cellcos migration towards faster technologies will not substitute the fixed broadband. In first place, these companies have their core business still in voice. The core business always impacts on the network, and this will not change for quite a long time. EDGE, GPRS and similar technologies are oriented to offer pure mobile connectivity services. Secondly, mobile operators do not have enough spectrum to dedicate it to data services exclusively, without deteriorate or sacrifice its “core” service, specially with the volume of clients they are acquiring. In third place users context is completely different both in circumstances –reflected in Dilbert and the mobile hero of Fig. 2 - and in the different types of communication (as shown in Table 2, where the message evolution was exhibited).

Location in maps via GPS or Wi-Fi will be an excellent application for 2.5G-3G applications. The role of content developers for Cellcos broadband providers is crucial here.

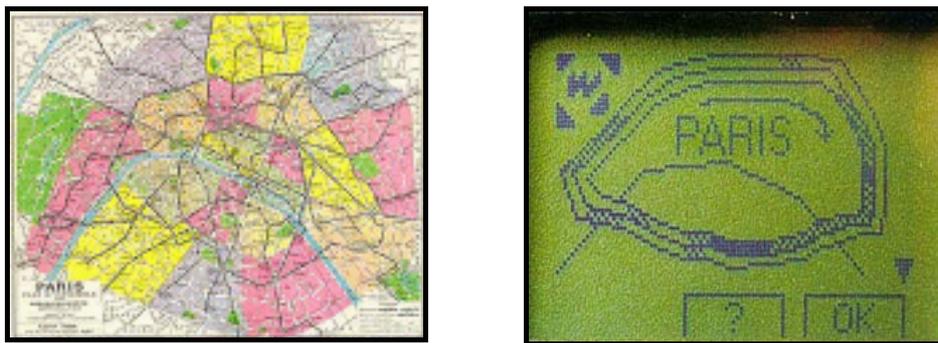


Fig. 12: Content Providers and context: 3G handset vs old WAP terminal (right).

In conclusion, it does not seem possible that mobile operators compete directly with fixed broadband providers. Assuming they have enough spectrum, maybe they limit, in these five years of transition to offer per byte data services of about 50 kbps in downtowns of larger cities.

7.2 – Wireless integration

Regarding to what has been described here as “light particles”, Wi-Fi is emerging as a partner technology and Wi-Max seems works fine in rural zones – even though is still under development. Integration with major players will eventually occur, because both means free spectrum available for carriers. The following aspects are critical for integration:

- Sniffing program: a front-end system that tells users what kind of network signals area available in a given location.
- Real-time user authentication system linked to Telcos users database.
- Handsets should manage both WLAN and 2.5G mobile technologies. Motorola CN620 is a good example. Works like a Wi-Fi handset at any HotSpot, then while the user may be wandering out of Wi-Fi range, but the phone will seamlessly transfers the call to the regular mobile network. FCC has recently approved this handset.

An expensive technology may grow in the empty spaces left by dominant and cheaper technologies. Thus, wireless broadband in the form of Wi-Fi and Wi-Max may find its place

in rural zones. Assuming that DSL follows closely the figure of PSTN deployment around big cities¹², then wireless may “cover” the holes between.¹³ [Ref. 18].

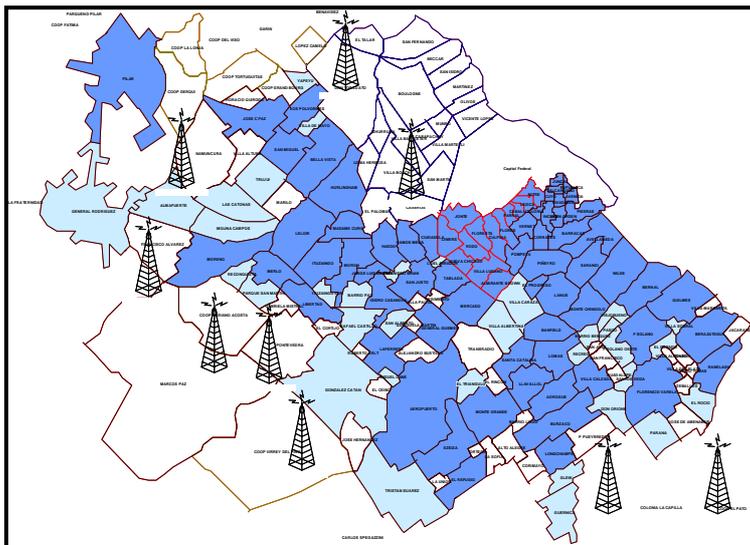


Fig. 13: Buenos Aires, with west and south suburbs, are the main operation zone of Telefonica. Blue and light blue areas represent where DSL is available, following PSTN fractal distribution. In the spaces between wireless solutions –symbolized with towers- are being tested

7.2 – And where is the Higgs boson?

Two cultural aspects deserve to be mentioned, and may help in the search of the Higgs boson –following our analogy- which means reaching broadband critical mass:

- Cultural issues: as I finish writing this, I see my daughter chatting with her friends via fixed broadband at home. The same happens with texting and blogging. I would make a *naive* advance, that is, watch what users want.
- Another hidden aspect is the low penetration of personal computers in many countries. The widespread of non-conventional broadband access terminals, like Set-top boxes, games consoles and many other will guarantee a critical mass to launch SVAs.

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¹² Actually, PSTN deployment resembles a fractal. A fractal is a shape made of parts similar to the whole in some way. Examples of fractals are a coastline, certain trees and a lightning. Besides, DSL is limited. The distance from the switch to the customer should be less than ~3 miles (~5 km).

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