



Economia delle Comunicazioni ed Internet Economics – Prof. Carlo Cambini e Prof. Enrico Ferro

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The Rise of Wireless VoIP

Abstract:

The telecommunications industry has been suffering significant changes since it was born. In the last decades, however, technology evolution has started to change end user's lives drastically. More specifically, technologies such as cell phones and the internet came to change the relationship of millions of people with the telecommunications, the forth wave, as Alvin Toffler says.

The popularity of the internet is bringing new channels for the telecom industry. Voice over IP, a technology available since the early 90's has the potential to substitute traditional voice technologies (circuit-switching end cellular telephony) improving efficiency and reducing costs.

Wireless technologies, another promising field for development, come to diversify the possible scenarios and divide specialists. Will these technologies be able to combine with VoIP and constitute a real threat to traditional telephony?

While the biggest doubts regard what the market is willing to absorb quickly, future becomes uncertain for most players in the industry. Since the only certainty is that changes are coming, the best thing to do is preparing for them.

What may happen according to the microeconomic models? How important may regulation be to define the industry's future?

This documents aims to search for answers to these questions based on the current situations and trends making use of microeconomic tools.

1 Introduction

Since the invention of the telephone in the 1870's, network externalities have been contributing to make the market for telecommunications grow steadily. Many innovations have been brought to this market and made specialists believe they would be disruptive. But disruptive innovations are not the ones that are simply drastic as the cell phone and the internet. In fact, if these technologies depended on substituting fixed telephony they would probably have died.

Facts speak for themselves. The cell phone technology is being though since 1947 when Bell Laboratories introduced police car technologies, but its further development depended on a spectrum allocation that was conceded by FCC to AT&T in the U.S.A. only in 1968. Motorola was the first to develop and patent portable device for making phone calls in 1975. The cell phone than took many



years to reach critical mass. It succeeded to grow by answering to niche demands (e.g.: business users) and by being able to communicate with the existing fixed phone network.

Many people believed that cell phones would replace the fixed telephony; however, it turned out to be more interesting to create a differentiated market of those who were willing to pay a premium price in exchange for mobility. In that sense cell phone came to complement the telecom market and even if it could have reduced growth of fixed phones network, it cannot be considered disruptive in relation to it.

The internet has also been created a long time ago, in the early 1960's. It was used in its early days to respond to Academic demands, but has soon become useful for business and military use. Only in the last 15 years the internet began to have a significant penetration in the domestic users market. The internet itself didn't seem to threaten the telephony business since it was totally focused on data transmission.

Voice over Internet Protocol (VoIP) is a technology that was developed and available in the early 1990's. It allows the use of an internet data link to transmit voice. For its essence, VoIP technology has been considered a potential threat to fixed telephony, even by some telecom companies. Since VoIP uses internet to allow voice communication, distance becomes irrelevant. That places long distance calls on the target first, but not least. In fact, actually some telecoms are using these technologies to improve their own efficiency.

In the last decade, however, not much has changed in the fixed telephony revenues due to VoIP, but it's a figure that is starting to change very quickly.

Wireless data links is a relatively new technology in what concerns providing mobility to internet users. It allows the use of internet via cell phone or personal computers, without the need of a cable connection.

WiFi (Wireless Fidelity) came to standardize and certify some wireless technologies for the use of internet through radio frequency hotspots. Such hotspots are being used to provide wireless internet access in business, home and public environments. Up to now, this technology allows access in a limited range of less than 50 meters radius.

Radiofrequency wireless internet technology is being developed to provide longer range and broader band. WiMAX (Worldwide interoperability for Microwave Access) is the most probable next generation technology for wireless internet (not considering cell phone technologies). It will allow connection from distances up to 50 kilometers in wide "low-density" areas and up to 1-2 kilometers in areas with a high density of buildings, such as a metropolis.

While WiMAX inspires a lot of possible appliances for itself, it might also associate with VoIP to be able to provide a service that can be very similar to cellular telephony and also provide complementary value added services.

The future of these technologies, however, is mainly defined both by regulation and the market, other aspects can influence this future, such as technical challenges but not so strongly as these two.

Regulation may influence the development and marketing of one technology despite the others, or may have a broader view of the current picture. In each case the scenarios are different.



Market opportunities will depend strongly on regulation issues or lack of regulation. From what history teaches us, creating critical mass and being widely adopted is possible and probable, but will these innovations manage to become disruptive for the industry?

2 The Rise of VoIP

With this great determinant innovation which in the beginning seemed an incremental innovation just adding some value to the internet, nowadays has become a potential threat mainly for the big telecommunication companies. This revolutionary development allows us to get our phone service delivered through the internet connection instead from our local phone company, but the most interesting fact, from the users point of view, is the possibility of having a pack of services (VoIP, TV, Chat, and others) offered through the same internet connection and with a sensible lower cost than the traditional telephony.

The development of VoIP depends strongly on external factors. To use VoIP up to now, a personal computer, broadband internet connection, a sound card, a headset (or a microphone and speakers), and specific software was needed. In many cases the available software depended on a server to make the conversation happen. Standardization has contributed to put many of these things together. From the software point of view, Skype, with its peer-to-peer approach simplified the connection. From the other side, the market is starting to see VoIP as a real promise and new products come everyday to ease its use. That increases the strength of VoIP as a promising technology and makes telecoms believe it will become either a threat, or an opportunity.

2.1 Technology

The secret that lies behind VoIP is the “*packetization*” of digitalized voice in order to transmit it over an IP network (such as Internet), enabling an user to take advantage of the unused bandwidth of his actual connection eliminating or reducing at a grate rate his actual voice services.

In this way almost without any further investment done by an user or ISP, using the actual routing devices, voice can be transmitted together with data taking advantage of technologies such as QoS that let data and voice coexist in a very efficient manner.

Companies such as Dialpad and Net2Phone based their business model on selling International Calls at very low rates (at the beginning they were just giving them away!), then emerged companies such as Vonage that were basically selling hardware and service together to plug into the internet connection without the need of a computer enabling the user to call and be called anywhere an Internet connection was available. Nowadays Skype has emerged with the Peer-to-Peer technology and its philosophy is “let’s talk for free”. Skype is trying to position itself as a standard in the business, leading hardware industries to create hardware surrounding its service.

VoIP makes easy some things that were difficult with traditional phone networks:



- Incoming phone calls can be automatically routed to your VoIP phone, irrespective of where you are connected to the network. Take your VoIP phone with you on a trip, and anywhere you connect it to the Internet, you can receive your incoming calls.
- Call center agents using VoIP phones can work from anywhere with a sufficiently fast Internet connection.

2.2 Drawbacks

VoIP calls have still many issues to solve before mass adoption. Some of the main drawbacks are the following:

- Implementation challenges (QoS, Latency and Jitter)

Currently the Internet doesn't differentiate the traffic that flows through it. In order to guaranty the quality of the voice, traffic must be classified and more time-sensitive services (such as voice) should have a higher priority.

- Reliability (Energy Dependency)

As computers, CPE's and all other devices are powered by the electric lines, an outage by the power company would lead also in the outage of communication, as opposed to the telephone lines that have their own powering systems.

- Emergency Calls

As it is requested by US government, an emergency call made by an user would induce in the geographic localization of the caller (as it is for the fixed and cell phone companies), but as the user might be calling from anywhere in the world, a global standard must be set in order that ISP's all through the world understand when a call to an emergency number is being done and correctly route it to the nearest attention center.

- Integration to Global Telephone Number System

Would names and phone numbers coexist? If so, how would compatibility issues be solved?

- Voice Spam

Having voice addresses accessible by anyone at no cost may lead to a wave of voice spam, as it happens with e-mail. Users may start receiving undesired calls or voice messages.

- Abuse from the customer side

Having the possibility of leaving an open voice channel may lead to abuses from the customer side. Bandwidth may become scarce for a great amount of voice traffic and quality may fall.



2.3 Efficiency

The advantage of package switching is that there is no reservation of capacity, what means that the line is equally available to a portion of any call at any time since there is no necessity of transmitting silence. With this benefit, operators can avoid the need to invest in and maintain multiple separate network infrastructures.

In the past year, the quality and reliability of VoIP technology has improved to the point that vast numbers of users have abandoned their standard telephone contracts entirely, in favor of VoIP.

2.4 Costs

In general phone service via VOIP costs less than equivalent from traditional sources. This is largely a function of traditional phone services either being monopolies or government entities. There are also some cost savings due to using a single network to carry voice and data. This is especially true when users have existing under-utilized network capacity that they can use for VOIP without any additional costs.

We can reinforce this concept with the words of Mr. Zennstrom, one of the founders of Skype: "We want to make as little money as possible per user because we don't have any cost per user, but we want a lot of them". This is the exact opposite of the traditional business model in the telecoms industry based on maximizing the average revenue per user. This can be the reason of why operators are moving towards flat rate pricing plans for traditional telephone service, so the marginal price of making calls falls to zero.

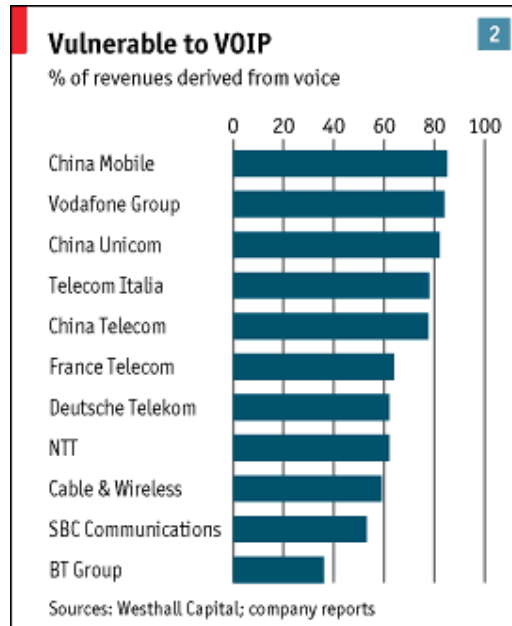
2.5 Issues on Regulation

We can find on one side people who believe that in complete absence of rules protecting competition, industries that display strong network effects like the internet have a tendency to drift toward monopolization, most probably through the aggressive takeover of rivals.

On the other side, there's a conviction that regulating VOIP would be fundamentally wrong, as it fails to grasp the shift in competitive dynamics and the revolutionary potential of VOIP, which could be the beginning of a major paradigm shift.

In the actuality, some countries like China have very strict regulations over these matters and they consider illegal the use of VOIP, consequently, are testing diverse technologies designed to block VoIP calls made using Skype, as well as other applications.

VoIP may be the beginning of a major paradigm shift, but we notice that time and magnitude of the impact remain uncertain, as a result many organisms are hesitant to forebear from regulating until competition has proven itself sustainable. We believe some kinds of international regulation might be adopted. Its role however should be to balance needs between promoting healthy market competition and ensuring widespread VoIP adoption on a fair and equitable basis. VoIP requires cultivation in the early years as the market develops and strong regulation is most likely to diminish this development.



Source: *The Economist* print edition
Sep 15th 2005 | LONDON AND SAN FRANCISCO

2.6 Competition and Market Opportunities

With the incoming new technology, many market opportunities have surged. The costs reduction in providing VOIP and consequently the possibility of adding value to the service of telephony by integrating it with complementary features such chat, TV, high speed internet, lead to a huge potential market and a new conception of business.

Market rules are changing with the entrance of new players such as, internet services providers (ISP), backbone carriers, cable TV providers and others. This means that telecoms operators are actually facing the challenge of balancing new VoIP revenues against declines in their traditional fixed-line revenues, as flat-rate IP-based voice tariffs replace time and distance related charges.

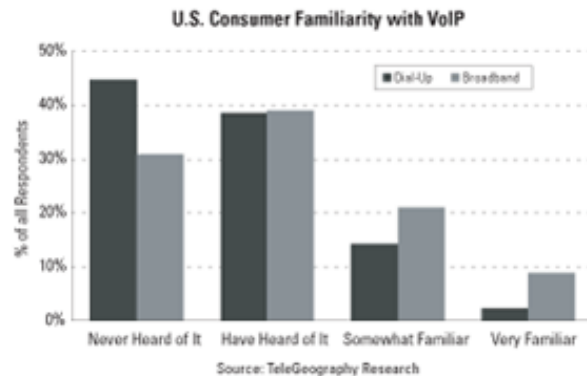
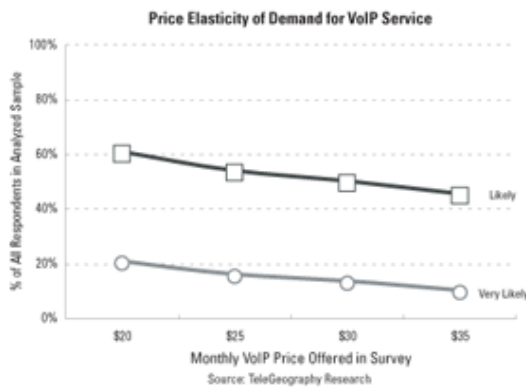
In these days we just can find about a thousand of providers with a considerable number of users and we also can observe a sustained growth through the pass of years. Although the market is still relatively immature, companies are mainly adopting VoIP in order to reduce their internal costs whether home users are experimenting a transition stage; they have both traditional telephony and VoIP service.

We believe that there is still space for every kind of competitor if they know how to manage and take profit of the advantages that this new technology brings. This is a figure that maybe about to change, depending mainly on regulation issues and standardization.

Some early VoIP service providers shared pricing experiences and indicated that VoIP faces a flat price elasticity curve and that lower prices do not always translate into higher market share gains, as customers purchasing criteria includes: quality, price and new features capabilities and value quality and features above cost.



That shows VoIP market can be very competitive and features and functionalities promise to be better differentiators than price. In the USA many enterprises are providing domestic VoIP with dedicated hardware. Their plans vary between 20 and 50 dollars and features may include calling other subscribers for free, call forwarding, voicemail and others. This diversification of services shows itself as the way to compete as standardization is still low. In the future, offering diversified features may become more difficult and having an already large amount of subscribers shall be very valuable. Acquiring them now is good strategy and is a need that is increasing competition.



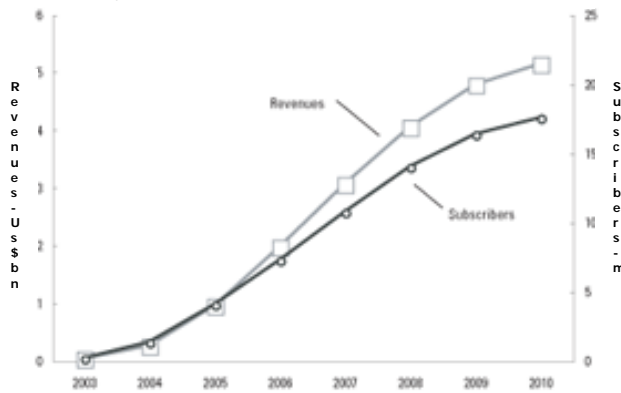
2.7 Network Externalities

Standards for interconnection are an important issue from the network externalities point of view. Many of the U.S. VoIP providers analyzed by IDC do offer free calls for other subscribers. If standards allow them to make free calls to other VoIP phones they can boost value added to clients by network externalities. While from the technical point of view it may seem a simple question, nowadays this interconnectivity doesn't exist in many cases. One good example is a Skype user trying to call a subscriber of Vonage VoIP service. Ironically, it would most likely be necessary to use the fixed network to complete the call. Solving this issue may also not be so simple by divergences of opinions. While for residential VoIP subscribers it is easy to understand they have a normal phone number, Skype users would rather keep their usernames. In fact Niklas Zennstrom, Skype co-founder believes this is the trend, "sooner or later, people will discard their unwieldy phone numbers altogether and use names, just as they do with their e-mail addresses" affirms him.

Considering the number of VoIP providers nowadays, 1,100 worldwide as estimated by Sandvine (a telecoms-equipment firm) in April, it is not hard to imagine the benefit for the development of the network an interconnection standard could bring by creating value through network externalities.

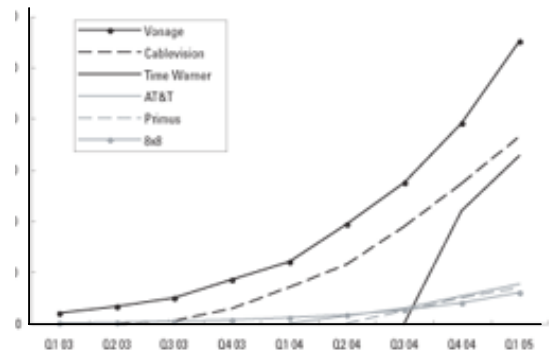


Projected VoIP Subscribers and Revenue, 2003-2010



Source: TeleGeography Research

VoIP Subscriber Growth by Provider



Source: TeleGeography Research

3 The Rise of Wireless Technologies

From the many wireless communication technologies that have been developing in the last 5 years, WiFi is probably the most well succeeded on what concerns wireless computer networks. That is surely related to the fact that Intel incorporated the technology developing as a standard the Centrino™ which is largely adopted by Laptop manufacturers nowadays. Not every laptop computer has an Intel Centrino™ processor and wireless card, but one thing that is surely hard to find is a new laptop without WiFi capability.

The adoption of the standard helped boosting the embracing of the technology, what doesn't means that other technologies have disappeared. Bluetooth for example is a technology that is also used in large scale, but mainly with different applications.

Other technologies are available or being developed to provide broadband wireless communications. Ultra wideband (UWB), WCDMA (which will upgrade GSM networks), UMTS, HSDPA (High Speed downlink pack access, an upgrade for WCDMA / UMTS R5), TD-CDMA, CDMA2000, 802.20 are only some examples.

WiMAX however, is probably the most famous one, and seems to follow some of the steps taken earlier by WiFi. While WiMAX 802.16-2004 (still not fully standardized, but already being adopted) is useful for fixed communications and offers no mobility, WiMAX 802.16e does offer and is for that reason catching much attention. Intel is willing to introduce in the market laptop computers with WiMAX 802.16e capability by 2006. That makes WiMAX a strong candidate to be the next largely adopted Wireless Broadband technology.

As the technology to be adopted maybe important by itself for specific studies, what will be taken as certain in this document is the trend for a broad use of a long-range broadband wireless technology.



Based on that assumption we can understand that there are many possible scenarios to the market. According to regulation it may become a very attractive investment and may be widely offered, or may become not so attractive and have a slow development and market penetration.

WiMAX forum has published a paper recently named 'Business case models for fixed broadband wireless access based on WiMAX technology and the 802.16 standard' in which the business of this technology shows itself very attractive. However, this study relies on very optimistic assumptions such as high population densities, steep adoption curves and high ARPU (Average Revenue per User). Despite this optimistic profitability predicted by WiMAX forum, also Ovum (an analyst and consulting company) has made a business case for this technology. Ovum with much more conservative assumptions, finds out that the business can be quite attractive, offering about 2 years payback period over capital costs. Ovum concludes that, for a good attraction of the business, a subscription density of more than 100 subscribers per square kilometer will be required.

Based on such information, we can expect many players will be willing to offer WiMAX services, even though it may still last some years for a significant demand. Early movers may have some advantages, but this will depend strongly on standardization and regulation.

Also, diverse business models may surge according to the businesses the players that are willing to enter the market have already in place.

3.1 Issues on Regulation

Regulators may see Wireless Broadband technologies in different ways, as will businesses. That may lead to interesting diverse decisions.

If regulators see these technologies mainly as a channel for VoIP to go wireless, all the regulation issues which apply to VoIP will also apply to them. The regulation issues to the association of Wireless Broadband technologies and VoIP will be discussed more deeply further on this document.

However, In-Stat, a market research company focused on communications technology, has issued early 2005 a report named "*Voice over WiMAX: The Key to Wireless Broadband Profitability?*" in which they predict that about 50% of the WiMAX subscribers will be also subscribers of Voice over WiMAX (VoWiMAX) specific services by 2009. Although In-Stat sees things this way, there may be also exclusively VoIP users in WiMAX networks.

Regardless of the technology that means that regulating Wireless Broadband as mainly a VoIP enabler may diminish the market for this technologies by half. This assumption indicates that there may be a strong pressure from providers (or candidates to) for another approach.

From the other side, telecom operators will fear the threat of these 50% (which In-Stat predicts to be 4.4 million users worldwide by 2009) and will also make strong pressure for regulation.

As mentioned before, some specialists say VoIP may push to deregulation of traditional telecommunications. As these may be a drastic scenario for the telecom industry, this opinion is a good indicator that, at least for Wireless Broadband it is a possible scenario.



From all the options regulation may offer to the market, we believe deregulation (or light regulation mainly regarding standards and spectrum sharing) would be the one to provide fiercest competition to the market. Strong regulation restrictions would most probably favor established players and disfavor competition.

We will discuss the market opportunities for each of these scenarios.

3.2 Competition and Market Opportunities

In lightly regulated markets, as In-Stat predicts, Wireless Broadband may constitute simply substitutes to ADSL or other cable modem services. As the costs of providing this kind of service will be based on installing and maintaining cell base stations, incremental cost per user will be nearly zero. This will take new players to enter the market where a high density of subscribers may be found and offer very cheap service. For many clients it may be attractive, since they would be able to gain mobility (even if it's restricted, especially if they couldn't still count with WiFi) and pay less. That business model may potentially be adopted by small and new players. Installing a station in a business center of a big city, for example, may become a very attractive business. The provider could serve many enterprises even providing mobility inside their buildings. This niche, however, promises to be good for the introduction of the technology. With the technology going popular and cheaper, residential neighborhoods and even rural may become attractive.

When the bigger companies start to enter the business, as it occurred with internet providing, it may become difficult to compete in the city centers. Larger companies may be willing to make heavier investments to cover wider areas and offer metropolitan coverage to their clients. As they will be entering a highly competitive market, they will have to offer competitive prices. The alternative for smaller players will be to merge or at least to make agreements of network use. Either way, the markets will probably tend to oligopolization as it's used to happen in markets with strong network externalities and weak protections to competition.

Metropolitan coverage will allow these new players to offer mobile VoIP capabilities (through handsets) which will then constitute a real threat both to fixed and mobile operators. The effect of this capability will be analyzed deeper further on this document, but we can assume from this perspective that some telecom operators may realize it will be interesting for them to be an early mover in providing simple Wireless Broadband access. This applies for both fixed and mobile operators.

Other kinds of businesses will also be willing to enter this market (as it's happening with VoIP in the USA and some parts of Europe). Other than current broadband internet providers, Cable TV operators, which may or not already provide internet access will find interesting to provide the service, either to reach new clients with relatively smaller investments in infrastructure or simply to avoid losing market share in the future. Other players which may find they can add value to the Wireless Broadband providing service may also feel attracted by the market. It may not be so simple to visualize new opportunities now, but the fact of being a wireless service will probably bring new and interesting businesses to market.



While we have seen that lightly regulated markets tend to drive prices down quickly by increasing competition, and then may rise slowly by adding valuable services, strongly regulated markets will react very differently.

Restrictions of many kinds may be applied and we won't go deep into details on them. Likely to happen is that, if regulation yields to the pressures of the big companies it will probably be in favor of their revenues and margins. That points to a scenario where it's very unlikely to happen that new small players enter the market pulling prices down.

As there will be a new service to provide, if demand really pulls this service to the market it will probably start with a smaller niche that is willing to pay premium price (probably for mobility). In that case, big existing players as mobile operators may choose not to invest in emerging technologies such as WiMAX, sticking to others that are "closer" to them, such as UMTS.

If the laptop market starts to be flooded by WiMAX (or other) enabled computers, however, there may be a demand which will have to be answered by someone. These will potentially be current broadband providers, provided that regulation allows them to. Either way, since they will be entering the market pulled by an unattended demand, even if competition for substitute products will be increasing, prices will start high and fall slowly.

3.3 Other Pricing issues

Depending on the player offering the service, and also from who will be willing to buy them, different pricing models may be adopted. Mobile phone operators, which are used to charge per call, are the ones that will be more likely to charge per use. This pricing model is suitable for those who are not heavy users, but need to count on mobility now and then.

Broadband providers will be more likely to provide a flat service, as will heavy users be expecting. Intermediate plans will surely appear as they do exist today both for cell phones (especially in the USA) and for broadband.

Also the regulation scenario will be important to define prices. In the high competition scenario, as we have seen, providers of Wireless access will be willing to cannibalize substitute services through low prices. They will also have to do so because if they want to create demand they will have to consider that a part of it will have to be enabled to use their technology (buying WiMAX cards for example).

Providing the equipments which allow the access to this technology is another possible move of the service providers (as cell phone operators do) but this financial cost will have to be considered in their pricing strategy.

4 Associating Wireless and VoIP

As seen before, the availability of a metropolitan long-range Wireless Broadband network will enable VoIP use in self-standing handsets. This kind of handset is already available to the market for use with WiFi technology, less than 4 years after its popularization. Accton Technology has launched in November 2005 a WiFi Skype enabled phone, quite similar to a cell phone in size and features. It is surely a sign that the same will happen for wider networks. Again, regulation will then play a critical role,



once the availability of such a set of technologies to provide final users with a capability that constitutes a obvious threat to telephone operators (either fixed or cellular).

This is also a scenario that may arrive in different ways. For example, some cell phone operators may have in sight this future and anticipate the possibility of providing Wireless VoIP making use of current technology. While this may seem a move that cannibalizes revenues for most operators, in some cases it can be a visionary strategic move.

That's the case of the German cell phone operator E-plus, which is a relatively small player in the German cellular telephony with about 13-14% of the market. E-plus is planning to allow clients to use Skype through its 3G network. The company is hoping to pressure the market while gaining valuable customers as an early mover.

Quality of Service is still a big question for Wireless VoIP. The mobility of the traffic between different networks requires complex management, greater bandwidth and processing power. WiMAX 802.16e technology, for example, doesn't provide good mobility over 100 km/h, what constitutes a problem for use of WVoIP phones in cars and trains.

Still many innovations have been left aside by important players in history for super estimating user expectations, making them late movers and leading to significant loss of revenues. This could be the case not to do the same mistake. Most of the operators who intend to invest in the technology however are waiting to see what comes with 802.16e standardization.

4.1 Network externalities

From the network externalities point of view, some interesting effects may happen. To understand them, we can assume that, despite what In-Stat predicts, not only WiMAX (data) subscribers may become WVoIP subscribers. With the availability of specific equipments (handsets) making smoother and easier the transition from cell phone to WVoIP phone, the number of exclusively WVoIP users may even overcome the number of data users. Added to that is the fact that IDC predicts, for the year 2009, a total number of 27 million residential VoIP subscribers (considering only plans which allow using VoIP without a computer through a handset) only in the U.S. If technology is available to the market, probably a good fraction of these handsets will be long range wireless phones.

While from the providers point of view it won't matter much if the users are in one group or in another, from the users point of view it does. It would be wonderful for the providers if they could sum the two groups to generate stronger network externalities. That way, the value for the users of group x would also depend on the number of users of group y and the value for both would be greater (proportional to $[x+y]^2$ for both instead of x^2 for x users and y^2 for y users). That effect may even be used by providers to generate value, by offering plans such as 'subscribe for one service and get both'.

With a nice marketing, and more specifically pricing plan, providers can use network externalities to boost subscriptions to both services. Of course, as mentioned before, it will depend strongly on the standardization and interconnectivity of VoIP services themselves. Such interconnectivity, in a world where VoIP could be used through handsets with metropolitan coverage, would mean that Niklas Zennstrom vision of the future would have arrived, even if you should call a number instead of a



nickname. It would also mean great value for customers and network externalities would contribute to turn this future very fast into the new scenario of telecommunications.

4.2 Regulation Issues

At the point in which VoIP is enabled through Wireless Long Range Broadband networks, it is likely that most regulation issues will have already been discussed and resolved. Basically because that will be a consequence of regulation over VoIP itself (if any) which is a matter already in discussion, added to the regulation over Wireless networks.

As VoIP is being discussed so intensively nowadays, it's very unlikely that, by the time Wireless networks start to spread, any regulator would look at the possibility to use them to make calls over the internet as something new.

Still, it may happen, and if it does, economic effects are quite predictable. In the markets where VoIP over Wireless becomes prohibited, which would be the most dramatic scenario, WVoIP is a market that won't grow. That way, providers of Wireless Broadband would not be able to benefit from stronger network externalities. In a way, ironically, this scenario could be similar to the most competitive scenario for Wireless Broadband, as presented before. At least in some markets, Mobile and even fixed phone operators may feel comfortable with the regulation (or prohibition) over WVoIP and keep doing business the same way. Providing Wireless Broadband only will not look so attractive for such big companies, as much as the delivery of this service by others won't be such a threat.

This lack of interest of big companies would then make small/new entrants proliferate. In some cases, as mentioned before, agreements or fusions could happen (mostly to provide wider coverage), creating some big players in the market. At this point, any change in regulations over WVoIP could generate big confusions, turning Wireless Broadband providers into WVoIP operators overnight and constituting an even more severe threat to traditional operators.

Regulators may find it difficult to deny the strength of the "VoIP trend". That way, we believe that in the long run it's very probable that even if WVoIP doesn't provide zero incremental cost per call to the end user, it will at least push prices for conventional telephony down. As we have seen, regulation interference with this trend will most likely disfavor competition and, despite the fact that it may retard the penetration of the new technologies from one side, it may have the effect of providing traditional telephony operators a higher fall from the other side.

4.3 Competition and Market Opportunities

Market opportunities will depend strongly on regulation, especially for WVoIP. The timing of companies maybe a critical success factor. Many of them are adopting a 'wait to see' approach, which, as history has many times shown, can be successful. Leading the process of change, however, maybe even be a safer strategy. In this particular case, what promises to change is the main source of revenues of telephony providers. What may not seem the most profitable strategy, for example the one being



adopted by the German operator E-plus, may avoid severe losses in a future which is difficult to estimate when will arrive.

Investing in emerging technologies is a move that many companies are likely to make. A simple 'game theory' analysis may help explaining why. Comparing fixed and mobile telephony operators options for instance, results that both gain on investing.

		Cell Phones	
		Invest	Not Invest
Fixed Phones	Invest	gain-keep	gain-loose
	Not Invest	loose-gain	keep-keep

Game theory analysis for investment in WVoIP by traditional telephony

Mobile and Fixed operators, as seen before, may reduce costs, gaining even if others don't invest. In the particular case of Fixed vs Mobile, if one of them does not invest, the other one may become a vector of fixed-mobile convergence through WVoIP, thus cannibalizing the others revenues.

If both kind of operators invest, probably they will become competitors through fixed-mobile-convergence and its most likely that in this scenario mobile operators will be in advantage, mostly by having a tradition in mobility and a whole network of mobile clients, while the others would have to conquer their market. The case in which none of them invest is more relevant if we compare with the decisions of other companies that may enter the market (as cable TV providers are doing with Broadband and VoIP).

Analyzing the alternatives for such players leads also to the interesting conclusion that all of them are likely to invest.

Supposing traditional operators don't do so, new entrants may profit a lot by

		Other Companies (Ex-ISP)	
		Invest	Not Invest
Telecom Companies	Invest	keep-profit	gain-no profit
	Not Invest	loose-profit much	keep-no profit

Game theory analysis for investment in WVoIP by traditional telephony and new entrants

cannibalizing their market. If they don't, traditional telephony is also not gaining on not investing. It just keeps its revenues as they are. If nobody but traditional operators does invest, however, they may keep their prices high and lower costs, gaining even more. If they invest and others do also, they will have the advantage of having the network of subscribers and using networks externalities in their favor. New entrants, however, could still profit.

This simple analysis shows that possibly, every player that can do so will try to enter this promising market. Of course this trend will be stronger; the more profitable business in such market shows itself. In every scenario players may strive and benefit from the rise of such technologies. The final user, however, promises to be the main beneficiary.

Naturally, initial investments are not to be ignored. For new entrants they are very relevant and must be measured well to take the decision of entering or not the market. For current players, however, and especially for cell phone operators, the most aggressive scenarios turn these investments into sunk costs, since the option of not doing them leads to certain losses.



Although real collusion doesn't seem to be a possibility from what this exercise shows, there are business and technical solutions that would allow less dramatic scenarios. In these scenarios, technologies would coexist through what is called Fixed-Mobile-Convergence.

5 *Fixed-Mobile-Convergence (FMC)*

From this simple game theory analysis it may seem that the 3 alternatives to voice (VoIP, Fixed and Cellular) could only diverge. Many specialists however disagree with WVoIP bringing such an economical impact which would make this a disruptive innovation. In the scenarios drawn, fixed telephony as we know seems most likely to disappear, but if we remember fixed telephony is usually driven by the largest Telecom operators of many countries, and that many of them have their own mobile operators it may also seem nonsense. Looking to the networks and technologies own by such an operator now, creating a whole new network using a new technology may not be a very successful idea, specially if the networks in place now can talk to each other. There is a concept behind the idea of using these networks altogether that is called Fixed-Mobile-Convergence (FMC).

In the FMC concept three technologies or other possible that may emerge will coexist in a very efficient manner taking the best profit of it. In some cases, even nowadays a mix of technical and cost restrictions diminish the use of Cell phone technology requiring large investments to have a reasonable coverage on interiors, which may not even be good (e.g.: in big buildings such as factories and malls). In such places Wireless technologies such as WiFi and Bluetooth could be used instead. Despite other questions about chargeability of the service, another question emerges "where will the "hotspot" routing devices connect?" That means, if handsets were enabled to use Bluetooth or Wifi networks, how would this network connect to other networks (supposedly even the internet)? Here is where the fixed network might take place to route a call to a fixed network or to an IP network (such as Internet) through VoIP.

Fixed network is already there and is already providing high-speed internet through ADSL. Using it integrated with new technologies makes a lot of sense, and focuses new investments where they are really needed.

Outdoors cell phone network would provide wireless cover, and could provide VoIP through already existing technologies. This is not the only possibility, though. WiMAX or other long-range Wireless technologies could be used. Handsets could even provide both capabilities.

In this way each "intelligent" device could choose automatically the network, depending on its location making transparent to the user which network is being held behind his call. This implies in very complex billing and cross payment models. This document won't go deeper in the discussion of such models, but we understand that, provided that from the point of view of the user, a single type of service is being used, a consistent pricing model will be expected. That would allow the user not to know and not to care whether network he is using.

Not only economic questions rise, but also many technical ones. VoIP for example could be adopted as dominant or coexist with traditional telephony. Although we have seen that using an exclusively data network and VoIP for voice traffic could lead to significant economies. Technology used for Internet access through personal computers is another question.



Heavy Reading recently published the results of a poll made with 109 telecommunication professionals in which 60.6% of participants believe in a FMC scenario rather than a simple cell phone substitution.

This scenario allows all users to go wireless, gives a new function to fixed telephony and offers a soft transition especially if it succeeds to arrive early. However it strongly depends on development of technologies and standardization. As it will bring complex economic models, it depends also of the development of business answers to technical capabilities. That way, big operators which are both fixed and mobile could be the most apt to lead such a transition, but may not be agile enough. Smaller players may seek the model through partnerships and agreements, but will have to do a lot of business to get there.

Either way, this future will arrive only if companies lead to it. And they may feel forced to by the threat new technologies may represent if they don't.

6 Conclusion

As we have seen, the future of the technologies mentioned in this document has many uncertainties. Trends, however, should not be ignored. Entrepreneurs, telecom operators and regulators shall know the possible scenarios to take decisions. We believe, in a simple way, they have been scratched here. It is early to take standards as certain. Some leading companies such as Skype may create standards, or may vanish.

We also believe this innovation has the potential to be disruptive to the telecommunications industry. However, some business models may be adopted to avoid it or to guarantee a soft transition. Projections show we are entering the S-curve. That means that the model that will last is not defined yet.

Companies may lead the transitions toward an FMC model, but that will require effort, agreements and much planning. As VoIP enters the scene, marginal cost (and price) per call tends to decrease. Sources of revenues may change, and companies should know the scenarios to be prepared to it.

7 References

Anderson, N. ; Poulbere, V. ; July 2005; Nomadic WiMAX: deconstructing the business model, OVUM;

Crandall, R.; Hahn, R.; Litan, R.; Wallsten, S.; 2004; Internet Telephones: Hanging up on Regulation?

Philpott, M.; January 2005; Exploring the BB wireless soup;

Stofega, W. ; Valovic, T. March 2005, U.S. Residential VoIP Services 2005-2009 Forecast and Analysis: Miles to Go Before We Sleep, IDC;

Grivolos, J; June 2005; Turning WiMAX 'Inside Out';

Delaney, J.; July 2005; Mobile VoIP: the impact on consumer mobile voice revenues;

Grivolos, J.; July 2005; WiMAX market Opportunities; OVUM;



The Economist; September 2005; The meaning of free speech;

The Economist; September 2005; How the internet killed the phone business

Internet Websites

http://digitalhomecanada.com/index.php?option=com_content&task=view&id=333&Itemid=51

http://europa.eu.int/information_society/topics/telecoms/regulatory/studies/documents/ip_final_report_execsum.pdf

<http://inventors.about.com/library/weekly/aa070899.htm>

<http://wimax.weblogsinc.com/entry/1234000873031953/>

<http://www.accenture.com/xd/xd.asp?it=enweb&xd=industries%5Ccommunications%5Caccess%5Cmc36.xml>

http://www.gstconferences.com/gst/brochures/brochures_13_rbc_report_on_2005_summit.pdf
<http://www.transnexus.com/News%20and%20Events/2005/VoIP%20Peering%20Business%20Models%20-%20IP%20Telephony.pps#277,23,Conclusions>

<http://www.networkworld.com/newsletters/wireless/2005/1031wireless2.html?nl&nltx=1107lanalert1&code=nlansalert10621>

<http://www.pulver.com/usvoipreport/surveys.html>

<http://www.voipbuster.com/en/index.html>

<http://www.wi-fi.org>

http://www.wimaxxed.com/wimaxxed_news/the_wimax_car_w.html

<http://www.wvoip.com/Logan.pdf>