Global Communications Newsletter

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IEEE 802.11 in Europe

By Enrique Costa-Montenegro, Felipe Gil-Castiñeira, and Rafael Asorey-Cacheda, Spain

Much has been discussed about wireless LANs and their future, not only in Europe, but also in the rest of the world. In the beginning they were intended to avoid cables in buildings, but new uses have been found, such as offering free Internet access in open spaces, or setting long distance links using directional antennas. The main standard adopted in Europe is 802.11b, basically because it was the first one, but also because of the problems with implantation of 802.11a in the EU.

New WLAN Usage Scenarios

Currently there are many firms offering hot spot service in airports, railway stations, conference halls, and other places. Usually companies install their own hot spots in certain places and establish commercial agreements with other access providers where they do not have coverage. In Europe, the traditional telecommunications operators (Telia, Telefonica, BT, etc.) provide these services, but there are also new companies (Kubi Wireless in Spain, Megabeam in the United Kingdom, Monzoon Networks in Switzerland and Germany, Wificom in France, etc.).

This usage scenario is also extended to cover towns or small cities. In Spain, Zamora has an Internet public wireless access network built by Afitel. There are projects to cover rural zones, like Awacat in Pènedes, Spain, or WRBB in the United Kingdom.

Analysys Research has published a report that anticipates that hot spots will grow from 1400 to 30,000 in Western Europe by 2007. Of course, regardless of the final result, these figures indicate that only a small number of WLAN operators will survive.

Legal Problems of WLANs

There are many different WLAN standards either already in existence or on the brink of ratification: 802.11b, 802.11a, 802.11h, 802.11g, HiperLan, and HiperLan/2 [1].

This problem is exacerbated for manufacturers by the fact that each country has different laws concerning the use of the bands required by WLAN equipment to transmit data. Despite this, the most well established and widely deployed standard is 802.11b, a specification that was ratified in 1999. After a slow start, 802.11b has had significant success in the enterprise market.

It is well known that 802.11b presents important congestion problems derived from DECT, microwave links, and so on. For a long time, the 2.4 GHz band was considered to have such poor quality [2] that it was exempted from licensing and useless for commercial applications. However, the appetite for wireless networks seems to have caused a rapid change of direction in many governments. Consequently, several European countries announced they were to allow commercial services to operate in the 2.4 GHz radio spectrum. Immediately, a number of companies announced plans to press ahead with the creation of wireless networks of their own. This situation could cause legal problems involving public and commercial networks competing for the same portion of the spectrum.

Lately, new concerns have arrived due to the advent of free access WLANs, managed by users that share their Internet connections. Telcos have complained about this, as they see this networks as a menace.

802.11a in Europe

One of the main differences between the European market and the rest of the world is the fact that IEEE 802.11a has not been initially approved for use in Europe due to its non-compliance with some requirements. The EU requires the devices working in the 5 GHz band not to interfere with military and government satellite networks using the same frequencies. To admit 802.11a-like devices, they must implement two requisites of the European Telecommunications Standards Institute (ETSI):

- Dynamic frequency spectrum (DFS): Equipment must be able to sense when radar or other broadcasts are present in the spectrum and avoid them.
- Transmission power control (TPC): This is a technique to reduce the power of the radio signal depending on the distance between an 802.11a card and the access point.

Some developers added DFS and TPC to its products, but due to European objections the IEEE developed a new WLAN standard, 802.11h, which is an extension to IEEE 802.11a operating in the same band and fulfilling ETSI requirements.

Some manufacturers have achieved in-country agreements to sell 802.11a devices (without DFS and TPC features), limited to undisputed parts of the 5 GHz spectrum. Intel has signed agreements for the markets in the United Kingdom, The Netherlands, and other countries.

Conclusions

As we can see, the future of wireless LANs in Europe is optimistic but unknown. They will keep doing well indoors, but legal problems compromise wide-area deployment. Will new standards take over old ones? Will wireless LANs take over 3G? The answers will jointly depend on European governments and telcos.

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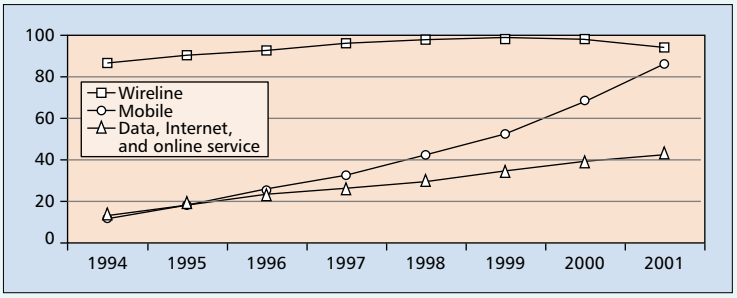
Fixed Telephony: Social Service or Business?!

By Nicolae Oaca, Romania

World Context

The deep crisis telecommunications is facing worldwide (in the last two years: over US$2 trillion decrease in market value, US$1 trillion in debt, over 500,000 employees laid off, over 60 telecom companies have declared bankruptcy, lack of confidence in corporate governance) has caused severe problems for important operators (heavy debts: France Telecom and Deutsche Telekom, over US$60 billion), and they have lost interest in Central European markets accordingly, especially in fixed telephony. Moreover, fixed telephony is a service in a descending part of its life cycle: in the United States and Europe the subscriber base and turnover are stagnating or decreasing. Since 1999 fixed line penetration in Hungary and the Czech Republic has stagnated at 38 percent. I wonder if 38 percent is the maximum penetration a country in Central Europe like Hungary could afford and, if so, what is this value for Romania, a country with a GDP per capita three times lower? In the current world context, raising funds for telecommunications in the international markets becomes difficult and could be made at higher costs.



■ **Figure 1.** *European telecom market (billions of Euros).*

National Context

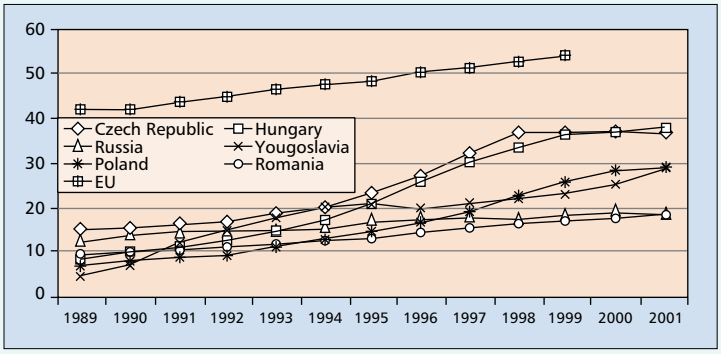
Romania is a country with a population of 21.7 million, the second market in the region after Poland by population. In the past few years, the country's macroeconomics (GDP, inflation, credit ratings, etc.) is improving. Fixed telephony using classical technology is at this time an unattractive business: higher investments and lower return due to lower tariffs than mobile telephony. With an investment of over US$600/line and some US$200 yearly average revenue per user (ARPU) compared to US$ US$200–400/line and some US$220 yearly ARPU for mobile telephony, it is difficult to expect rational investors to put money in fixed telephony using classical technology.

Romania's Post Liberalization Landscape

Liberalization permits development of three independent markets for local, long distance, and international services. New participants in the domestic long distance market can be companies that already own backbone networks: state owned companies (CTCFR, an affiliate of the railroad company with 3.530 km of optical fiber backbone network; Teletrans, an affiliate of a power company with 900 km of optical fiber network; Radiocomunicatii, 2.500 km backbone), or private companies (RCS, cable company with 2.500 km optical network; Astral Telecom, cable company with 650 km optical network). The strongest competition will be in the international market due to lowest investment: an exchange and an interconnection contract with an international carrier is enough to provide international services. Mobile operators will provide international services to their mobile clients, while Internet service providers (ISPs) will provide voice over IP (VoIP). Other potential competitors could be the above-mentioned companies in the domestic long distance market.

Due to higher investment and lower return, one could expect poor competition in the local market, specially for residential customers. Cable companies, already wired over 45 percent of Romanian households, could enter this market if they were able to raise funds, some US$200/user, to install equipment for bidirectional connections permitting services bundling: TV channels, data, Internet, and voice. However, so far there is no European success story of a cable operator entering the fixed market and successfully competing against incumbents. Here, in Europe, there are cable operators providing fixed telephony, but with a low market share; niche players. Mobile operators, whose investment per user is low, perhaps lowest, could enter the fixed market addressing the most lucrative segment, just to increase the package of provided services. Code-division multiple access (CDMA) technology used by Telemobil in the 450 MHz band (Zapp Mobile launched in December 2001) deserves a special mention. Telemobil could be the strongest competitor due to the lowest investment per user permitting lowest tariffs, excellent for a price-sensitive market strongly driven by poor macroeconomics (low average wage, etc.).

The European liberalization experience shows very strong positions of incumbents, which the world telecommunications crisis could preserve. Deutsche Telekom in Germany has a 98 percent market share in its local market after five years of competition and some 60 percent of the long distance market, while Spain's Telefonica has 90 percent of its local market. In the United Kingdom, BT has over 82 percent of its local market after 20 years of competition, losing 18 percent in 20 years, less than 1 percent/year!



■ **Figure 2.** *Fixed line penetration in Central and Eastern Europe (%).*

Fixed Telephony Tariffs

In Romania, as well as in all other countries before liberalization, local calls are subsidized by long distance calls (domestic and international). Liberalization permits the development of three markets, and forces tariffs rebalancing, putting tariffs on costs so that local call tariffs can increase slowly while long distance tariffs decrease dramatically.

In the last 13 years, forcing/keeping low tariffs, Romanian fixed telephony was positioned as a social service, resulting in poor development of telecommunications infrastructure, which ranks Romania among the last positions in Europe. RomTelecom's low tariffs after 1990 did not permit provision of quality services or infrastructure development. This is because there is a direct relation between tariffs, revenues, net profit, and borrowing and investing capacity. For instance, in Hun-

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Fixed Telephony: Social Service or Business?! (cont'd)

gary fixed line penetration doubled to 30 percent in four years between 1994 and 1997 due to use of the price cap formula, permitting US$500 million/year investment in a period when mobile telephony was in its infancy.

A government ordinance issued in 1998 just before privatization gave RomTelecom the right to adjust tariffs quarterly taking into consideration inflation/ROL depreciation, as well as a 5 percent increase per year in real terms — the price cap formula successfully used in Hungary, the Czech Republic, and other countries. RomTelecom adjusted tariffs quarterly in 1999, while in the last three years this was not possible. This is why RomTelecom has decreased tariffs in real terms: 12 percent in 2000, 4 percent in 2001, and 6 percent in 2002 considering inflation rate. Not a word on a 5 percent increase in real terms; so much for the price cap formula! Even in these conditions, RomTelecom was criticized for adjusting tariffs, forgetting the fact that mobile operators, its main competitors in the telephony market, and all the other players (cable companies, ISPs, etc.) with tariffs in US$ had protected their revenues against inflation erosion.

Technology	CDMA450	GSM900	Fixed	Cable TV
Investment (US$/line)	200–300	300–400	>600	300–400
Local tariff in peak hour (US$/min)	0.02	~0.10	0.03	
Domestic long distance call in peak hour (US$/min)	0.02	~0.10	~0.10	
ARPU (US$) in 2002	N.A.	220	200	50 for TV
Lines/employee	N.A.	>1000	~140	
Yearly revenue ($) per line for US$100 investment	N.A.	50–70	< 33	20–40
Growth in 2002 (mil/%)	0.06	1.3/35%	0.2/5%	
Turnover in 2002 (US$millions)	N.A.	820	850	130
Estimated growth in 2003 (subscriber base)	0.1 m	0.8–1.0 m	0.2m	~ 5%
Estimated turnover in 2003 (US$mil)		880–900	840–860	150
Market value (US$/user)		300–600	150–300	75–150
Ebitda multiplier for valuation		5–8	3–5	4–6
Potential market	Population	Population	Households	Households

■ **Table 1.** *A summary of telecommunications in Romania.*

Interconnection Tariffs between Desire and Reality

The new interconnection tariffs proposed by the recently established regulatory body, ANRC, express a desire, not reality: the desire a higher-efficiency Romania in general, and RomTelecom particularly, cannot afford for the time being. This seems to be a look into the future, ignoring the present Romanian fixed telephony, which means manual and analog exchanges, old fashioned equipment, overstaffing, political interference, and so forth.

Looking eastward one can observe an increase in tariffs. For instance, local interconnection tariff is on average 0.8 c/min in the EU (peak hour), 1.95 c in Czech Republic, and 2.87 c in Hungary. It is not so difficult to guess the right value for Romania, a country to the east of Hungary. It is surely not 1.15 c/min, the value proposed by ANRC! Countries have been classified into three groups. The first group is represented by the EU countries with the lowest interconnection tariffs (e.g., 0.8 c/min for local calls in peak hour), a second group is composed by candidates for immediate admission in the EU (Hungary, Czech Republic, etc.) whose tariffs are much higher (over 2 c/min for local calls). With low tariffs (1.15 c/min for local calls) Romania seems to be placed between these two groups. Nevertheless, for many reasons, Romania should not be placed between them. From a macroeconomic point of view (GDP per capita) with an average wage three times lower than countries from the second group (e.g., Hungary), decreasing inflation but still higher (two digits), and delays in the economy restructuring process, Romania is "to the east" of Hungary. And this is obvious as long as Romania's admission in the EU is planned after the admission of the Visegrd group.

From a technical point of view, EU countries, having much higher GDP than Central Europe, have terminated network digitalization. This means higher efficiency, lower operational expenditures (also lower assets depreciation), and a higher number of users per employee. Countries in Central Europe have not completed digitalization: Cesky Telecom had 95 percent digitalization in 2001 and Hungary's Matav 85 percent. RomTelecom still has manual exchanges, while its digitalization ratio is under 70 percent. Manual exchanges still in operations, as well as old analog exchanges and equipment, involve higher operational costs.

The new entrants in a liberalized market are more efficient companies (modern technologies, lower investments, fewer but more skilled personnel) than incumbents (RomTelecom has some 150 users/employee and Hungary's Matav some 300 users/employee vs. the Romanian GSM900 operator's over 1000 users/employee). To improve its efficiency to some 300 users/employee, RomTelecom should invest enough in modern equipment to be able to get rid of half of its personnel. This is not possible overnight in the existing context.

On the Horizon: The Crisis of Fixed Line Business in Central Europe

Soon, fixed telephony could become a loss-incurring business in Central Europe, an area with low GDP and average wage, and accordingly lower telecom services consumption. A prolonged world telecommunications crisis, strong competition with mobile telephony, low interest in fixed telephony, and especially an obligation to keep lower tariffs at higher investments/costs could be signs of a future crisis for fixed line business in Central Europe.

Poland was the first country in the region where telecommunications companies faced problems. In Spring 2002 TPSA, backed by France Telecom, avoided the payment of US$3.2 billion loans, and its main competitors Netia and Elektirm were not in good condition. If Netia, strongly backed by Telia, was able to avoid bankruptcy, Elektrim was not so lucky, becoming the first telecom bankruptcy in Central Europe.

In the Czech Republic, privatization of Cesky Telecom by attracting a strategic partner failed and was postponed to 2005. There are other cases of privatization failures in many

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The High Performance Switching and Routing Workshop 2003

By Marco Ajmone Marsan and Andrea Bianco, Italy

The 2003 High Performance Switching and Routing Workshop (HPSR 2003) took place in Torino, Italy, on June 24–27. HPSR is the flagship meeting of the IEEE Communication Society Technical Committee on Communication Switching and Routing.

HPSR 2003 attracted 112 submissions from 29 countries; among those, 53 papers were selected for presentation at the conference, which gathered about 130 participants from 24 countries. We are particularly proud of these numbers, especially taking into account the worldwide economical situation, the SARS spread, and the Iraqi war, that clearly had quite a negative impact on the number of participants.

The conference proceedings were published in the IEEE catalog, as both a book and a CD-ROM. Paper presentations were organized in 15 technical sessions, mainly arranged in a single-track program. The technical program covered a wide spectrum of research topics, such as switch architectures; WDM networks; scheduling algorithms; QoS issues; metro ring networks; optical burst switching networks; resilience, protection, and restoration; traffic engineering; packet lookup, classification, and forwarding; and routing. Details on the technical program are available at http://www.tlc-networks.polito.it/HPSR2003.

The keynote speech was delivered by Silvano Gai, Andiamo, USA; two invited talks were presented by Francesco Masetti-Placci of Alcatel, France, and Andrzej Jajszczyk of University of Cracow, Poland; the invited speeches also included three presentations from industrial partners (CISCO, TILAB, and Marconi), and an interesting and controversial Panel Discussion on the future of Internet routers, moderated by Nick Mc Keown (Stanford U.), with B. Prabhakar (Stanford U.), F. Bononi (CISCO), and Francesco Masetti-Placci (Alcatel) as panelists.

Two tutorials were held on June 24: Automatically Switched Optical Networks (ASON) by Andrzej Jajszczyk (Univ. of Cracow), and High-Speed and QoS Mobile Internet Architectures by Abbas Jamalipour (Univ. of Sidney).

Three papers were selected as finalists in the contest for the best paper award: "Creating Multipoint-to-Point LSPs for Traffic Engineering" by S. Ganguly, S. Bhatnagar, and B. Nath, "Benes Switching Fabrics with O(N) Complexity Internal Backpressure" by G. Sapountzis and M. Katevenis, and "Efficient Multicast Algorithms for High-Speed Routers" by D. Stiliadis; the first won the HPSR 2003 best paper award.

The conference took place under the technical co-sponsorship of IEEE, and was supported by a number of other organizations. We wish to thank all financial supporters: Fondazione CRT, Regione Piemonte, CISCO, FASTWEB, MARCONI, TILAB, Unione Industriale, Elsevier, and IEIIT, which helped us organize comfortable accomodation for all participants.

We are indebted to many individuals who made the conference possible and successful: Maurizio Munafo, Information Systems Chair, Mohammad Atiquzzaman and G.S. Kuo, TPC co-chairs, all TPC members, Advisory Board members, and reviewers who helped us in a careful paper selection process.

We hope that the 2003 edition of HPSR will be remembered as a good technical meeting and a pleasant occasion to meet friends and colleagues, and thus contribute to the success of future meetings of HPSR.

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FIXED TELEPHONY/*(continued from page 3)*

countries in the region. Bulgaria, Greece, Turkey, and Moldavia have failed to attract strategic partners for their incumbents via international auctions. Behind these failures one finds low interest in fixed telephony in the region, as well as differences in the points of view of seller and buyer. While the state, as a seller, considers it sells assets that could have a clear value (e.g., book value), the buyer buys future free cash flows, which could be strongly influenced by regulations. For instance, changes in interconnection tariffs influence future revenues, and accordingly a company's value.

According to *Public Network Europe*, October 2002 issue, Hungary's Matav believes its fixed line business could become loss-making in two to three years, warning that without quick corrective actions (tariffs increase, etc.), not only service but also quality will be affected. Considering macroeconomics differences between Romania and Hungary (Romania has GDP per capita and average wage three times lower, higher inflation, etc.), as well as differences between RomTelecom and Matav, this could happen earlier in Romania if it has not already happened. Let us remember that fixed line penetration in Hungary is 38 percent, a phone for every household, while in Romania it is only 19 percent.

If one wants to gauge the real impact of liberalization, mainly on the development of local infrastructure where there are big problems, one should consider fixed telephony a business, like mobile telephony till now. Competing with mobile telephony, fixed telephony has no chance in existing conditions (higher investment per line and lower tariffs/return than mobile telephony). Thus, in the medium term one should answer the question: do we need fixed telephony anymore? To be or not to be, that is fixed telephony!

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