Intelligence in Communication Systems Evolution, Trends and Business Opportunities

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Abstract. This paper reports the findings of recent studies on the impact of intelligence in modern/future-oriented telecom networks. The ICT/ telecommunication market evolution and future trends are presented. Subsequently, the business opportunities are also discussed. The main drivers for the evolution as well as market success are mobility, security, and intelligence in the network.

Though the global economy is still far from recovery, analysts expect the world telecom market in 2004 to exceed 1,000 billion Euros, with an impressive annual growth rate of between 3% and 4%.

Current security threats and security fiascos reveal the fact that, in spite all innovative and advanced security solutions offered by renowned companies, the security market is still quite promising. There are big business opportunities for mature solutions involving intrusion detection systems, fire walls, antivirus systems, encryption and secure mobility.

The evolution towards mobility is currently passing from third-generation to fourth-generation, milli-wave lAN and HAPS solutions in the next decade. Considering the technological evolution and the current trends, the telecommunication market will present excellent opportunities for intelligent solutions and products that provide maximum bandwidth with optimal mobility, convergence between mobile and fixed networks, connectivity on demand, and finally build, transfer, optimize, manage and operate the network.

1 Introduction

The ICT market represents almost 39% of the total world electronics market. 55% of which are generated by the telecommunication industry. Thus the telecom business is the main driving force for progress of the electronics industry and subsequently for the global economical and technological progress. This paper will report on the impact of intelligence in modern/future-oriented telecom networks, and technological trends, subsequently, the business opportunities are discussed.

2 ICT Market

The development and growth of the Information and Communication Technology (ICT) market over the recent years has been exceptional, perhaps even unique in the history of industrial change, despite the global economical disaster, and despite the political instability,

While the markets in Europe are still struggling with the aftermath of the global economic downturn, the US economy is showing strong signs of recovery.

2.1 Development of the ICT World Market

The ICT world market in 2003 exceeded the magic 2.000 Billion-Euro mark, with a quite impressing unexpected annual growth rate of 1.4 % as follows:
+ 1.2 % for Europe,
0 % for USA,
- 0.8 % for Japan and
+ 4.8 % for Rest of the World (RoW).

For 2004, the annual growth rate of ICT world market is expected even to exceed the value of 3%. (3%-4%).

Considering the split out of the ICT market, the telecom market resembles more than 55% of the ICT market, whereas the IT is less than 45% (see Fig. 1)

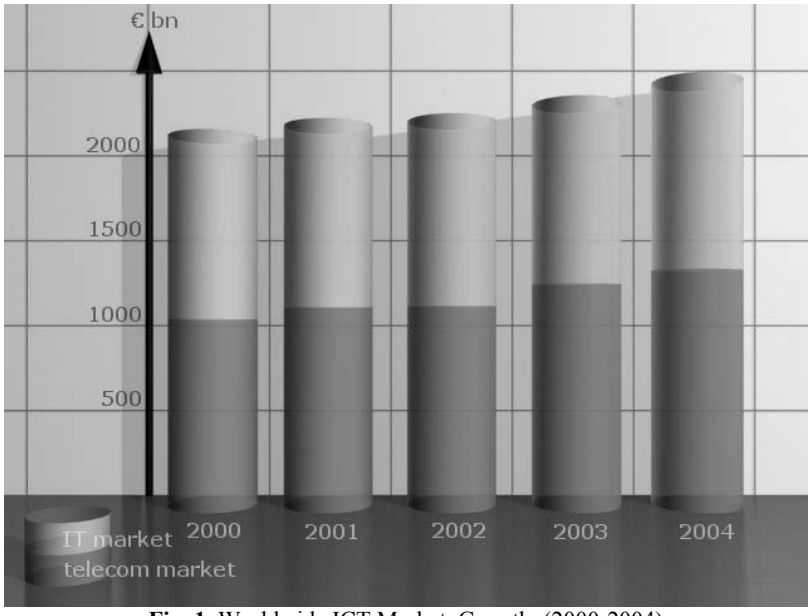

Fig. 1. Worldwide ICT Market. Growth (2000-2004)

2.2 World Telecommunication Market by Region

The current analysis considered the breakdown approach Europe, USA, Japan and RoW to take into account the mutual influence of the €, $, and the Yen.
In 2003, the worldwide communication market showed the following breakdown:

Europe	29.2 %
USA	24.5 %
Japan	12.3 %
RoW	34 %

The expected growth rates in 2004 are:

Europe	3.0 % (promising because it include eastern Europe)
USA	-0.6 %
Japan	-1.1 %
RoW	5.9 % (very promising)
Total average growth rate	2.5 %

This analysis gives a good impression, where to have a good business opportunity in the telecom world.

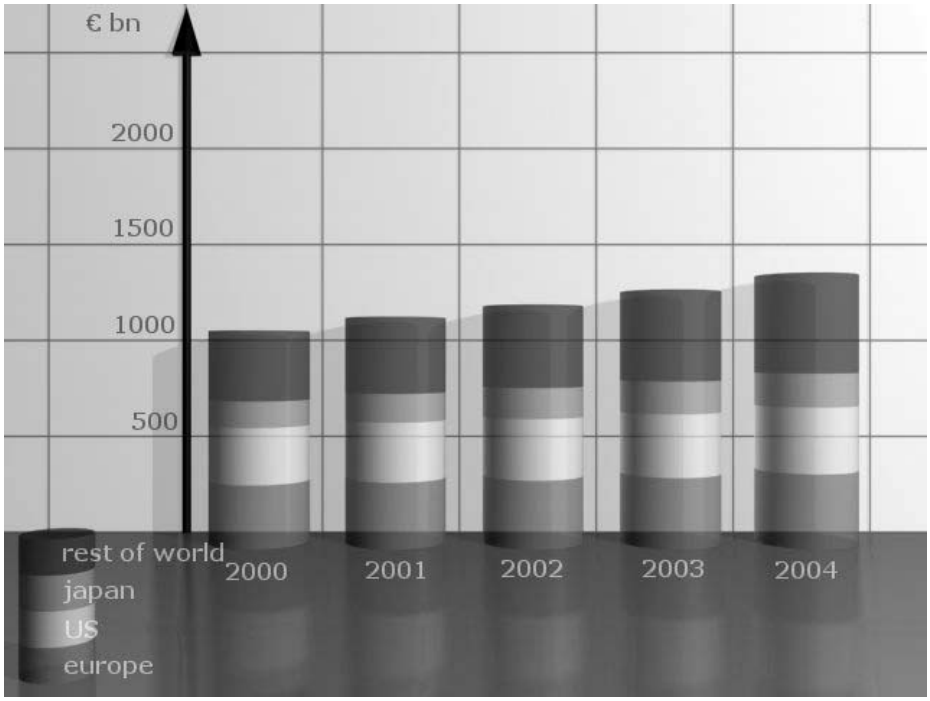

Fig. 2. World Telecommunication Market by Region (2000 – 2004)

2.3 ICT Market in Selected European Countries

The following table displays the total national Telecom Market achieved in 2003 for some selected European countries. The annual growth rate was within the range 1.5 in Greece and 3.2 % in the UK. Figure 3.

Austria: € 7.3 B
Belgium: € 9 2 B
France: € 39.5 B
Italy: € 41.1 B
Denmark: € 5.8 B
Greece: € 5.6 B
Netherlands: € 15 B
Switzerland: € 9.1B
Sweden : € 9.9 B
United Kingdom: € 57.4 B

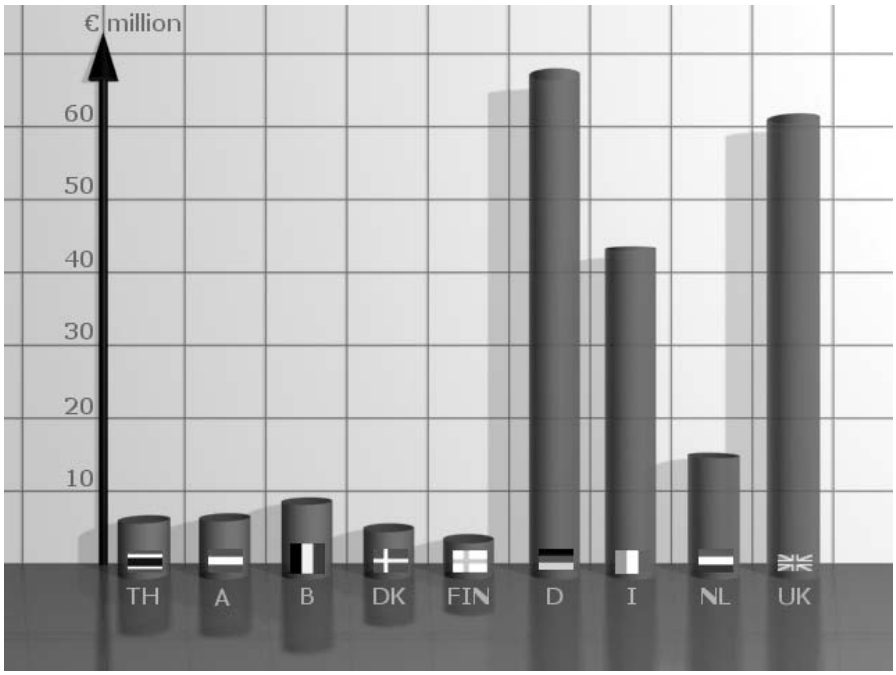

Fig. 3. ICT Market in Selected European Countries (2003) together with the conference host

2.4 Telecommunication Market in Thailand

Asia is the world's largest ICT market as well as boasting the world's fastest growing economy. Thailand, the host of INTELLCOM o4 has one of the most promising markets in Asia. Thailand's ICT market in 2003 was about $1.4 billion and is expected to grow by 12-15% over the near term. Fast-changing technology, competitive prices and the entry of new strong financial players have intensified the competition in Thailand's telecommunications market. The growth rate of fixed line telephones is relatively slow at 5-7 percent due to high acquisition costs. On the other hand, the mobile phone growth rate is incredible. The penetration rate expanded from 18 percent in early 2002 to 22 percent, or 18.5 million subscribers at the end of the year. Monthly fee cutting and value-added services such as higher data speed technologies, multimedia capabilities and short-message-services are the most important of today's sales strategies. Even though Thailand is not leading in implementing new technologies, the country has followed developed market trends on wireless technologies from analog to digital, then WAP to broadband.

Thailand's Internet usage has grown tremendously, by approximately 20-30 % year-on-year, with 3.5 million users at the end of 2002. Wireless Hot Spots are a new trend and are increasingly being deployed in business areas, commercial buildings, shopping malls, and airports. Although the opportunity for ICT equipment and services shows solid growth, the barrier for new entrants is the delay in the establishment of independent regulators in the form of a National Telecommunication Commission (NTC) and National Broadcasting Commission (NBC), as licensing and spectrum allocation is on hold until this is completed. Once established, however, these two agencies will play an important role in Thailand's communication and broadcasting sector. Best prospects for Thailand's ICT market include 2.5-3G services, high-speed Internet, wireless hot spots, e-procurement, e-government, and e-education systems.

The following table presents the highlight parameters for Thailand in a comparison with Austria.

Table 1. Thailand and Austria at a Glance (2003)

	Population (Million)	Area (Million sq. Km.)	GDP (Billion $)	Tel. Main Lines (Millions)	Tel. Mobile (Millions)	Internet Users (Millions)
Austria	8	84	245	4	6.4	3.3
Thailand	65	514	476	4.5	16	4.8

3 Security

3.1 ICT Security Market

In spite all innovative and advanced security solutions offered by renowned companies, security disasters at the international level are no more controllable. The current security threats and security fiascos get no end, from the famous worm "Sassa" to intrusion of the NASA, Visa, Microsoft, FBI, NSA and Pentagon servers, to discard whole telecommunication networks .

Thus security issue is getting more and more importance in every business aspect, especially telecommunication.. With the growing use of voice and data communication to transfer sensitive corporate information, and global use of the Internet as a data and information highway, it is now essential for companies, organizations and public authorities to realize security strategies. In all considerations about security, it is essential to take into account the magic CIA triad – Confidentiality, Integrity and Availability – the key factors of each security solution.

Though the ever-lasting global economical disaster, a continuous increase in the ICT market is expected. From one side the current security threats act as motivation to spend and increase security budget, from the other side, ICT industry, especially communication companies, will do everything to avoid more security fiascos, which would mean, end of business.

An illustrative example is security market in Western Europe. In 2002, ICT security spending was some € 9.6 billion. This number increased rapidly to € 12.1 billion, and expected to exceed € 15 billion this year (2004). Almost 34 % is spent internally and the remaining is spent externally.

With the increasing awareness and pressure to introduce and improve ICT security, total European ICT security spending is expected to rise to around € 19 billion by 2005 with external spending growing to around € 12.5 billion

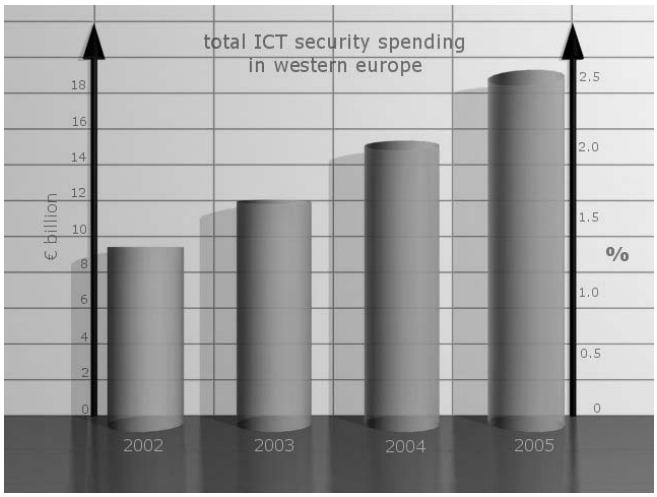

Fig. 4. Worldwide ICT Security Market

3.2 ICT Security Solutions Spending

The strong desire for the base level of protection that firewall and anti-virus solutions provide means that penetration rates of these technologies are high end users. Also recognize that intrusion detection and vulnerability assessment solutions can increase the protection levels offered by firewalls and anti-virus and have also looked to solutions that increase employee productivity and free up valuable bandwidth, such as URL filtering.

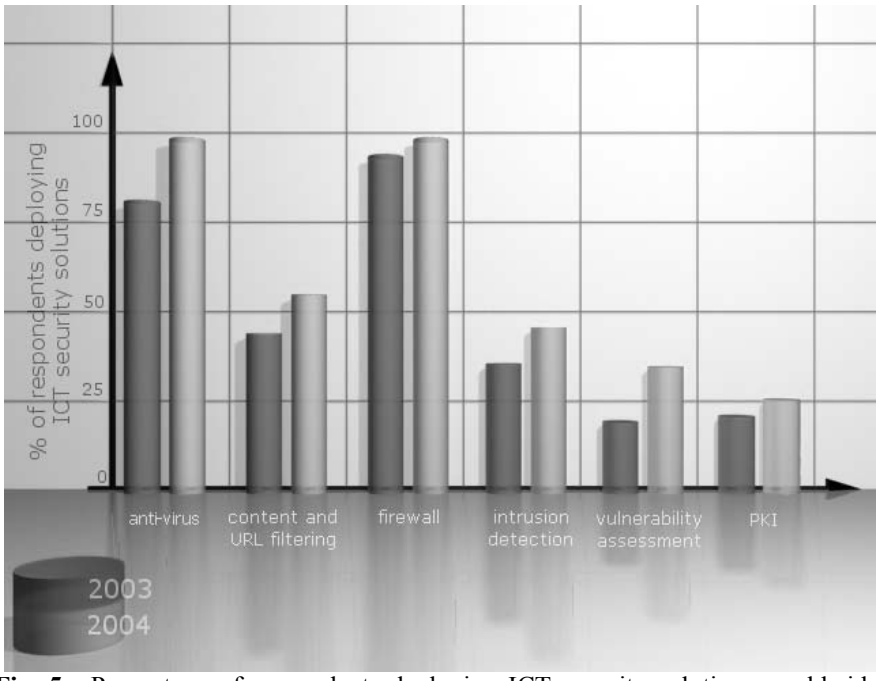

Fig. 5. Percentage of respondents deploying ICT security solutions worldwide. Comparing these percentages in 2002 & 2003 respectively, it is clear that the anti-virus detection solutions, firewall and intrusion detection solutions are gaining a continuous increasing value

3.3 Key Facts in ICT Security Market

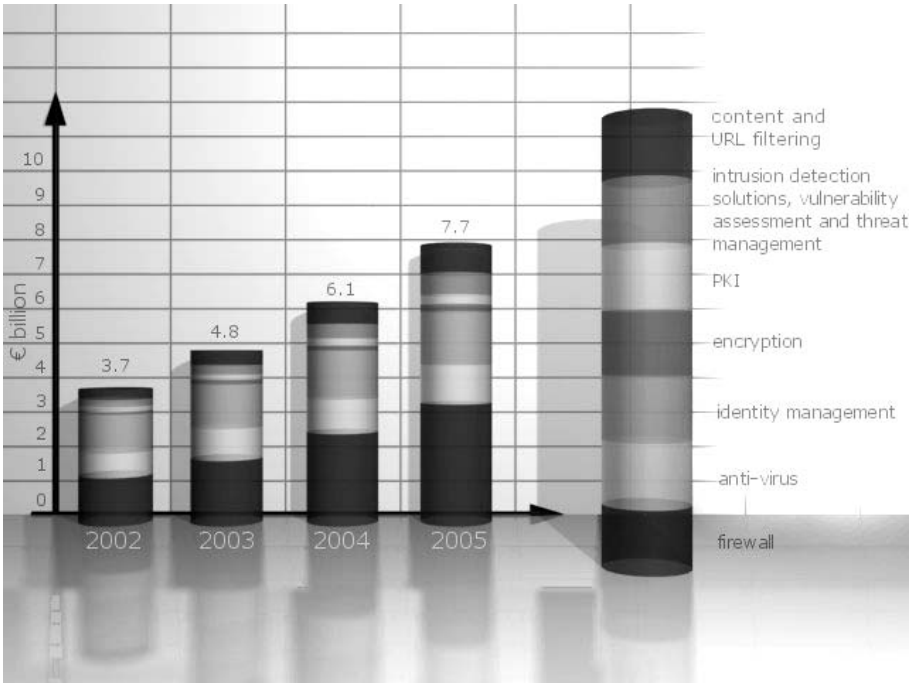

Fig. 6. Split-Out of the ICT Security Market

In 2002, the ICT industry in Western Europe spent over € 3.7 billion on leading security solutions. The main categories were firewall, antivirus and ID management for wire-line and wireless networks.

In 2003, this number increased with 30%, and it is expected to increase to € 7.7 billion in 2005.

3.4 Driving Potentials and Security Trends

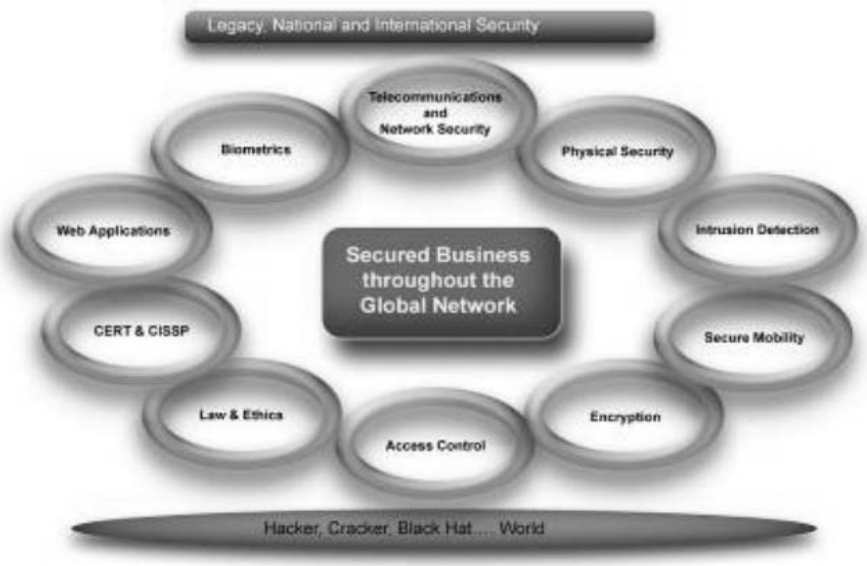

Fig. 7. Driving Potentials and Security Technological Trends

The main factors acting as driving potentials for security market and its technological evolution are: Legacy, national and international security from one side, and hacker, cracker, black hat world from the other side.

The most technological evolution progress is detected within the following sectors:

Physical Security which deals with controlling access to the most sensitive system resources, such as administration computers, servers, and routers. If unauthorized people access critical resources, all additional software and hardware security procedures are useless. Smart Card is e very good example.

Intrusion Detection Systems (IDS) are commonly implemented as distributed systems. A set of detection devices is positioned in critical points of the private network and a central device collects reports from detection devices and signals possible attacks to the administrators.

Encryption: Two basic types of encryption systems are defined depending on how keys are managed, that is, the private-key and the public-key systems. Recently, security companies presented "new" techniques in Cryptography. Here are two examples:

- Quantum cryptography provides a way to communicate with complete security over an insecure channel such as an unguarded optical fiber. The security is guaranteed by the fundamental quantum properties of light rather than by computational complexity or physical barriers to interception

- Hardware supported encryption. (Already available commercially) there are components, especially designed for online applications that allow IPsec (Internet Protocol Security) for VPN Connections and SSL (Secure Sockets Layer) transactions.

Biometrics are security techniques for recognizing a person based on a physiological or behavioral characteristic. Some of the features measured: face, fingerprints, hand geometry, handwriting, iris, retinal, vein, and voice. Biometric technologies are becoming the foundation of an extensive array of highly secure identification and personal verification solutions. As the level of security breaches and transaction fraud increases, the need for highly secure identification and personal verification technologies is becoming apparent. Several companies are providing advanced biometrics-based solutions like ID Mouse, ID Center and ID Modules solutions

Telecommunications and Network Security: This is one of the key issues for the success of a Next Generation Network. The business trend will be more and more advanced security solutions to support emerging web applications like e-commerce, m-business, multimedia entertainment/ edutainment, emergency and critical ad-hoc networking applications and. location based application and services. IP tunneling and IPSec are expected to play big roles: IP tunneling achieves this objective by encapsulating, at the boundary between the private and the public Network. IPSec establishes a logical connection, between source and destination. The Security Association (SA), specifies security parameters configuring authentication and encryption. Several types of encryption can be selected through IPSec, such as Triple DES, RC5, IDEA, CAST and Blowfish. IPSec can work in tunnel mode and, therefore, can be used to build virtual private networks over the public internet. Considering the current global political instabilities, it is expected that a product or solution providing reliable administration and execution of Lawful Interception in the network. Note that in many national and upcoming international laws, providers of telecommunication networks are obliged to allow or perform lawful interception

CERT ® Coordination Center is an American research and development centre of Internet security expertise, federally funded. CERT (www.cert.org) offers a wide range of valuable information related to Internet security.

CISSP ® Certification is designed to recognize mastery of an international standard for information security and understanding of a Common Body of Knowledge (CBK). Certification enhances a professional's career and provides added IS credibility to the company/team. (www.isc2.org).

Secure Mobility, including innovative solutions for wireless end to end security, W-LAN security, security of mobile devices, ..etc.

4 Mobility

4.1 Market of Mobile Subscribers

The mobility of the global personal communications and the increasing demand of seamless coverage and multimedia integrated services is getting more and more urgent and important, on one hand, wideband/broadband wireless communications have very bright business perspective, on the other hand, world's huge market potential should be the source- driving force for the technical evolution and advance of this sector.

Mobility is the magic formula for every successful ICT future business. This fact is demonstrated by the development of number of GSM subscribers worldwide. It exceeded the one billion mark already in 2002, and still growing up. Fig. 8 displays the progress and forecast of the worldwide mobile subscribers from 2002 through 2007. Based on strong growth in Asia and Latin America this number will exceed even the 2 billion mark In 3 years.
Overall, it is estimated that there will be 1.6 billion mobile communications subscribers around the globe by year-end 2004, of which nearly 750 million, or 44% of the total, will be in the Asia Pacific Region. Between 2004 and 2009, we expect total mobile subscribers to increase at a compound annual growth rate (CAGR) of 8.5%, topping 2.5 billion subscribers by year-end 2009. The number of mobile subscribers will top the 2 billion mark sometime in the latter half of 2005.

From the business point of view, this reveals the fact that mobility is a fruitful future business with promising business opportunities.

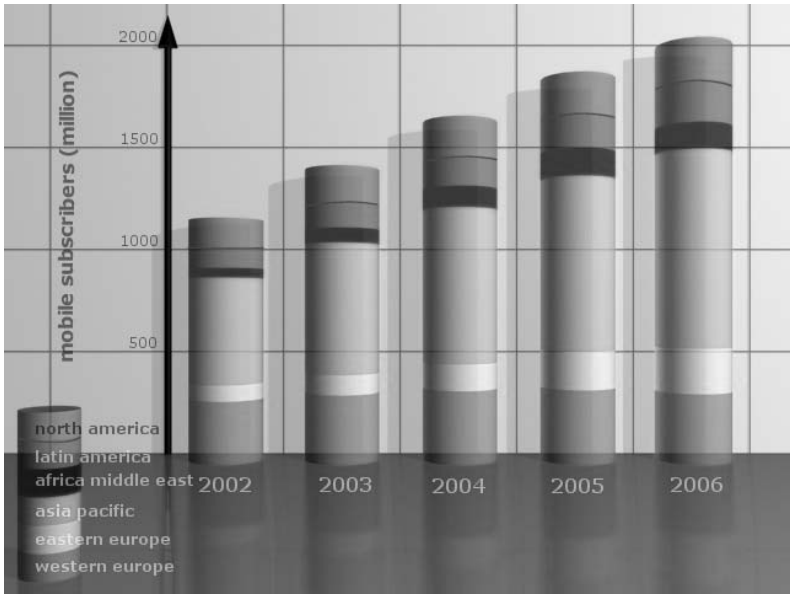

Fig. 8. Development of the Global Mobile Subscribers (2002-2006)

4.2 Technological Evolution of Mobility

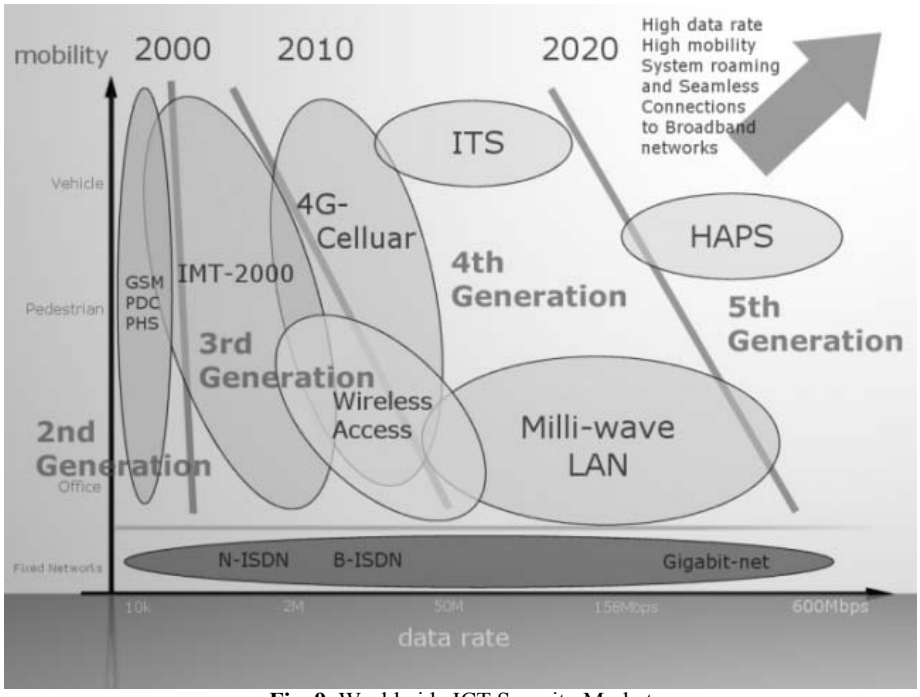

Fig. 9. Worldwide ICT Security Market

The two main factors governing the telecommunication business are: the never ending demand on more and more bandwidth and the increasing demand on more mobility. These two factors are inversely affecting each other i.e. the more mobility, the less bandwidth. The evolution of the wireless technology can be summarized as follows:
Mobility evolution is currently going through third generation towards fourth generation, Milli-wave lAN and HAPS solutions next 2 decades. Telecommunication market will present excellent opportunities to intelligent solutions and products that provide maximum bandwidth with optimal mobility, convergence between mobile and fixed networks, Networks on demand, and finally build transfer, optimize, manage and operate the network.

The evolution began with 1G (Analogue cellular), This was followed by 2G (also known as (PCS) Personal Communications Services) which converts voice to digital data for transmission over the air and then back to voice. Subsequent technology is the 2.5G networks with GPRS or 1xRTT which changed existing wireless networks to a packet-switched service, thus increasing data transmission speeds. Most carriers moved to this wireless technology before making the upgrade to 3G. Finally came the 3G which combines high-speed mobile access with Internet Protocol (IP) based services, up to 384 Kbps when a user is standing still or walking, 128 Kbps in a car, and up to 2 Mbps in fixed applications. 3G can use a variety of present and future wireless network technologies, including GSM, CDMA, TDMA, WCDMA, CDMA2000, UMTS and EDGE.

The **4G** is expected to come next decade with the following motivations:

- Support interactive multimedia services: teleconferencing, wireless Internet, etc.
- Wider bandwidths, higher bit rates.
- Global mobility and service portability.
- Low cost.
- Scalability of mobile networks. and
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Expected characteristics of 4G are:

- Entirely packet-switched networks.
- All network elements are digital.
- Higher bandwidths to provide multimedia services at lower cost (up to 100Mbps).

5 Technological Trends and Business Opportunities

The development and growth of the Information and Communication Technology market over the recent years has been exceptional, perhaps even unique in the history of industrial change, despite the global economical disaster, and despite the political instability. While the markets in Europe are still struggling with the aftermath of the global economic downturn, the US economy is showing strong signs of recovery.

Despite the instability of the financial markets and despite the global political instability, every single day we get successes stories of telecom industries in the headlines:

Some of the recent headlines:

xx1 networks to buy xx2 for £255M .

xx3 to rename itself xx4- Communications once deal (1,4 B $) completed.

xx5 Telco expresses interest in partnering with xx6 PTT .

Global wireless users set to exceed 1.75Bn in 2007 – xx7:number of users worldwide set to grow 9% by 2007.

xx8 buys xx9 for $800M IN Stock .

Profits at xx10, beat forecasts.

(xx: stays for name of different companies)

The Big Question is now is: who still has money?, who is still ready to spend, and what for?

According to recent studies, the market in a number of regions, still offer business opportunities to the telecom industry These regions include: Eastern Europe, Far east, especially China and some of the third world countries.

The enlargement of the European Union is expected to have an important impact on the European ICT markets. ICT investment in the Acceding Countries is still below the EU average, and it will take some years to reach the IT penetration and spending levels characteristic for most countries in Western Europe. However,

From the business/technological point of view, innovation is without doubt the main success driver. Innovation is seen as "the creation of new products or services which impact the Return On Investment (ROI) at a short range base. Thus we consider the possible areas where innovation is still required, or themes, which are not jet mature enough, these are (globally): Security, Performance, Mobility, Bandwidth and Consumer Oriented Web-Applications e.g..

- Advanced technique to allow for high performance delivering VoD. Service and huge data streams multicast.
- Providing precise timing and location information, think about a higher speed physical layer
- Dynamic and efficient service systems taking into account. On the one hand, the continuous varying availability of the resources, on the other hand the fact that the resources are increasingly configurable, extendable, and replaceable
- Employing artificial intelligence to resolve and handle complex problems and optimising performance dynamics of the telecommunication networks
- Interface control and management of mobile ad hoc networks
- Mobile computing and the architecture of mobile distributed virtual memory
- Platform for web-based architecture providing common services for mobile as well as stationary access.
- Emerging technology concerning service-oriented database management system (DBMS) that provides a flexible and loosely-coupled model for distributed computing
- Bandwidth research
- Active/ad hoc networks
- Intelligent human interaction
- Smart, flexible and easy to configure web services.

6 Conclusion

The Information and Communication Technology is slowly recovering, however, the Telecommunication world provide a market full of opportunities. This paper reported on the impact of intelligence in modern/future-oriented telecom networks. The ICT/Telecommunication market evolution and future trends were presented. Subsequently, the business opportunities were discussed. The main drivers for the evolution as well as market success are mobility, security, and intelligence in the network.

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Internet Society: http://www.isoc.org/
Internet Surveys: http://www.nua.com/
InterPlanetary Network Special Interest Group: http://ipnsig.org/
Mobile Wireless Internet Forum (MWIF), http://www.mwif.org/
Next Generation Internet: http://www.ngi.gov/
OVUM: http://www.ovum.com/
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