BRIDGING THE GAP: TAKING TOMORROW'S NETWORK INTO TODAY

THE CASE OF THE ITALIAN REPUBLIC

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1 INTRODUCTION

Throughout history there has always been people who have led the way. In 1871 Antonio Meucci [1]filed a patent caveat for a telephone device and in 1895 another inventor Guglielmo Marconi[2] built the equipment and transmitted electrical signals through the air from one end of his house to the other, and then from the house to the garden; thus becoming the inventor of the first practical system of wireless telegraphy. Ever since, Italians have continued to be at the fore in telecommunications.

At the dawn of the 21st century, information and communication technologies are revolutionizing the functioning of the economy and society, and are generating new ways of producing, trading and communicating.

The ICT sector and media is experiencing many different forms of convergence: technological, network and content convergence. One further crucial area of convergence is the way in which different and diverse platforms for delivering services are coming together.

The next step is to complete the path towards a fully Italian ubiquitous network society.

1.1 Why Italy

Italy is well positioned to lead and shape the future development of not only technologies but also their impact on Italian life and work. With a view to achieving maximum impact in economic and social terms, effort should focus on the future generation of those technologies in which computers, interfaces and networks will be more integrated into the everyday environment and will render accessible, through easy and "natural" interactions, a multitude of services and applications. This vision of "ubiquitous networks and next generation networks" seeks to place the user, the human being, at the center of the future development of the knowledge-based society.

According to the Observatory's data[3], in mid-2005, 19 per cent of Italy's 22.2 million households had broadband access, while 37 per cent of the country's over 4 million businesses had fast connections and 61 per cent of government was connected via broadband, ranking Italy among the leaders in Europe in the uptake of this digital infrastructure.

Moreover, Italy has one of the highest rates of mobile phone ownership in the world; the country currently ranks second worldwide in terms of mobile telephony penetration levels per 100 inhabitants[4], first in total number of mobile subscribers in Europe and boasts one of the highest per capita short message service (SMS) usage rates in the world.

Furthermore by 2006, digital terrestrial television, with its mould breaking, interactive and single-theme channels, will have replaced analogue television completely.

1.2 About the report

In 2004/05, Italy was selected as one of four SPU case studies to be conducted on the topic of Ubiquitous Network Societies. The Case of the Italian Republic was presented in April 2005 in an ITU International Workshop on Ubiquitous Network Societies[5] and provided a concise description of Italy's path towards a ubiquitous network society.

Since then the concepts of "ubiquitous networking and next generation networks" have been receiving increasing public sector and industry attention in Italy. For this reason, and to encourage further the development of a ubiquitous network society, the Italian Ministry of Communications, the Ugo Bordoni Foundation, the Aosta Valley and the Strategy and Policy Unit is co-organizing the "Tomorrow's Network Today" Workshop.

This analysis forms part of the background research for an International Telecommunication Union New Initiatives Workshop on "Tomorrow's Network Today" (http://www.itu.int/tnt/) to be held in Saint-Vincent (Aosta), Italy, from 7 to 8 October 2005.

This ITU New Initiatives workshop serves as a forum for telecommunication policy makers, national regulators, private sector participants, and academics to discuss specific measures to overcome potential challenges, ensure that such a society is realized and, at the same time, evaluate future actions.

This paper intends to provide a concise overview of the benefits and drawbacks of the possible Italian migration towards tomorrow's networks.

2 COUNTRY BACKGROUND[6]

Italy has been a Parliamentary Republic since 2 June 1946 (following a referendum that abolished the Monarchy).

Legislative power is held by a bicameral Parliament made up of a Chamber of Deputies (630 elected members) and a Senate (315 elected members). The members of the two Chambers are elected by a mixed majority-proportional voting system for a period of five years. Deputies are elected by universal and direct suffrage, and eligible voters are those who have reached the age of twenty-five on election day. Candidates over the age of forty are eligible to become Senators.

The Head of State is the President of the Republic, elected by Parliament (joint session) and by 3 delegates from each of the 20 regions for a seven-year term. The President has a limited but highly symbolic role. He has power to block laws if he feels they are not fully financed or constitutional and can dissolve parliament in times of crisis. Executive poser is exercised by the Government, consisting of the Prime Minister (referred to in Italy as the President of the Council of Ministers) and the Ministers jointly constituting the Council of Ministers. The President appoints the Prime Minister and, on his advice, the Ministers. The Government has to enjoy the confidence of both chambers and is answerable to Parliament. The Prime Minister conducts and is responsible for the general policy of the government. He ensures the unity of general political and administrative policies, promoting and coordinating the activities of the Ministers.

Italy is made up of 20 regions, five of which are governed according to a special autonomous statute; it includes 103 provinces and 8,100 municipalities. The regions have legislative power together with the State in matters of concurrent legislation, except for fundamental principles that are reserved to state law. The regions have exclusive legislative power with respect to any matters not expressly reserved to state law. Municipalities and provinces have regulatory power with respect to the organization and fulfillment of the functions assigned to them.

The Constitution of the Italian Republic was adopted on 22 December 1947 and entered into force on 1 January 1948.

Italy was a founding member of the European Community in 1957.

3 POSSIBLE MIGRATION TO TOMORROW'S NETWORKS

3.1 Ubiquitous Networking and Next Generation Networks: Some important aspects

The possible migration to Next Generation Networks (NGN) is nowadays becoming an important issue for the major telecommunication players. The market trend shows an eventual total switch-off from the traditional Public Switched Telephone Network (PSTN) to NGN in the next ten years.

This transition is driven by several forces, or enabling factors, summarized as follows:

- structural changes on the ICT market
- new users' needs and requirements
- technology evolution

The most significant factor, among these, present also in the Italian ICT environment, is the significant development in the area of IP, in particular broadband and VoIP; this focus could represent the birth of new

capabilities for users and business opportunities for service providers and telecom operators. On the other hand, the above factors are challenges to incumbents who do not proactively respond with concrete actions to the changing conditions and thus risk losing some of their market and revenue. Although NGN is still more of a concept than a consolidated deployed framework, the impact isexpected to be significant on the ICT market, and also on businesses in general and to individual customers. NGN will help in enhancing access to communication services and more innovative and personalized services and applications. NGN will help in enhancing access to communication services and more innovative and personalized services and applications. NGN would be a basis for the UNS (Ubiquitous Network Society), where user-friendly networks can be connected at anytime, anywhere, with anything and for anyone.

Starting from the main elements composing the NGN concept and architecture, it is possible to analyze the possible impact and eventual opportunities for the operators, the service providers and the users:

- **IP Packet based network** - NGN is an integrated IP network for wired and wireless communication. Hence, it is clear that one of the main concepts behind a possible migration to NGN is the global adoption of the IP protocol. The current version of the IP (version 4) may not be enough to support the foreseen increase in the number of devices connected to the network. The introduction of a new version of IP (IPv6) is seen as one of the most important aspects in facilitating the migration to NGN. In Europe, as in Japan, the current trend is to spread and promote the use of IPv6. In particular, with the increasing use of cellular phones and other mobile devices and the growing expectations for ubiquitous networks, European countries are operating in the same context as Asian countries. We are seeing aggressive moves to support IPv6 in Europe: Germany, UK, France, Italy, Spain, Poland, Austria, Switzerland, Denmark, Portugal, Belgium and Luxembourg. As in Asia, the exhaustion of IP addresses accelerated through the growing use of cellular phones and other mobile terminals as well as the increasing number of peer-to-peer applications call for the large address space of IPv6. Supporting this trend, the European Union (EU) set up a European IPv6 taskforce in 2001. At this time two large-scale IPv6-trial networks, called 6Net and Euro6IX, were organized forwarding order to accelerate the deployment of IPv6 technology. Many network equipment vendors as well as major network operators are participating in these projects. IPv6 will likely emerge initially in those fields of the industry that focus on mobility, such as mobile networks. IPv6 features such as end-to-end reachability auto configuration and mobile IP are expected to be the key to implementing new applications.

- **Separation between transport network and service applications** - In existing networks, applications are vertically integrated with the transport layer and certain networks dedicated to a specific application. On the other hand, NGN provide an open architecture by decoupling applications and networks and allowing them to be offered separately. In this context, the applications can be developed independently regardless of the network platforms being used. With an open architecture, standardization becomes increasingly important, but this allows operators to choose the best products available and a new application can be implemented in a much shorter period of time than for the PSTN or ISDN. Content providers can also develop applications and services for end users. Service providers may package one or more applications into a service offering or applications may be utilized by users on a peer-to-peer basis. The horizontal nature of the NGN architecture could facilitate the process of decoupling the services by the underlying physical network infrastructure, as shown in Figure 3.1[7].

- **Ubiquitous services** - In a Ubiquitous Network Society, telecommunication appliances will be present in all aspects of daily life, and linking them together via networks will make it possible for business and consumers to enjoy converged services. However, comprehensive systems platform and solutions for the provision of such services are being independently developed by the ICT players, and continuation in this manner will pose issues concerning convergence and compatibility among the different systems. The key is on the service side; the migration to NGN will exploit the ubiquitous nature of the services provided to the end-users; such ubiquity has to be supported by the implementation and maintained by the convergence approach in deploying ICT services.[8] Unlike the traditional telecommunication network that was tuned towards voice, services in the NGN will go beyond voice only. Location-based services, presence-based routing, context-aware routing, user specified routing policies, plurality of communication devices (computer, personal digital assistance,

Figure 3.1: Vertical Network versus Horizontal Network
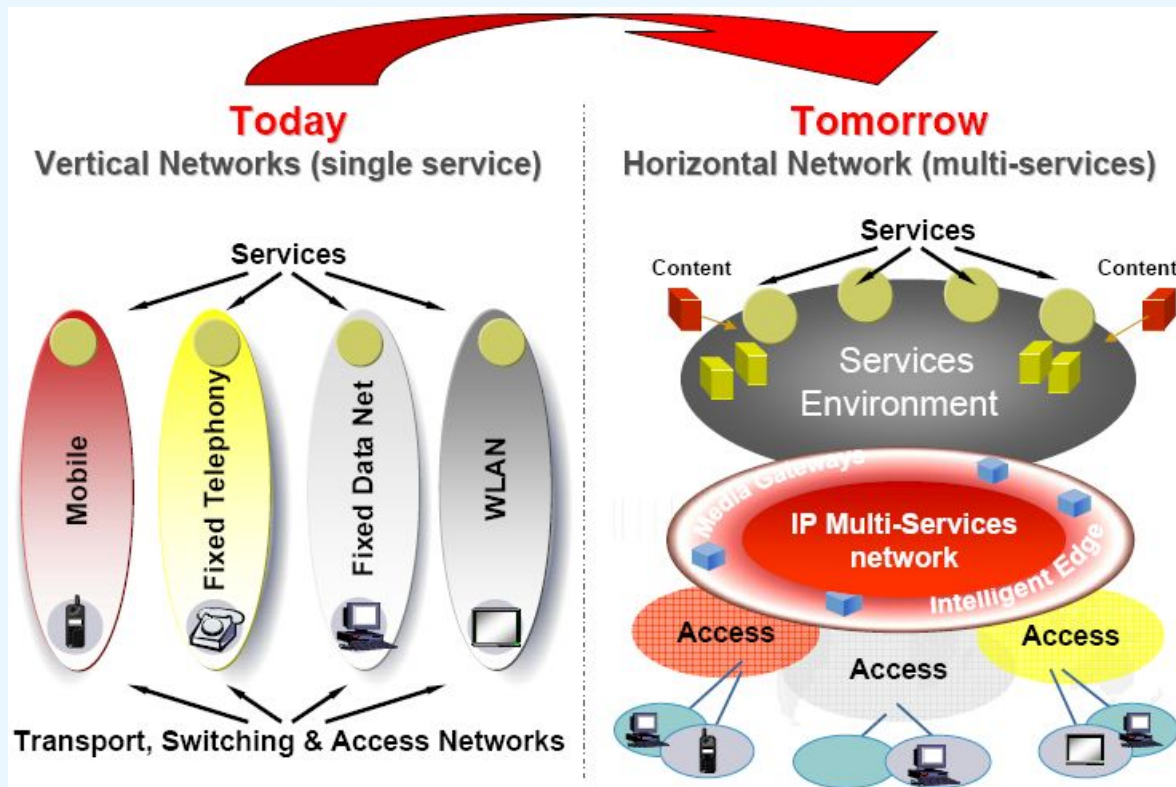
Source: Vodafone

cellular phone); all of these will engender new services[9]. Two users who wish to communicate with each other are no longer relegated to playing phone tag; the presence service can indicate to each of them when the other is accessible and the availability service can allow them to arrive at a set of suitable communication means (text chat, phone call, SMS, MMS). Another strong element supporting the ubiquitous services in the NGN implementation is the user-mobility. Introducing mobility in the fixed network is, in fact, one of the major challenges for NGN. Enabling more transparent fixed-wireless broadband communications and mobility across various access technologies seems to be a major issue. Today, there are no well-developed service control standards to support mobility for users or roaming over different types of networks. However, fixed network operators are trying to introduce mobility management in their fixed telephones. The mobile operators are also planning more on a mobile network scenario that will take charge of all the services by using the fixed network. Co-operation between fixed and mobile operators and a relevant set of standards could help to overcome the challenge.

- **Qualities of Service (QoS) -** There have been concerns as to whether current IP networks are able to deliver an acceptable grade of service to meet the expectations of customers. Some current IP networks are not able to guarantee secure delivery especially during periods of congestion. Many current IP networks are essentially 'best efforts', without any guarantee of QoS. To transform the current PSTN network to an all IP network, NGN need to ensure that the network will work reliably all the time. In a NGN environment where many different networks will be connected with each other and different types of services delivered, limitations in the interoperability between different vendor equipments can deteriorate end-to-end. Therefore, it is important to reach agreement among different systems on end-to-end QoS suited for each different type of data stream, and to set the parameters with upper layer protocol to control the lower layer, transport and access level QoS mechanisms. In addition, there is insufficient information at end-user interfaces to enable them to select among connections with different QoS parameters. The quality of the access for some end-users is also insufficient to support satisfactorily the full range of applications. Greater availability of high-speed broadband access and other capabilities will help address this.

3.2   Forces of convergence

Convergence of networks is a concept that can have several meanings and perceptions, depending on the context. The following are some of the most common definitions.

- Integration of voice and data on a common platform delivered to a single device such as a PC, or an IP-phone.

- Merging of fixed and wireless networks, making all services independent of access technologies In essence, this means providing the same services independently of how we access the network.

- Making networks transparent to applications. Here, the focus is on the de-coupling of service provisioning and technology, allowing services to be carried and delivered across different network types.

- Convergence of services, integrating voice, data and applications into business solutions. Services convergence is the marriage of applications and multiple services bundled as a single option.

In the Italian context, all of the above definitions have been embraced and taken into account by the players who have tried to reach an integrated, converged environment to deliver their services.

In a wider context, a convergence can be seen as an intelligent integration of as many technologies and services as possible, to facilitate the transparent, secure access to added value ICT service. The figure 3.2 represents this vision.[10]

One of the newest forces to emerge from the Italian market, especially in light of the current state of development of the mobile and broadband world, is the concept of **Fixed Mobile Convergence (FMC)**.

Traditionally, the term Fixed Mobile Convergence has been used by the telecom industry when discussing the integration of wire line and wireless technologies. A decade ago, the telecommunication industry started to discuss fixed-mobile convergence. Even though the theory was right, the relatively immature technology meant providing convergent services in an efficient way to end users was very complex.

With the rapid emergence of NGN implementations, Italian network operators now re-evaluate convergence and see it as an opportunity to create stickiness and provide more value to subscribers. Example of convergence-related services and implementations available today are:

- User services:
  - Bundling of fixed, mobile and broadband subscriptions
  - Triple play (telephony, internet and IP TV via broadband)
  - Single phone number
  - Single mailbox

- Devices
  - Seamless WLAN/2G/3G connection
  - Multi access mobile phone with both licensed and unlicensed mobile access
  - Media and PC functionality in mobile access

- Networks
  - Layered architectures with NGN

While technology was a limiting factor some years ago, it has today reached a level of maturity that enables convergent services to become a reality or to become a viable proposition. One advantage that now makes convergence a reality is the evolution toward one common NGN network, which is IP based. Furthermore, high-speed broadband connections, both fixed and wireless, make it possible to offer convergent multimedia services, independent of access type. (See Box 3.1).

Within the Italian context, the framework that is advancing the most is *Unlicensed Mobile Access (UMA).* UMA allows operators to use broadband and wireless LANs as an alternative low-cost access network to the

Figure 3.2: Service Convergence Concept
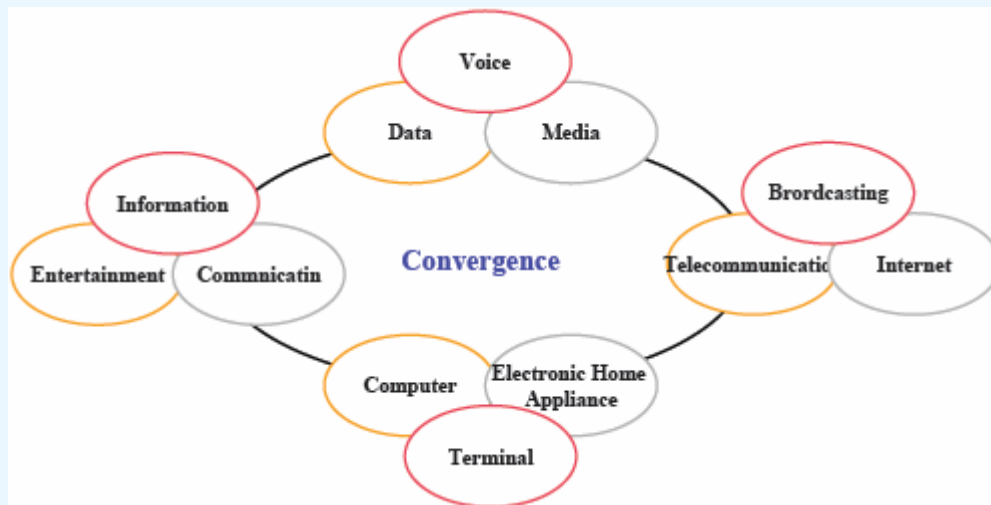
home or office. Users can seamlessly move from one access network to the other. Operators can therefore provide communications that are cost-effective in the home/office and the wider-area together with the convenience of a single handset with a single number, contact book, voicemail and one bill. In addition, the delivery of wireless broadband to the mobile device offers the potential of providing new data services to subscribers.

From an operator point of view, UMA provides a number of benefits including:

- o The ability to offer integrated fixed and mobile services, thereby increasing their share of a customers total spend;

- o Increase the use of mobile voice and data services in areas of poor network coverage;

- o Increase the average revenue per user (ARPU) by providing additional voice and data services utilizing a wireless broadband connection to mobile devices.

On the users' side, the primary goal will be to enable users to get the information content they want, in any media/format, over any facilities, anytime, anywhere, and in any volume. Based on the above-mentioned trends, the following is a summary of several service characteristics:

- Ubiquitous, real-time, multi-media communications - The only hope for dramatically increased fidelity, akin to communicating in person, is high-speed access and transport for any medium, anytime, anywhere, and in any volume[11].

- More "personal intelligence" distributed throughout the network - This includes applications that can access users' personal profiles (e.g., subscription information and personal preferences), learn from their behavioral patterns, and perform specific functions on behalf of them (e.g., "intelligent agents" that notify them of specific events or that search for, sort, and filter specific content).

- More "network intelligence" distributed throughout the network - This includes applications that know about, allow access to, and control network services, content, and resources. It can also perform specific functions on behalf of a service or network provider (e.g., "management agents" that monitor network resources, collect usage data, provide troubleshooting, or broker new services/content from other providers).

- More simplicity for users - This shields users from the complexity of information gathering, processing, customization, and transportation. It allows them to more easily access and use network services/content, including user interfaces that allows for natural interactions between users and the network. It involves providing context-sensitive options/help/information, transparently managing interactions among multiple services, providing different menus for novices versus experienced users, and providing a unified environment for all forms of communication.

Box 3.1: Italian Public Sector moves towards Fixed Mobile Convergence solutions

Avaya Inc., a leading global provider of business communication applications, systems and services, announced the installation of an Avaya converged voice and data network at the National Centre for Information Technologies in Public Administration (CNIPA). The new Avaya IP network has enhanced communication capabilities across the Government organization, improving productivity and is helping align the network to its business processes.

CNIPA has replaced its existing PBX system with Avaya IP telephony and unified messaging solutions to improve communications for its 250 telephone users at its main location in Rome. This set-up increases the efficiency and speed of employee communications across departments to support the organization's primary purpose which is to identify, test and propose new innovative communication technologies for public administration departments across Italy. Also, it will deliver significant savings in both time and communication costs, which will be derived from intelligent call routing, integrated within the corporate network.

Additionally, CNIPA is trialing Avaya Mobile enterprise fixed mobile convergence (FMC) applications for Series 60 platform devices jointly developed with Nokia. These downloadable applications transform Series 60 platform mobile devices into virtual desktop phones by enabling workers on the move to access the features and functions of their Avaya Communication Manager office desk phone.

The trial, which is due for completion during the month of October, is taking place at CNIPA's head office in Rome and is being piloted by employees from all areas of the business, including the president of CNIPA and the information technology department.

An intuitive user interface enables advanced mobility capabilities such as 'one business number' extending from the office to the mobile phone, providing easy access to business telephony features such as abbreviated extension dialing, multi-party conferencing, call transfer, voice mail forwarding, group call features, and call forward to coverage for executive support.. Also, the application gives the user a business and a personal profile with respective bills to eliminate onerous, manual separation of business and private calls. In addition, the application will allow CNIPA to centralize control of landline and mobile phone costs.

Source: http://www.cnipa.gov.it/site/it-IT/

Box 3.2: Strong demand for Unlicensed Mobile Access

A survey commissioned by Motorola, Inc. has confirmed strong consumer demand for Unlicensed Mobile Access (UMA)-enabled services across key European territories, with Italy, Spain and Sweden the most enthusiastic nations in terms of acceptance and potential take-up.

The online survey, conducted by BrainJuicer, which targeted 1,000 consumers in each of six leading European markets -- Germany, France, Italy, Spain, Sweden and the United Kingdom -- concludes that a UMA-enabled service would be positively received.

The results showed that the cost of any potential UMA converged service have a major impact on a consumer's possible adoption of the service. If mobile calls in the home were priced the same as fixed line calls then over 50 per cent of respondents said they would be likely to sign up to a UMA service within 12 months.

Of the respondents who would probably buy the service, a third would make most or all of their calls at home on their mobile.

A significant number of respondents also stated that the need to install broadband or switch suppliers would not be a barrier to adopting UMA services. Overall, only 17 per cent would definitely or probably not switch mobile supplier, just 22 per cent would be unwilling to switch fixed line operator while only a quarter would want to avoid changing their broadband provider.

The research shows there are no major barriers to the adoption of UMA in these six key territories and that respondents across all countries show a good comprehension of the technology and fundamentally find it credible. The overall results demonstrated Swedish respondents were in general very enthusiastic about UMA, with Italian and Spanish respondents also demonstrating clear interest in a UMA service. As consumers in both Italy and Spain make a high number of mobile calls in the home, they are in a prime position to benefit from the introduction of FMC technologies.

Source: http://www.my-cellular.com/article2399.html

- Personal service customization and management - This involves the users' ability to manage their personal profiles, self-provision network services, monitor usage and billing information, customize their user interfaces and the presentation and behavior of their applications, and create and provide new applications.

- Intelligent information management - This helps users manage information overload by giving them the ability to search for, sort, and filter content, manage messages or data of any medium, and manage personal information (e.g. calendar, contact list, etc.).

Figure 3.3 summarizes the concept of a transparent, converged, user-oriented telecommunication environment.

Figure 3.3: Service convergence: advantages for the end-user

Source: ETRI
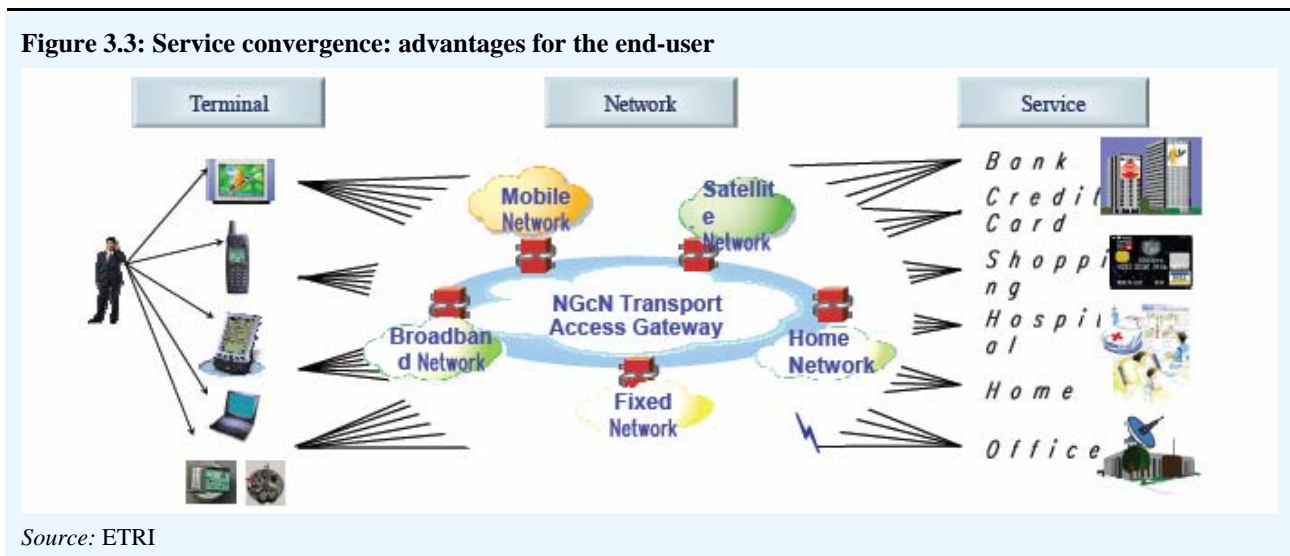
3.3   Standardization

The new ICT applications, such as mobile and wireless communications, Triple Play services, Next Generation Networks services, multimedia devices, car navigation systems, and so on are radically changing the way Italians work and enjoy their leisure time. Most people already use at least one of these on a daily basis. But the supporting networks – and the applications which they use – will not reach their full potential, unless they are fully interoperable. This creates a need for standards. Standards are technical specifications to support the development of open and competitive markets that benefit both consumers and industry[12].

In Italy the standardization process is driven mostly by the introduction of a new technology; the operators, the vendors and the content providers will then evaluate such technology and deploy the related services, sometimes verifying the standardization implications, sometimes not. This is because, in the standardization areas, the concerned governmental entities have not yet reached the necessary collaboration and coordination level with the private sector, in order to supervise the process on introducing a new communication technology, compliant with a specific, recognized standard.

Another important element that should be taken into consideration is the internationalization of the ICT market, nowadays more and more related to not only to national or European regulatory bodies, but to International entities, that should be involved as mediators and coordinators of activities during the development and the adoption of a specific standard.[13]

This method has for some time been agreed by most of the nations, identifying some specific entities (such as ITU) as reference bodies. In Italy, unfortunately, the involvement of the Italian player into the work of such entities is still **reactive**, getting what is coming out as results, but not **proactive**, proposing and participating in the standard creation process.

Standards are developed or imposed by means of a set of conventions and common rules agreed among operators, hardware and software vendors, system integrators and international bodies in order to achieve:

- Specifications definition to be implemented by everyone in the same manner to obtain scale economies;

- Improved interoperability between the different solution implemented to reduce integration and maintenance costs;

- Reduced systems complexity in identifying common implementation methods and coordinating the work among the actors involved;

Until the end of last decade, standards were essentially norms or recommendations delivered by entities such ITU, ETSI and ANSI. Together with these organizations, several other consortiums began to appear, aimed at not just filling some specific requirements or lack of a specific standard, but also to produce solutions that are able to follow the rapid evolution of the needs expressed by the operators and the users.

NGN deployment will result in a variety of architectures and protocols, which creates interoperability issues. In this context, international standardization bodies play an important role by setting the specifications of protocols, establishing a common general architecture and technological blocks of NGN. If players on the Italian market want to evolve within the NGN framework, it is obvious and necessary to adhere as much as possible to the guidelines created by such entities, to avoid misalignment and consequent eventual re-adjustments.

The following section aims to give a snapshot of the main players involved in the NGN standardization process, in order to clarify the role of the above-mentioned bodies.

- **ITU (International Telecommunication Union)**
  ITU-T has become more active in developing NGN standards and is planning a reorganized structure to focus on NGN and related matters. ITU-T SG (Study Group) 13 has been involved in standardization research of NGN. During its January 2002 meeting, SG 13 decided to undertake the preparation of a new ITU-T Project entitled 'NGN 2004 Project'. At the November 2002 SG 13 meeting, a preliminary description of the Project, which includes characteristics and capabilities of NGN, the objectives of NGN and seven study areas requiring standardization of NGN, was endorsed by SG 13.

  A major goal of the NGN Project is to facilitate convergence of networks and services. Some main areas on NGN have been identified and studied, such as:
  - General reference model of the NGN.
  - Business model, service architecture and scenarios for NGN.
  - Functional requirements and architecture of the NGN.
  - Identification requirements for the NGN.
  - Mobility requirements and mobility management architecture.
  - QoS requirements and end-to-end QoS architecture of the NGN.
  - Reference service model for MPLS based reliable and manageable IP network.
  - Migration of networks (including TDM networks) to NGN.
  - Technical issues and layer models useful for 'regulatory' considerations.

  The NGN Focus Group that was established in June 2004 to ensure continuity of ITU-T's efforts on NGN following the final SG meetings in the 2001-2004 periods will also feed into a new NGN SG. The new SG will be assisted by a joint coordination mechanism set up to co-ordinate core NGN studies in the areas of mobility, signaling, naming, numbering, addressing and routing.

- **ETSI (European Telecommunications Standards Institute)**
  NGN standardization has been part of the ETSI Strategic Guidelines since November 2000. It was then decided to establish NGN-SG (Starter Group). It defines NGN as a concept for defining and deploying networks, which, due to their formal separation into different layers and planes and use of open interfaces, offers service providers and operators a platform which can evolve in a step-by-step manner to create, deploy and manage innovative services. In addition, NGN-SG considered NGN as the general concept of new network architectures using any kind of transport and distributed call control using a variety of different access and core technologies covering wired, wireless and mobile

domains. This includes issues such as end-to-end service enabling capabilities, interoperability and QoS, security, network management and network architecture along with the use of protocols such as MEGACO (Media Gateway Controller), SIP (Session Initiation Protocol) H.323 (Packet-based multimedia communications systems), BICC (Bearer Independent Call Control), Parlay, IP, ATM, etc.

To strengthen the role of ETSI in the provision of standards for NGN technologies, the new technical committee, TISPAN (Telecommunications Internet converged Service protocols for Advanced Networks) was created in September 2003 combining the work of the former ETSI bodies SPAN, on fixed network standardization and TIPHON, on VoIP based networks. TISPAN is responsible in ETSI for all aspects of standardization for NGN, which will enable the emergence of pan-European multi-media networks. In addition, TISPAN held a workshop together with 3GPP in June 2004 to discuss the globalization of IMS to make it applicable as a core network component of Fixed and Mobile NGN.

- **ATIS (Alliance for Telecommunications Industry Solutions)**
  In the United States, the Technical and Operations (TOPS) Council of the ATIS initiated a programme in 2002 to identify and assess the industry's technical and operational initiatives of strategic importance, including its technical and operational priorities. It initially established Focus Groups to investigate the important NGN topics of VoIP, Network Security, Wide Area Ethernet, Mobility and Data Interchange. ATIS will be holding special industry forum to progress several key issues and will be co-operating and collaborating with other groups such as the IETF and IEEE to address industry standards needs on a timely basis. Additional ATIS TOPS Council Focus Groups are expected to be formed to investigate other priorities, e.g. optical networking and wide area storage.

- **IETF (Internet Engineering Task Force)**
  The IETF is not working on NGN as an individual topic, but its Working Groups have responsibility for developing or extending existing protocols to meet requirements such as those agreed for NGN in other standardization bodies. Among the standardization activities undertaken in IETF related to NGN, MMUSIC (Multiparty Multimedia Session Control), SIP, MEGACO and NSIS (Next Steps in Signaling) are the core protocols. Other related protocols include SIPPING (Application of SIP), IPv6, MOBILEIP (IP Routing for Wireless/Mobile Hosts), IEPREP (Internet Emergency Preparedness), MPLS, GMPLS (Generalized MPLS), etc. The IETF also developed the ENUM specification to enable an E.164 (telecom) number to be used to access the Internet DNS system. ENUM might be used to facilitate interworking between telephony (and other carrier services) and IP services (including IP telephony and multimedia).

- **3GPP (Third Generation Partnership Project)**
  Many of the NGN principles have already been standardized in the 3GPP work on Third Generation Mobile and the 3GPP2 group which have adopted a common IP Multimedia Subsystem or IMS as the core of their network architectures for later versions of 3G.

- **GSC (Global Standards Collaboration)**
  NGN standardization work is coordinated in the above-mentioned standardization bodies which meet regularly in the GSC to discuss their work and to minimize overlap and increase co-operation and collaboration. NGN work was discussed at GSC7 (hosted by ACIF in 2001), GSC8 (Ottawa, Canada, 2003) and GSC9 (Seoul, Korea, 2004). These meetings have identified principal areas for NGN standardization work such as architecture and protocols, end-to-end Quality of Service, service platforms, network management for NGN, lawful/legal interception, security, the interworking of services supported by both current networks and NGNs, and the transition of these services from legacy networks to NGNs.

- **TMF (Tele Management Forum)**

  The Tele Management Forum (formerly know as Network Management Forum) is focusing on providing strategic guidelines and practical solutions to improve the management and the roll-out of information and communication services. The aim is to develop technical solutions adoptable in the industrial context (Operators, Vendors, System Integrators, etc). It started a programme called

NGOSS "Next Generation Operation Systems and Software" aimed to define an integrated framework for the development of OSS/BSS systems.

After having provided a general high-level view of the standardization process currently in progress, a focus should be given according to the trends identified in the forces of convergence section and within the Italian context.

In Italy, as already mentioned, the possible migration to NGN is not exactly following the frameworks identified by the standardization bodies, albeit Italy's participation in most of the activities. This is because, as easily perceptible, the process towards standardization follows the technology evolution and the strategic decisions of all players involved. As analyzed in the previous paragraph, Italy is showing interest towards Fixed Mobile Convergence and, generally speaking, forward the various forms of voice communications.

It is therefore expected that actors are interested in the standardization of protocols and technologies related to that specific subject. In Italy, the technology trend is currently following the success stories of the past years, where the mobile technologies and the diffusion of broadband offers have penetrated the market. In particular, the evolution of voice services towards IP, has raised expectations from the customer side and motivated interest by the Italian telecommunications players, moving the attention to all those technologies and communications frameworks revolving around VoIP and related services. Thus, the attention concerning standards and standardization processes expressed by the Italian telecommunication actors has moved towards VoIP standards, as summarized in Figure 3.4.[14]

Figure 3.4: NGN and VoIP standards – The standardization process

Source: http://www.wirelessbrasil.org
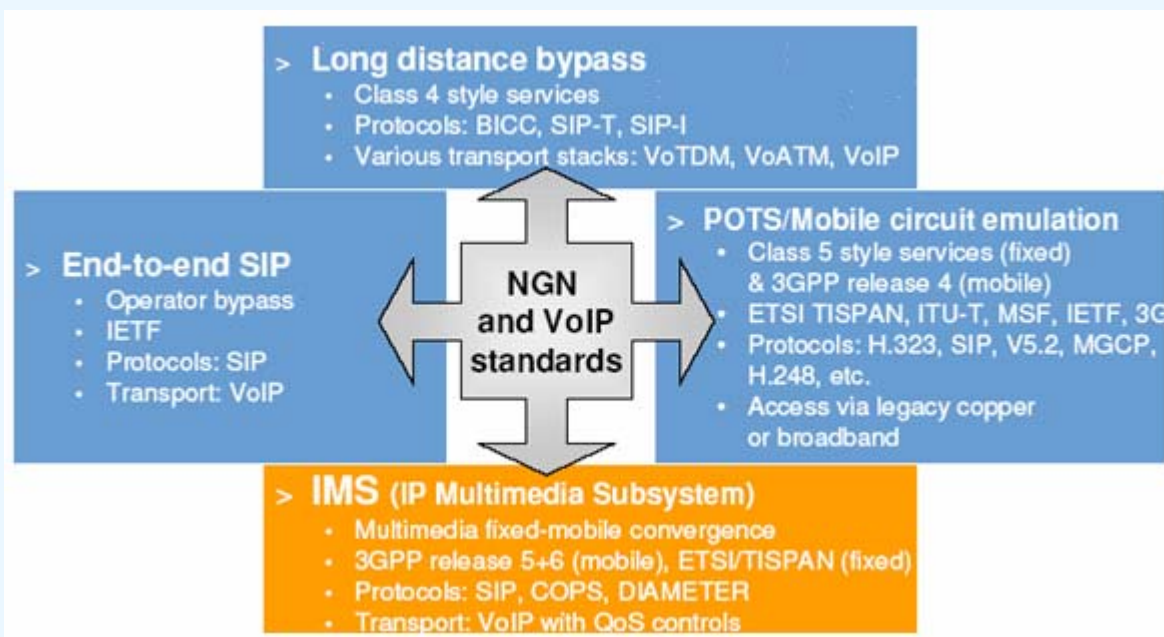
4 REGULATORY FRAMEWORK

4.1 Introduction

The rapid evolution and convergence of information and communication technologies (ICTs) poses new regulatory and policy challenges. The challenge to government decision-makers in Italy is guided by national desires to promote industry development, improve overall socio-economic growth, ensure wide spread ICT access for all, and promote and protect consumer welfare. This chapter will examine what role the Italian Ministry of Communications and the Italian Communications Authority might play in promoting the migration towards next generation networks, which could be a basis for a fully Italian Ubiquitous Network Society.

4.2 Italian Communications Regulatory Authority

The Communications Regulatory Authority (Agcom) is an independent authority[15], established by Law No. 249 of 31 July 1997.

The two main tasks assigned to it by Law No. 249 are to ensure equitable conditions for fair market competition and to protect fundamental rights of all citizens.

The guarantees refer to:

Operators, by means of:

- implementation of liberalization in the telecommunication market through regulation and supervision activities, and through dispute resolution;

- rationalization of resources in audiovisuals; application of antitrust rules in the field of communications, inquiries on dominant positions;

- organization of the Registry of Communication Operators.

Consumers, by means of:

- strict control on quality and distribution of services and products, including advertising;

- resolution of disputes between operators and consumers;

- regulation of universal service and creation of specific rules aimed at safeguarding socially vulnerable categories;

- fostering and safeguarding political, social and economic pluralism in broadcasting;

- defence of copyright of audiovisual and software products, by means of a recently established Unit against piracy;

Furthermore, the Communications Regulatory Authority (Agcom) is a "convergent" authority[16]; in fact it has been attributed a series of functions extending from telecommunications to audiovisuals and publishing.

This choice took into account the deep changes caused by the "digital revolution" which has blurred the boundaries between the different media, whose contents – images, data, voice – are becoming more and more interactive.

4.2.1 Ongoing and future actions to be taken by the Authority

With reference to the overall information and communication system, in Italy there is a framework in which there are many factors of movement and innovation, but where there remain major imbalances and lasting areas of shadow.

The Authority is involved in the analysis of the eighteen relevant markets indicated by the European Commission for purposes of identifying dominant positions and possible corrective measures to be taken (the

so-called remedies). In the radio and television sector, application of the many new responsibilities assigned by Law 112 to the Authority, involving in particular the implementation programme for the digital frequency allocation plan; verification of the so-called "integrated communications system", for purposes of monitoring dominant positions in the new digital environment; oversight of compliance with public-service obligations, including separate accounting for service activities and those of a commercial nature; the Authority participated in the drafting of the new radio and television code which was approved on 29 July 2005. (See Box 4.1).

4.2.2 Protecting consumers and users rights in a new environment

The advent of new disruptive technologies in the telecommunications sector, and the consequent development of new and traditional communications media towards convergence and increasingly personalised services, have helped outline a scenario in which new problems relating to consumers' and users' rights have cropped up.

Given the growing need for proper and widespread information for citizens in accordance with criteria of transparency and efficiency of public administration, the Authority took action to seek more appropriate modes of systematic and ongoing dialogue with the citizens – whether one-by-one or in associations.

In fact, among the purposes of authorities regulating services of public utility, article 1, subsection 1, of law No. 481/95 calls for protecting the interests of users and consumers, as well as for promoting and spreading knowledge of the conditions for carrying out the services, in order to guarantee maximum transparency.

Moreover, this law requires holding periodic hearings of those forms of association in which consumers and users have organized. Law No. 249/97, which instituted the Authority for guarantees in communications, identified, within the sphere of mass communications, the responsibility for regulation (art. 1, subsection 6,

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Box 4.1: Agcom competencies

Radio frequencies
- Allocation and assignment of radio frequencies
- Transfer right to use radio frequencies - competitive conditions analisys

Numbering
- National numbering plan approval
- Harmonisation numbering resources
- Cooperation with international organisations

Market analysis
- Assessment dominant position
- Defining and market analysis

Interoperability of digital interactive television services

Dispute resolution
- Disputes between companies
- Cross-border disputes

Rights of use and numbers
- Define competitive or comparative selection procedures
- Procedure for limiting the number of rights of use
- Control on respect of conditions for usage of rights
- Selection of criteria to set fee on rights of use

Access, interconnection
- Define and review obligations on operators
- Define and review obligations regarding trasparency, non discrimination, accounting separation, price control
- Co-location and facility sharing

Universal service
- Approach for ensure the implementation of universal service
- Ensure directory enquiry services
- Ensure public pay telephone services
- Defining special measures for disabled users
- Designation of undertakings
- Affordability of tariffs
- Control of expenditure
- Quality of service
- Compute of net cost of Universal Service
- Control obligations

Source: http://www.agcom.it

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lett. b, No. 5 and art. 1, subsection 11) and for the management of disputes (art. 1, subsection 6, lett. a, No. 14), in addition to verifying the regulations governing the protection of minors, as well as oversight on respect for the protection of recognized linguistic minorities (art. 1, subsection 6, lett. b, No. 6 and No. 7). Furthermore, with reference to the "usership guarantee," issue, art. 1, subsection 28 calls for establishing, at the Authority, the National User Council, with the task of expressing opinions and making proposals to the Authority, Parliament, and the Government, as well as to all public and private bodies with competence over, or that carry out activities in, the communications sector.

Lastly, Art. 4 of law 281/98 establishes, at the Ministry for Productive Activities, the *Consiglio Nazionale dei Consumatori e degli Utenti*, or the National Council of Consumers and Users (CNCU), giving it the task of protecting consumers' interests and rights. Art. 5, subsection 2, of the same law establishes the requirements that the associations must possess in order to be included in the list of the consumers and users associations representative at a national level, and to be part of the aforementioned CNCU.

Moreover, law No. 150/2000, entitled "regulation of the information and communication activities of public administrations" sets for the public relations office the objectives and modes of operation to be adopted in communication towards citizens – whether one-by-one or in associations. In light of what has been briefly discussed, the Authority proposed a framework agreement with the Ministry of Productive Activities and a protocol of understanding between the Authority/NUC and the CNCU. In particular, the Authority and the Ministry of Productive Activities, also through the General management of market harmonization and consumer protection, within the context and for the implementation of the respective institutional tasks, are to promote a multi-year programming agreement aimed at ensuring the development of specific collaboration efforts in the area of consumer and user protection.

The institutions would undertake to carry out initiatives with regard to:

- protecting and promoting the consumer's right to information;
- the joint development of tools enabling proper and widespread information for consumers and users in the communications sector (telephony, audiovisual, information technology, publishing, electronic communications in a broad sense), also in consideration of the evolution of services and of media convergence;
- monitoring the evolution of services, and promoting conditions of accessibility, security, quality, and use of the services;
- simplified access to dispute resolution tools;
- facilitating relations with institutions, also by capitalizing on the experience and initiatives of the associations represented in CNCU and NUC.

To achieve these objectives, the players involved will identify projects and tools through the following activities:

- periodic meetings on the Authority's activities;
- consultations between the Authority/NUC and the consumers associations, before provisions of general interest that impact consumers and users within the sphere of the corresponding procedures;
- seminars for deeper analysis, aimed particularly but not exclusively at the operators of associations that have ongoing relationships with consumers and users;
- information for all users, through a variety of initiatives such as publishing service cards, and publishing and distributing materials in hardcopy or on computer support;
- capitalizing on the activities performed by the consumers associations to monitor the quality of the service delivered to the customers, operators' application of and compliance with the ethical and commercial conduct codes, and violations of the regulations in place to protect consumers with regard to fixed and mobile telephony and audiovisuals. The tools to protect consumers and users introduced by the operators, and in particular the application of codes of commercial conduct, may be verified by these associations, through initiatives on a local scale, in order to provide the Authority with elements of assessment;

- making it easier to have knowledge of the tools available to consumers for resolving disputes out of court quickly, affordably, and in an easily accessible way, in line with the principles and goals of recommendations 98/257/EC and 2001/310/EC, such as the regulation concerning the resolution of disputes arising in relations between telecommunications bodies and users, issued by decision No. 182/02/CONS of 19 June 2002. The development of out-of-court conflict resolution tools – a primary form of protection of the users of services of public utility – may also be implemented through trials agreed upon with the consumers associations.

4.3 The new Italian Code for electronic communications: a technologically neutral solution[17]

With the adoption of the "*Codice delle Comunicazioni Elettroniche*" (the Electronic Communications Code) approved by Leg. Dec. of 1 August 2003, No. 259, which fully implements the new European directives, the areas of jurisdiction of the Communications Ministry and the competence of the Italian Communications Authority has been re-defined; mainly by assigning to the Ministry of Communications the task of supervising the authorization process and compliance with the universal service obligations and to the national regulatory authority the task of conducting market analyses and proposing remedies as explained above.

The Code meets the legislative requirements made necessary by technological developments and is in harmony with the European regulatory framework. It represents an important turning point towards complete liberalization and the establishment of competitiveness in the electronic communications market. Significantly Italy was one of the first countries in Europe to comply with the European directives.

4.4 Spectrum management in Italy

The main legal instrument of spectrum management is the *Piano Nazionale di Ripartizione delle Frequenze*

Box 4.2:Main characteristics of the Electronic Communications Code

The main characteristics of the Code are the following:

• Redefinition of the concept of "significant market power" and of the threshold for imposing obligations on certain operators, with the introduction of market analysis;

• The introduction of the term "electronic communication services and networks" (a broader term which now encompasses the term "telecommunications");

• "electronic communication services and networks" can now be provided pursuant to a "general authorization";

• more flexibility by national regulatory authorities to select which access and interconnection obligations to impose on operators notified as having "significant market power" in a relevant market; and

• redefinition of certain measures relating to retail price regulation and extension of number portability to mobile operators.

Moreover, the Directives (and other EU-related regulatory interpretations and recommendations) as implemented by the Code provide for guidelines on market analysis and calculation of "significant market power" and identify 18 markets at retail and wholesale level where such analyses and identification shall be conducted. According to the Code, the Italian National Regulatory Authority will have to conduct a new evaluation of the operators having "significant market power" and propose applicable remedies. Within the authority allowed by EU law, the Code also provides for the following:

• allows the trading of the rights of use of frequencies among operators, offering the same type of services;

• excludes from the category of universal service (and its related obligations), the provision of directory information services;

• provides for specific and more defined rules aimed at reducing the burden of current legislation and local regulations which discipline the installation of networks;

The Code also introduces a new definition of and specific references to "broadband services", encouraging their development also at regional level.

Source: http://www.comunicazioni.it/it/index.php?IdPag=725

(PNRF), which is the Italian frequency allocation table approved by a Ministerial Decree. The reference source of the PNRF is, obviously, the ITU Radio Regulations and CEPT activity on frequency planning. Normally the PNRF is upgraded every three years to conform to the results of each World Radiocommunication Conference (WRC), but often the PNRF is also modified to take into account the need to introduce new services or applications. The PNRF is published on the Italian Website (www.comunicazioni.it) and on the ERO website under the page devoted to the EFIS (REO Frequency Information System), and is the main source of information for people interested in the frequency allocation in Italy. It is also the basis for the evaluation of all frequency allocation plans in Italy whether elaborated by the Ministry or by the Authority.

The main task now in progress is the preparation of the second phase of Regional Radio Conference for the DVB-T scheduled to be held in Geneva in 2006. In this regard, the Italian Administration is currently engaged in a number of bilateral meetings with neighboring countries to reach agreements on the reciprocal requirements to be presented jointly during the second phase of the Regional Radiocommunication Conference (RRC).

Moreover, the spectrum management request the planning of the frequencies assignment both by ministerial action or cooperation with the Authority; the most relevant assignments in the recent past have been those related to the release of the right of use of frequencies to the UMTS, performed in 2000, and to the WLL application in the band 2.6 and 2.8 GHz, performed in 2001, both through an auction. Currently the Ministry is planning a second auction for the WLL and an auction for the PAMR application in the frequencies band 450-470 MHz.

The frequency management also requests the continued monitoring of the spectrum to prevent inefficient or unauthorized use of the radio resource; in this regard the Ministry of Communications acts at both the national and international levels.

At the international level Italy is a component of the international monitoring network acting under the control of ITU and aiming to monitor the frequencies whose propagation characteristics allow areas well outside the national competence to be reached.

At the national level the monitoring, performed by regional departments, concentrates on two main aspects:

- preventing and eliminating interference to and between the different users;

- ensuring efficient utilization of the spectrum by operators verifying that operators reach the coverage obligations.

The first aspect is performed through a number of fixed and mobile monitoring stations spread throughout the national territory and having the measurement instruments appropriate to this type of monitoring.

The second aspect is performed through the valuation, both theoretical and practical, of the coverage. This means that the Ministry has software tools with which it is possible calculate the coverage of a radio station starting from the detailed knowledge of the radio electric transmitting station (power of the transmitter, antennas characteristics, geographic location, height of transmitter and so on). But the theoretical studies can also be verified through direct on-site measurements, sending mobile monitoring stations in the service area of the station. In this respect the Italian administration is now monitoring the coverage area of the operators of the third generation mobile radio systems and has recently completed the measurement, requested by Authority, of the coverage reached by national digital TV broadcasters.

Finally, the spectrum management attains to control the radio devices placed on service because of the conformity of the radio transmitter to the technical specifications approved and certified at international level. In this area the Ministry of communications acts in three ways:

- checks that the radio devices placed on the Italian market are compliant with EU rules, i.e. that they conform to the technical specifications published on the EU Official Bulletin;

- certificates the ability of the laboratories that request certification to act as Notified Bodies;

- publishes the national interfaces that serve as a guideline for the manufacturer intending produce and place radio devices on the market.

4.5   Broadcasting Policy

In Italy the DVB-T (Digital Terrestrial Television, known as *Televisione Digitale Terrestre* in Italian) is expanding rapidly. Almost every major network in Italy—including Rai, Mediaset, La7 and MTV—started digital transmissions (continuing with analogue television transmissions at the same time, at least until the transition is completed). Starting from January 2005 some networks (notably Mediaset and La7) started offering pay TV services through a prepaid smart card (soccer games, usually three euros per game).

By parliamentary law[18], Italy will definitely switch to digital television by 31 December 2006 with a 100 per cent coverage of the national territory, although there is the possibility of a delay. The Italian government is currently promoting the new standard by granting a financial contribution of 75 Euro for the purchase of a digital television decoder.

Box 4.3: Relevant regulations for digital terrestrial TV

The legislative framework for the development of DTT in Italy consists of various laws and regulations:

- Law No. 249 of 31 July 1997 raised the issue of DTT for the first time, stipulating that the Communications Authority had to reserve part of the frequencies for the broadcasting of digital radio and television signals when planning analogue television frequencies.

- The national analogue television frequency assignment plan, drawn up by the Communications Authority in 1998, pursuant to Law No. 249 of 1997, reserved four channels for digital terrestrial television (66, 67, 68, 69). Nevertheless, the failure to implement the plan has impeded the release of the new channels, which have been extensively used by local and national commercial broadcasters for analogue television.

- Decree Law No. 5 of 20 January 2001, amended by Law No. 66 of 20 March 2001, provided for the switch-off of analogue networks and, therefore, for the definitive switchover to digital transmission on terrestrial frequencies by 2006. In particular, the law provides for:

  a)   An obligation on holders of more than one analogue license, and who intend to conduct trials with DTT, to reserve at least 40 per cent of the transmission capacity of their own digital multiplex for independent third party operators.

  b)   The possibility to request DTT trials, and to find the necessary frequencies for its development through frequency trading, for a period of three years from the entry into force of the law.

  c)   The reservation of frequencies for the concessionaire of the public broadcasting service to establish at least one multiplex for the transmission of "free-to-air" broadcasting of digital terrestrial television programmes.

  d)   The abandonment of analogue television planning and the prompt establishment of a new, entirely digital, national frequency assignment plan.

  e)   An obligation on broadcasters to transmit at least three television programmes on each digital multiplex and to design television programmes for "free-to-air" broadcasting.

- Pursuant to Law No. 66 of 20 March 2001, the Communications Authority approved the regulation for issuing individual licenses and general permits for DTT (Resolution No 435/01/CONS of 15 November 2001). The regulation provides for three distinct players for DTT: content providers (who have editorial responsibility for contents), service providers (who, through network operators, provide information services), and network operators (who hold the right to install and operate the network). Pursuant to the regulation, the interested parties (current analogue licensees and broadcasters transmitting via cable or via satellite, as well as in consortium with third parties), had the possibility to request specific authorization to conduct DTT trials by 30 March 2004, using their own analogue frequencies or obtaining others through frequency trading. The public broadcasting service licensee is authorized directly by the law to conduct DTT trials and a specific broadcasting multiplex for unencrypted television programme schedules has been reserved. On this reserved multiplex, RAI can transmit only its own programmes, and not those of other broadcasters. On other blocks, RAI, like private operators, is required to reserve at least 40 per cent of transmission capacity for third parties, and may operate as a content provider, as well as a services provider.

- The new national DTT frequency assignment plan was prepared in advance by the Communications Authority on 29 January 2002.

- The service contract for the three-year period 2003-2005 between the Ministry of Communications and the

public broadcasting service licensee, approved by the Presidential Decree of 14 February 2003, Article 23 requires RAI to submit a plan defining the development of digital terrestrial networks. The RAI plan, approved in July 2003, provides for national coverage with two multiplexes, which had to reach 50 per cent of the population by 1 January 2004 and 70 per cent of the population by 1 January 2005. A programme agreement between the parties, dated 8 August 2003, defines the times and modes of development of the digital terrestrial multiplex of the public broadcasting service. For the necessary frequencies, RAI will avail itself partly of frequency trading and partly of the assignment of frequencies that are free or available under the frequency reservation provided for under Law No 66 of 2001. Moreover, it has partly optimized the use of its own analogue frequencies.

- The date of 31 December 2006 for the switch off of the analogue networks was laid down by the "Gasparri Law", which regulates and accelerates the switchover process by defining a set of transitional measures that set intermediate steps for the development of the new transmission technology and facilitate broadcasting to Italian families, using new reception sets partially financed by government subsidies.

Source: Italian Plan for DTT.

4.6 Policy challenges

To further promote the creation of a Ubiquitous Network Society, in terms of regulation and monitoring, it is necessary to develop a strategy and an approach adequate to the new reality taking shape technologically and economically, in the light of the new rules, and in the context of the current digitalization.

This strategy should be based firstly, towards maximum promotion—based on the new directives on electronic communications—of the "Europeanisation" of the rules and procedures for monitoring events in the world of telecommunications and the audiovisual field, and on the new converging technologies. "Europeanisation" of the rules will make it possible to contain national differences and to gradually extend those standards that already exist into the European area, not only in terms of competition but also pluralism: this objective could first of all be pursued taking into account the approach of the new European Constitution, by expansion of the contents of Directive 89/552/CEE, the so-called "Television without Frontiers."

Secondly, towards giving maximum encouragement to approaches involving development of the communication technologies associated with convergence. In fact, this development represents the factor that can best promote a merger of market rules (those of the telecommunications sector); and the rules of public service (those of the audio-visual sector), consequently stimulating a beneficial exchange among the various sectors of communication and information, so as to make the search for balance between competition and pluralism easier in the various contexts.

In addition, the current regulatory framework of dividing telecom service providers into several categories based on the separated networks, such as wireless/wireline, Internet/broadcasting/ telecommunications, will be challenged as NGNs deploy further. Different regulatory frameworks need to be reconsidered in an integrated NGN environment. In this context, there are considerable challenges for policy-makers and regulators and their role will be a significant one.

5 ICT MARKET OVERVIEW

5.1 Introduction

The primary forces driving the transformation of national, regional and global economies are dramatic changes in technologies, policies and markets. The combination of, the development and increasingly pervasive applications of information as well as communication technologies and services (ICTS) on the one hand, and the worldwide movement to market liberalization and restructured regulation, on the other, are opening new opportunities for participation in ICTS sector and the application of communication-based services throughout the economy. The conversion of telecommunication (telecom) networks and all forms of communication and information content to digital standards has created an electronic network infrastructure that facilitates the convergence of formerly discrete telecom services on a single telecom network. More

recently, extended applications of Internet Protocol (IP) have permitted the convergence of services on the Internet to include, not only data, pictures, music and video, but also voice communication, including public voice services. Voice over IP (VoIP) is the latest major step in a convergence process that has been underway for three decades. It means that now all types of services can be provided in an integrated manner over the Internet using IP. The Internet services, in turn, are provided over the digital network facilities of public telecom operators.

5.2   Market Trends

In this context, several interesting and evolving scenarios have given the Italian ICT cause for optimism. These include the continued development of the mobile technologies, the extraordinary growth of broadband, the diffusion of digital terrestrial TV and the introduction of technologies like VoIP.

In 2004, the Italian ICT market recorded a growth rate higher than the past year. In fact, the positive cycle that characterizes telecommunications for almost two years continuing, while in the meantime the IT trend, although still negative, is improving. In 2004 the Italian telecommunications market confirms and improves the positive behaviour started in 2003. It grew, in fact, by 2.4 per cent, reaching a value equal to 41.8 billion Euros.

In general terms, therefore, market dynamics are slowly settling: after the enormous growth of the two years 2000-2001, tied to the considerable investment in broadband, we now observe a greater balance. The market, though less inclined to withstand high impact transformations in the short term, is anyway marked by strong changes, already appearing in the course of 2004. A good part of these is stimulated by the rising of the digital contents market, which, in the medium term, should give a new push to the segment, introducing new areas of offerings and new sources of revenue.

5.2.1   Fixed-line telecommunications and the Internet

In 2004, revenue from the fixed-network telecommunications sector recorded a drop of 0.2 per cent, although this was an improvement on the negative trend of the three previous years, when the drop was in the range of 3 per cent (See Figure 5.1.)

Broadband services caught on considerably and, in the mean time, traditional voice and data communication services became consolidated. In the course of the year, the number of operators present in the market kept dropping, although to a lesser degree than in the past, going from 146 in 2003 to 142 in 2004. This trend is caused, on the one hand, by a "natural selection" process of the players in an ever more consolidated context and, on the other hand, by the high number of inactive operators. Some of these are carriers that, even holding a license, did not stipulate interconnection agreements with Telecom Italia, the incumbent operator, and effectively gave up operating in a substantial way.

On the whole, the number of licenses continues to drop: the six new licenses granted in the course of 2004, in fact, did not counterbalance the ten that were surrendered during the same period. Going down from the aggregate data to the single elements, one notices that not all licenses are involved in the drop. What is dropping is the number of licenses for the implementation of a national telecommunication network (from 80 in 2003 down to 75 in 2004) or of a local one (from 67 in 2003 down to 65 in 2004). Instead, the trend of licenses for delivering services at the local level (up from 14 in 2003 to 17 in 2004) is positive. Finally, the situation of authorizations related to voice services at the national level appears stable (two cancellations and two new grants in 2004).

Figure 5.1: The fixed-line telecommunications market in Italy (revenue in million Euros)
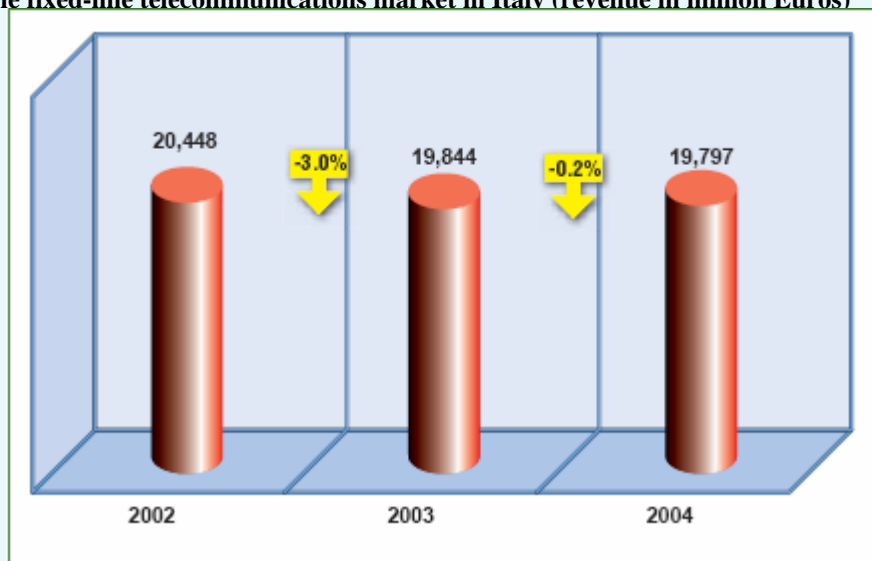
Source: Assinform Report 2005

5.2.2   Mobile telecommunications

During 2004 the mobile telephony market continued the growth and evolutionary phase that had already begun in 2003, in light of a competitive situation characterized by mobile operators putting in place operations of a commercial and strategic nature. All carriers, although with different capacities, completed their commercial launch of UMTS services. This event intensified both generic competition and competition related to those innovating services that represent for every operator the key for the migration of customers from 2G to 3G. Specifically, the actions of mobile operators are directed to cost reduction and achievement of economies of scale. Campaigns are implemented both through operations of a financial nature and new procedures for managing the technological assets. These could lead, in the near future, to remarkable changes in the market scenario.

5.2.3   Mobile lines and users

During 2004 almost 6 million new mobile lines have been activated, with a significant 10.5 per cent growth compared with 2003. In total, the amount of active mobile lines comes up to 62.75 million. The growth can be detected both in the number of subscription contracts, which grew 7.5 per cent, and in the number of pre-paid cards, which recorded an important increase of 10.8 per cent, exceeding 57 million. This trend has been substantially influenced by the business policies of a number of mobile operators. On the pre-paid services side, carriers intensified the offering of packages bundling cell phone plus new SIM and, on the side of contracts, they launched new promotions enabling subscriptions that include the free possession of the cellular handset. Not by chance in 2004 the phenomenon of multiple Sims owned by single users re-emerged: users are driven by the wish to try the new 3G services without having to quit the prior operator. The growth can also be noticed in the number of mobile users, which grow 2.7 per cent compared with 2003 and go from 41.6 to 42.7 million, a figure corresponding approximately to three-quarters of the official country's population. The market has reached a value corresponding to an almost complete saturation. The launching of new terminals conceived for specific market niches (for example, children) and representing the new frontier of this sector may contribute to further increase the penetration.

5.2.4   Mobile Number portability in Italy

The mobile number portability (MNP) service allows the user of mobile and personal services to maintain his/her number. The user may request that the service be conducted by a different mobile operator, even in the case where there may be a variation between the technology used by the operator of origin (TACS, GSM or UMTS) and that used by the new operator (GSM or UMTS). This service became fully operational in

Figure 5.2: Mobile Number Portability in Italy
Number of transfers, cumulative, in millions
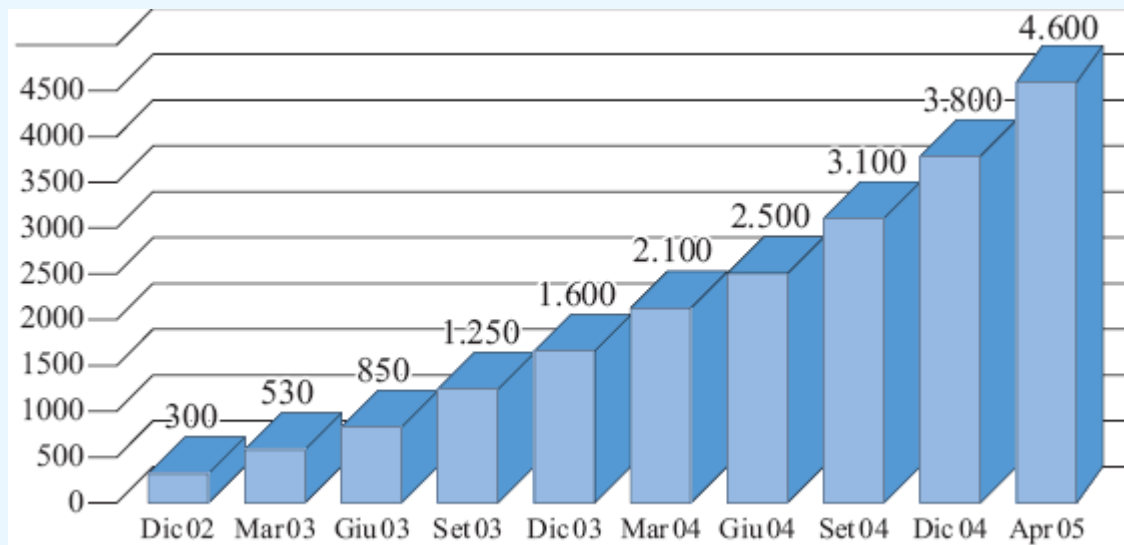
Italy on 30 April 2002, and at the end of April 2005 the number of transfers effected reached 4.6 million. (See Figure 5.2).

With the introduction of MNP, the number itself no longer identifies the mobile operator which manages the numbering, in the sense that the correspondence between the number itself and the mobile operator supplying the service is lost. Considering the fact that for calls originating from a fixed network, but primarily for calls from a mobile network, the price of the call may vary in relation to the fee schedule, as a function of the operator managing the destination number of the call, it was necessary to ensure that the user would receive adequate information on the actual fee applied for calls directed at a mobile number. For this purpose, the Authority defined a single area code, 456, to supply this service to users; as a result, in the national numbering plan defined in Resolution No. 9/03/CIR of July 3rd, 2003, an appropriate numbering space was set aside.

Beginning in October 2003, the operators have activated an offline answering service to offer clients information on fee clarity for numbers carried to other networks. The service is free and constitutes an initial way - promoted by the Authority and implemented by the operators - to offer clear fee information on calls to mobile numbers. This was done in a competitive context characterized by an increasing number of portable numbers.

6   ENABLING FACTORS: A TECHNICAL VIEW

Customers, business partners and suppliers are all talking about Next Generation Networks, convergence of networks and integrated added value services. These terms imply changes that will forever alter the market landscape for network operators and services. In Italy the convergence of all technologies is being driven into the market by the "triple play", which means offering TV, phone and Internet services from a single source, with a single bill. In its purest form, it can mean delivering all three over a single broadband Internet cable, so users get IPTV television and a Voice over IP telephone service along with their Internet access. But most suppliers are happy to pick and mix technologies, as long as they can make a profit.

The next step could even be a "quadruple play", a combination of TV, Internet access, and both fixed and mobile phone services. For example the fusion between Telecom Italia and Telecom Italia Mobile, formerly

separated into two different companies providing respectively fixed and mobile telecommunication services, respectively, could boost the convergence process in deploying quadruple play services.

Finally the thrust for the Next Generation Networks is spurred by the unprecedented growth in one particular network type – the IP-based Internet and its innovative service offering. The growth in Internet traffic is an unrelenting force that is opening a vast array of new information and transaction opportunities, both for end-users using public communication networks, and for enterprises using services that optimize and streamline their businesses. Common to both is the concept of a network that supports whatever content and whatever applications are necessary to satisfy their needs.

However, the issue of network convergence can mean very different things to different people. This chapter presents an overview of the development in access, service, and transport technologies created by pressure from the packet-based networks, through the analysis of the different communication frameworks that are being taken into consideration by the different Italian players. These developments are giving birth to a tremendous number of new technologies to enable Next Generation Networks. In addition, some of the main application categories will be discussed together with services that are more likely to be present in a Tomorrow's telecommunication environment. The focus is on the high-influence technologies and applications that can benefit from the new technologies. The examples used are intended to provide a common understanding of these technologies and the Next Generation Networks that are designed to support them.

6.1   Triple play and beyond

IP solutions on multi-service or full-service networks allow to provide on a single network termination, a very broad set of services, either traditional or innovative, using an adequate service platform and with a user terminal (Customer Premises Equipment – CPE), which is able to connect, but without impacting on the existing transport infrastructure, meaning essentially in a transparent way.

Such networks have been defined "Triple-Play", and are able to provide Internet telephony (Voice), broadband access (Data) and digital TV (Video) in an integrated manner.

Triple Play architectures tend to bring together the needs of Internet world and multimedia world, drastically reducing costs, adopting new technologies of video compression and hardware solution for CPE.

The most important challenge surely resides on video services, specifically TV, in which several operators are showing interest. In fact in the current evolving telecommunication scenario, video services seem to represent the last and the most vital ingredient that operators are inserting in their services.

IPTV, which is Television conveyed via IP protocol, is a significant and important evolution towards multimedia communication and is quickly becoming a moment of important transformation in the paradigm of development of network and related services,

In particular the IPTV service on cable, using a unicast method, allows the realization of a real interactivity and personalization of video communications with the establishment of symmetric services such peer-to-peer.

For the time being, only a few operators have integrated the IPTV offer with voice services and broadband access, acting as market testers analyzing possible issues related to introducing such services and creating new innovative offers (video on demand, pay lite, etc). As a matter of fact, until few months ago, only Fastweb had a consolidated triple play offer. It was the first company in Italy to propose only broadband based services, from TV over ADSL to VoIP. Fastweb launched TV services on DSL in August 2003. The operator launched its Video on Demand (VoD) service through FastWeb fiber optic lines in March 2001. This service was later launched over ADSL in March 2003. The operator offers these services over FTTP (Fiber to the premises) in some areas, and over DSL lines leased (from Telecom Italia) where FTTP is not available. Now that the interest for IPTV, within triple play offers is becoming an "hot" issue, also the incumbent (Telecom Italia) and other content providers are starting to deploy solutions to provide the end users TV content via broadband access.

Figure 6.1: Triple Play Concept

Source: Microsoft

The following are some interesting examples of the activities carried out to enable IPTV environment:

- Telecom Italia has begun free trials of its IPTV service in more than a thousand households in four Italian cities (Rome, Milan, Bologna and Palermo). Once the trial phase is complete, over 4 million households will be able to access a wide range of content including movies, news, sport, music, reality shows and live events on their TVs over a 4 Mbit/s ADSL connection

  The service offers a wide range of TV programming and video content in high-quality format over ADSL access lines. Commercial service is being rolled out this autumn, initially in 21 cities across Italy (Rome, Milan, Bologna, Palermo, Bari, Naples, Padua, Cagliari, Genoa, Florence, Alessandria, Modena, Venice, Verona, Turin, Trieste, Catania, Brescia, Biella, Sondrio and Reggio Emilia).

  During the trial phase, IPTV users have a special Set Top Box connected to their TV to access content over the 4 Mbit/s link broadband services "Alice". Users also have an ADSL Wi-Fi modem to which up to five PCs can be connected at any one time. An infra-red keyboard allows users to access the Net and send and receive email directly from their TV.

  IPTV trials are being conducted with technology partners Alcatel, Microsoft and Pirelli. Alcatel is supplying technologies including the latest generation of ADSL access devices and its "Open Media Suite" set top box video entertainment TV distribution platform. Microsoft has supplied Telecom Italia with its innovative "Microsoft TV IPTV Edition" software, which the company is using to test and offer a new generation of for-payment video services and content. Microsoft and Alcatel are working together to supply operators with complete, integrated solutions designed to accelerate IPTV protocol rollout over existing and next generation networks. Pirelli Broadband Solutions has developed intelligent modular routers that open up a world of high-quality video services that leverage the most advanced home networking solutions (including multiple high-speed Internet connections, Voice over IP and Wi-Fi) over broadband through a Set Top Box [19]

- Digital Identity, Italy's largest streaming media developer and services provider and California based EdgeStream, Inc today announced that they have entered into a partnership to provide the 'Next Generation Video on Demand and IPTV Streaming Technology platform' in Italy. With this agreement, Digital Identity will enable its network with the EdgeStream software and also License the EdgeStream technology to customers who will then be able to provide uninterrupted DVD quality video on demand streaming content to every broadband user in Italy and globally using the public Internet. With the availability of the EdgeStream platform, content providers and owners across Italy are now assured of delivering a quality experience to their consumers at the lowest cost per stream while building profitable businesses. [20]

  With this agreement, Digital Identity will now be able to bring to market the 'Next Generation Video Streaming Technology' to the Italian network and will facilitate true TV and DVD quality video on demand streaming applications to all broadband connected clients in Italy. The companies also said

that the software can be embedded for applications in set top boxes, hand held devices and entertainment hub.

- UTStarcom, Inc., a company well known in IP-based, end-to-end networking solutions and services, has announced that it had signed a two-year agreement with Tiscali Italy, a subsidiary of the European Internet Communication Company, to offer subscribers converged voice, video and high-speed data services. This will be done with the initial deployment of approximately 150'000 lines of its AN-2000 Digital Subscriber Line Access Multiplexer (IP DSLAM) solution and UT300R2U ADSL 2/2+ customer premises equipment (CPE) to expand the operator's multiservice broadband network in Italy. The announcement represents an expansion on the initial contract with Tiscali Italy announced in June 2004.[21]

The demand of IPTV and, generally speaking, triple play services has not reached a critical mass in Italy yet, like other technologies and related offers, such as mobile and broadband. Italy is at the beginning of this new chapter in the telecommunication world, considered important to open new businesses and speed up the economy. Therefore, the new telecommunication platforms must ensure the potential of triple play, offering innovative services, as mentioned earlier, at the same time involving as many actors as possible, from content creators to hardware vendors and device suppliers.

At the same time, another important issue to be faced is the quality of service offered to end-users, who will expect at least the same quality currently offered by the traditional services (such as, analogical and satellite TV), elaborating adequate business models, to keep the pricing affordable and accessible by almost everyone.

Although the triple-play concept is not consolidated yet, the big telecommunication operators aim to define their own market approach based on quadruple-play[22], which is the integrated triple-play offer with video services on third generation mobile. It could appear too premature to introduce a further innovation while the technological environment is still struggling to align the heterogeneity in the current infrastructures. In reality the concept of Fixed-Mobile convergence has been present for many years, but practically all of the standards have been invented and developed either by standardization bodies or ad hoc technical communities. The result is a well-known fragmented broadband world using different technologies and network infrastructures.

On the other hand, the mobile industry has started, in advance, the activity of standardization of the third generation mobile network, also thanks to several partnerships with recognized and well identified coordination entities (such 3GPP), strongly aimed to define a common network infrastructure able to offer a broad set of interactive services. This aspect can surely facilitate and simplify the integration and convergence process, at least from the technological point of view.

Furthermore the possible migration to quadruple play is justified by the increasing needs expressed by the user communities, which is reluctant to face radical changes in using the already consolidated services, being much keener to have the same voice, data and video services also in mobility.

6.2   IP Multimedia Subsystem (IMS)

The IP Multimedia Subsystem (IMS) standard defines a generic architecture for offering Voice over IP (VoIP) and multimedia services. It is an international standard, first specified by the Third Generation Partnership Project (3GPP/3GPP2) and now being embraced by other standardization bodies including ETSI/TISPAN. It has been furthermore identified as possible baseline component for Next Generation Networks during the activities carried out by the ITU Focus Group on NGN. The standard supports multiple access types – including GSM, WCDMA, CDMA2000, Wireline broadband access and WLAN. For users, IMS-based services enable person-to-person and person-to-content communications in a variety of modes – including voice, text, pictures and video, or any combination of these – in a highly personalized and controlled way. [23]

The IP Multimedia Subsystem (IMS) provides a flexible architecture for the rapid deployment of innovative and sophisticated features. The IMS focuses on introducing both a technical and commercial framework for a mobile operator to offer person-to-person services using a wide range of integrated media, voice, text, picture, video etc. The IMS standard will speed the adoption of IP based multimedia on handsets, allowing

users to communicate via voice, video, or text via a single client on the handset. The vision for the IMS core network is maximum flexibility and independence from the access technologies. This flexibility is accomplished, in part, via a separation of access, transport, and control. The control is further split into media control, session control, and application control.

IMS also supports the interworking with PSTN and Circuit Switched (CS) domain for voice, and with corporate intranets, ISP networks and the Internet. Further, IMS is access agnostic and works together with any packet-based access network. This allows operators to leverage the IMS core infrastructure by using it not only for UMTS radio access, but also for GPRS, EDGE, TD -SCDMA, license free hot spot radio technologies (e.g. Wi-Fi) and wire line networks. The figure below briefly describes the architecture of IMS[24]

Figure 6.2: IMS Architecture
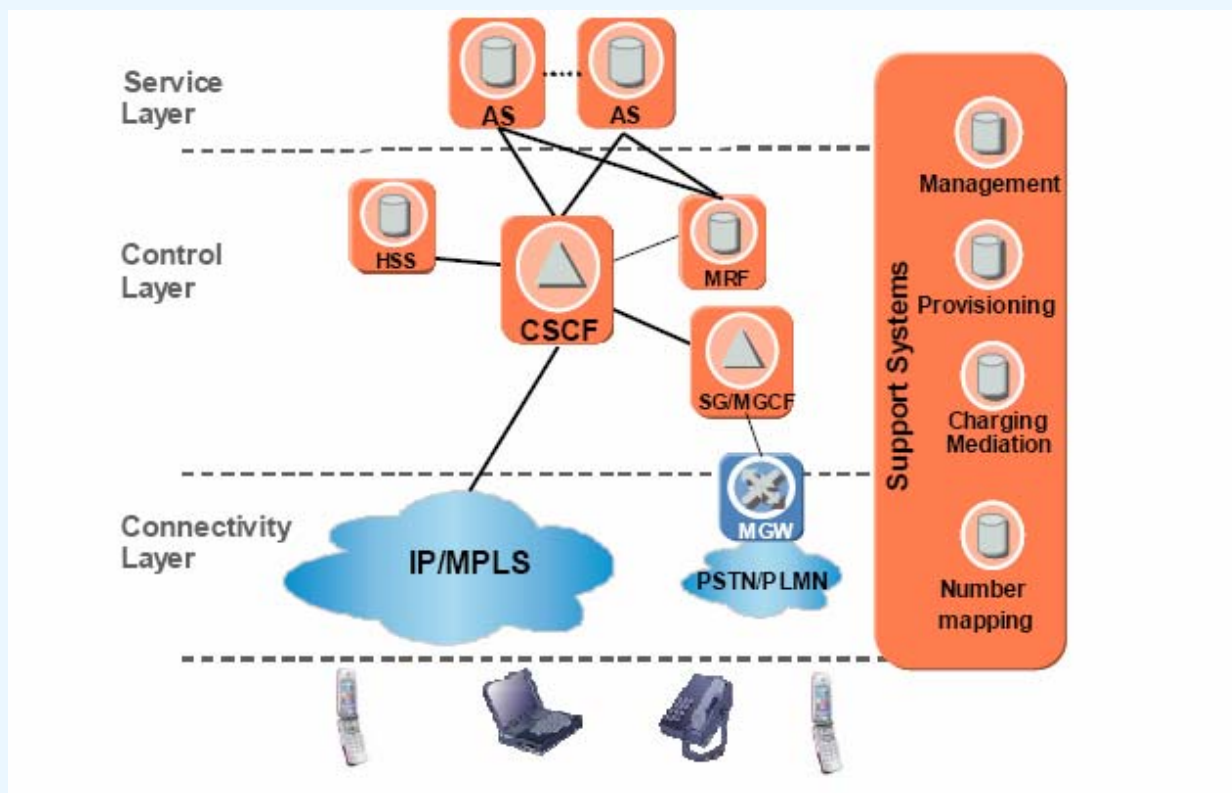
Source: Ericsson

- The *application layer* comprises of application and content servers to execute value-added services for the user. Several services can be implemented and deployed, almost all towards the concept of multimedia; presence and availability, Push-to-talk; enriched mobile video communications are some of them.
- The *control layer* comprises of network control servers for managing call or session set-up, modification and release. The most important of these is the CSCF (Call Session Control Function), also known as a SIP server. This layer also contains a full suite of support functions, such as provisioning, charging and operation & management (O&M). Interworking with other operators' networks and or other types of networks is handled by border gateways.
- The *connectivity layer* comprises routers and switches, both for the backbone and the access network.

As mentioned before, it is quite clear now that the introduction of IMS as communication paradigm could really strengthen the service provisioning, giving huge advantages in terms of ease of use to the end

customers. On the other hand, it could facilitate the possible releases of Next Generation Networks, being already adopted by the standardization bodies, and at the same time being a recognized standard.

On the end-users side, lots of new services and potential applications are foreseen. The payback is the need of bandwidth, but according to the state of the art of the broadband and mobile in Italy, it seems that enough resources are already available to support the eventual introduction of such applications. The picture below wants to describe the potential of IMS in relation to Circuit and Packet Switched networks.

Figure 6.3: Service evolution using IMS platform
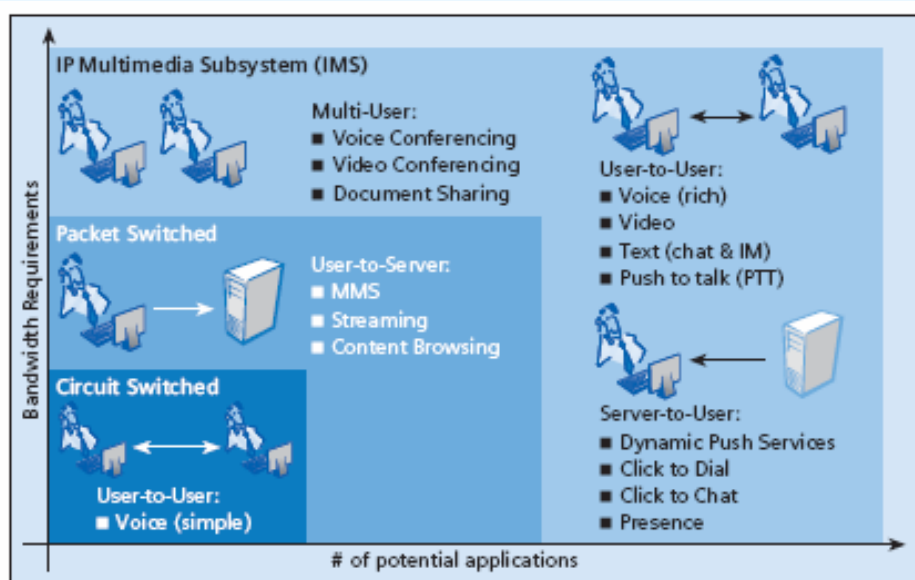
Source: Siemens

In Italy, only recently have telecommunication companies and vendors started to express interest in IMS. However, some initial proposals and solution approaches have been produced as joint ventures and interesting collaborations between vendors and carriers. Boxes 6.1 and 6.2 provide examples of the outcome of such coordination.

One of the main components of IMS is the Session Initiation Protocol. SIP is a peer-to-peer, multimedia signaling protocol that integrates with other Internet services, such as e-mail, Web, voice mail, instant messaging, multiparty conferencing, and multimedia collaboration. When used with an IP infrastructure, SIP helps to enable rich communications with numerous multi-vendor devices and media. SIP can set up individual voice or conference calls, videoconferences and point-to-point video-enabled calls, Web collaboration and chat sessions, or instant messaging sessions between any numbers of SIP enabled endpoints, including IP phones, PCs, laptops, personal digital assistants (PDAs), and cell phones. In the opening scenario, the participants could be using end-devices from any number of different vendors, and if the devices supported the necessary SIP applications with sufficient attention paid to implementation, the rich-media conference call would work perfectly.

The standards have recommended the adoption of the Session Initiation Protocol (SIP) as the service control protocol in the architecture of IMS, and this will allow operators to offer multiple applications simultaneously over multiple access technologies such as GPRS or UMTS or ultimately other wireless or even fixed network technologies.

Box 6.1:Ericcson and TIM together towards IMS based services

Ericsson has been selected as supplier of its IP Multimedia System (IMS) including combinational services to TIM Italy. The implementation of the IMS based services will enable TIM's mobile users to share videos, images, and collaborate on whiteboards while having an ongoing phone conversation. The new services will be available on a number of different terminals from a variety of suppliers.

A main benefit with such services is to enrich and enhance end user's experience, providing the consumers with an instant way of sharing different media during an ongoing voice call. Furthermore they are based upon existing user behavior, which will improve service take-up rates. It will also create a number of new business opportunities for mobile operators

Ericsson IMS is based on 3GPP/PP2, OMA and ETSI TISPAN, and in line with the specifications expressed by the work of the ITU's Focus Group of Next Generation Network.

Source: http://www.ericsson.it/press/viewnews.asp?NID=226

Box 6.2: Nokia and Telecom for IMS related services

Nokia has demonstrated live IP multimedia applications based on its 3GPP2/3GPP-compliant IP multimedia subsystem (IMS) over a commercial CDMA 2000 network.

Using the commercially available Nokia IP multimedia subsystem, Nokia demonstrated peer-to-peer gaming with simultaneous instant messaging and file sharing. The demonstration included interoperability between GSM/GPRS terminals and CDMA terminals, as well as with CDMA 1xEV-DO Release 0-capable laptop computers.

In summer 2004, Nokia introduced the industry's first commercially available end-to-end 3GPP IMS solution for SIP based applications, including real-time video sharing, push-to-talk, content sharing, instant messaging, interactive gaming and presence.

Recently, Nokia and Telecom Italia had announced their plan to target a mass-market launch of the video sharing service in Italy starting from the second quarter of 2005.

Source: http://www.nokia.it/nokia/0,0,72400,0,0.html

The natural application of SIP is VoIP services; Box 6.3 shows an interesting example.

Box 6.3: VoIP on SIP protocol

Although VoIP is nowadays a well-known communication framework, consumers and end-users devices are not yet spread on the market. The situation could rapidly change with the introduction of AVM, which has presented the innovative FRITZ!Box Fon, a device that integrates router, ADSL modem and PABX functionalities. It is in fact possible to use the traditional telephones to call via Internet; even with the PC shut down, using any provider VoIP that supports SIP. The device will be marketed in Italy by some of VoIP providers such Unidata.

Source: http://punto-informatico.it/p.asp?i=54182&r=Telefonia

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6.3   Next Generation Networks: The way forward?

Next Generation Networks (NGNs) are emerging from evolving technology. The goal is to use the best of the voice and data communications infrastructures. The vision of NGN is a common infrastructure that supports a wide range of applications - including voice, data, video, and multimedia - while maintaining the high reliability, security, ubiquity, and controlled Quality of Service (QoS) provided by today's voice infrastructure. The NGN is intended to be able to support users with a wide range of Customer Premises Equipment (CPE), from the telephony phones in the PSTN to Internet appliances (including Personal Computers (PCs) and Personal Digital Assistants (PDAs)), using a variety of wireline and wireless access technologies, and provide an infrastructure to rapidly offer new, innovative applications and services.[25]

The evolution of telecommunication networks towards the so-called Next Generation Networks is already in progress and initial practical applications and concrete implementations are starting to appear on the market.

Next Generation Networks introduce some new concepts, already addressed in the work of the various standardization bodies, such as the principle of circuit switching toward packet switching, the de-coupling of the network infrastructure from application services and a sort of intelligence, mostly on the edge side.

The architectural models of Next Generation Networks are justified essentially in the need of overcoming the limits of the current infrastructures, structured as vertical solutions. The NGN, in fact, tends to develop towards dedicated horizontal layers with respect to the transport, the network control and the services. They keep the specificity in the access layer (fixed or mobile) and allow the identification of the different roles - from pure transport service provider to advanced end-users services.[26]

Main elements of NGN seem to be the adoption of packet protocol (such as IP) in the transport layer and the use of "open architecture" in the service layer. The trend shows also a strong interest of NGN implementations proposals aimed to create synergies with WEB service and related technologies.

Box 6.4: Web service evolution within NGN

The main goal of Web Services architecture is the realization of an interoperable network of services focused on service reuse and it is suitable both to interact with 3rd party applications and to export services by a network operator or a service provider. The Web Services can be used to export network services by exposing its WSDL (Web Services Definition Language) interfaces; these services communicate using SOAP (Simple Object Access Protocol), a protocol used to transport data between web services; service discovery and service registration are implemented accessing to the UDDI (Universal Discovery, Description and Integration) registry; XML is used as data format for SOAP messages that rely on existing internet protocols like HTTP. Web Services implementations need that the language dependent API must be translated in WSDL and the application server where web-services are deployed must translate incoming SOAP messages to the underlying interfaces (Java, C++, CORBA...). Web Services has been widely supported by the most important software companies and their goal is becoming the standard application-to-application middleware. Different Web Services toolkits are available and almost all Application Creation Environments include them or offers a plug-in to handle Web Services. Toolkits can be used to translate in WSDL the existing applications' interfaces made with different languages. These toolkits also generate SOAP proxies used within the application server in order to translate SOAP messages in the underlying application language.

Source: http://www.iec.org/events/2004/bbwf/exhibition/tp_theater.html

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Within the Italian context, all actors involved in the Telecommunication world are starting to express a strong interest in NGNs, trying to develop solutions based on the services and technologies already in use or the ones that will become critical and with a strong impact in the short-medium term.

This approach has generated an Italian vision of Next Generation Networks, as might be foreseen, where the different entities have taken pieces of the work produced by standardization bodies and re-adapted to the Italian environment and reality. As a matter of fact, in Italy, Next Generation Networks in synonym to VoIP, IPTV, and generally speaking Triple play solutions, joined to the idea of moving all solutions using a unique transport protocol which is the IP.

With regard to Quality of Service and security requirements the present situation shows a fragmented work, driven by technology and different business models, instead of reaching a common NGN Italian platform by a joint effort which includes regulators as well.

This working method derives by several factors, political, cultural and also marketwise. The risk is having in the future different conceptual interpretations of NGN, generating different solutions, compatible for sure but not "harmonized". This means that different providers will deliver different NGN solutions and the end-users will be obliged to choose the solution that will fit their requirements.[27]

It is also true that NGN has not penetrated yet massively the market and also at the international level it is not clear yet how the possible implementation should be carried out; studies are still in progress, and the work of Italy in this direction, producing NGN-like solutions, is remarkable.

Some Italian operators tried to identify an integrated framework that is compliant with the specifications emerged by the NGN related studies. As already stated, the integration and consolidation process has been triggered by the attempt to extend the services already deployed and offered to the end users, inheriting the

physical infrastructure currently in place, but expanding its functionalities through partnerships and joint-ventures with hardware vendors and system integrators.

A concrete follow-up on this subject has been carried out by Fastweb, who has been able to extend its triple play offer integrating some of the infrastructure elements characterizing the NGN approach. The following figure shows a possible NGN-like solution, developed by the Italian operator Fastweb.[28]

Figure 6.4: Evolution of Fastweb's NGN Architecture
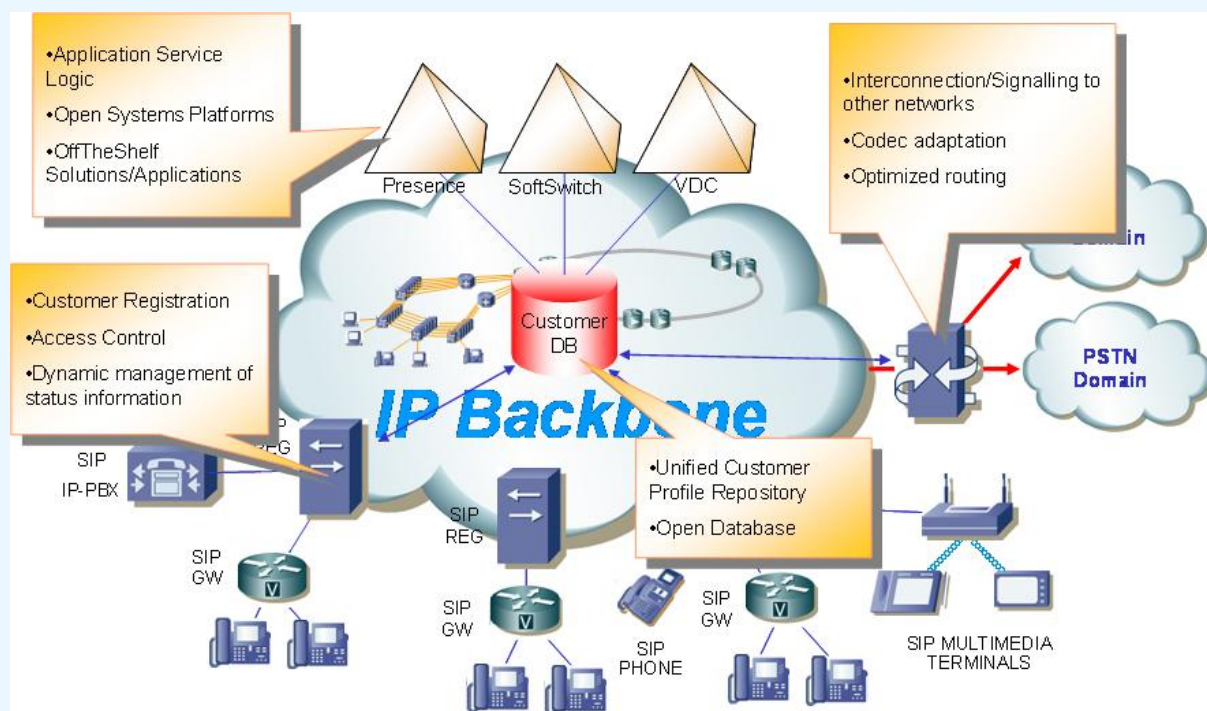
Source: FASTWEB

Furthermore, through partnerships with Italtel (a system integrator in Triple Play and IP Next Generation Network solution) and Cisco, Fastweb has managed to strengthen the service provisioning, moving towards the possible migration to real NGN (see Box 6.5)

Box 6.5: Fastweb fortifies collaboration with Italtel and Cisco systems to enhance its VOIP network

The solution including elements from Italtel and Cisco Systems helps to ensure streamlined integration and interoperability of FastWeb's VoIP network with all varieties of fixed and mobile networks. A significant decision driven by FastWeb's needs to enhance its network infrastructure to deliver voice, data and video services to its customers.

 Italtel, a company in the integration of voice/data/video services for the development of IP-based Next Generation Networks, and Cisco Systems has deployed a solution for the evolution of FastWeb's VoIP network.

Characterized by its 'Trunking Gateway' feature, the Italtel-Cisco solution provides FastWeb with a highly reliable and scalable voice/data/video IP infrastructure with the flexibility to adapt to the evolutions and advances of network and IP-based services. Additionally, the network's overall optimization and rationalization has enabled significant reductions in operating costs.

Source: Italtel

In addition, Telecom Italia, which is the incumbent operator in the Italian market, mainly through its R&D division, Telecom Italia Lab, has studied the evolution of networks towards Next Generation Networks, building architecture able to evolve and adapt to the NGN requirements and technical specifications (see Box 6.6).[29]

Box 6.6: Telecom is defining "Long-Term Network architecture"

The global architecture of the Long Term Network, consists of a set of segments: terminal and Customer Premises Equipment (CPE), access networks, transport networks, and control layer for network and services

In the edge part, it will be necessary to integrate diversities related to terminal functions, and access modalities (such wired or wireless), as well as traditional accesses, (fixed and mobile). It is therefore foreseen in the access network a multiplicity of solutions. On the core network side, instead, the approach is to maintain as much as possible integrated solutions.

Concerning the control layer, the network will use mainly the functionalities of IMS (IP Multimedia Subsystem), to manage users' sessions (using the SIP protocol); on this matter, Telecom Italia Lab has developed a solution for its Wireline and mobile part with Italtel.

The control layer will guarantee, other than the IMS related functions, also other characteristics such as:

- AAA (Authentication, Authorization, Accounting) to ensure the correct user identity;

- QoS (Quality of Service) to allow the network to protect itself from the overload, protecting at the same time user activities;

- Mobility control, activating the Mobility Manager for the identification of the user displacement;

- User and Service profiling, such as presence functions;

- Data repository of the current geographic position of the user, to ensure the "always best connected" paradigm, wit access modalities related to the operational context.

Source: Telecom Italia Lab

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7 SECURITY AND DATA PROTECTION

7.1 Introduction

The major changes in information and communication technologies and services that have taken place over the past quarter century and are continuing at a rapid pace have changed the nature of public communication dramatically. These changes are requiring that traditional ways of providing various communication public services are breaking down. These include emergency communications for citizens (e.g. emergency telephone numbers), security for law enforcement agencies (e.g., legal wire tapping), and personal privacy protection. Now that mobile services are prompting people to give up fixed network services, and IP is being used increasingly to provide various forms of voice service, it is apparent that a "new business model" is needed to ensure that publicly acceptable standards on these matters are developed and implemented in the new convergence environment.

7.2 Security: Is there any in a new convergent world?

As the Internet and other info-communication networks become an ever-increasing part of our daily lives, so does our dependency on their underlying infrastructure, especially in a NGN environment. Unfortunately, newly discovered forms of attack on network infrastructure, the availability and wide distribution of attack tools, the increase in other threats to online safety such as spam and phishing schemes, as well as accelerating efforts by malicious hackers to exploit vulnerabilities in software have created rising challenges to network security.

Policy–makers and regulators have to ensure that appropriate measures are being taken to keep NGN from disruptive shocks such as cyber attack or accidental damage.

7.2.1   Anti-Spam Law in Italy

With this regard, Italy has enacted a tough anti-spam law that makes spamming a criminal offence and is punishable by up to three years' imprisonment. The fight against spam, with respect to the protection of personal data, falls within the competence of The Italian Data Protection Authority ("the Authority") under the terms laid down in the Personal Data Protection Code (legislative decree No. 196/2003 - Sections 121-132, in particular 130). The Authority may receive complaints and/or reports from alleged spam victims and impose administrative fines on offenders. It has the power to carry out on-the-spot inspections, search premises and to seize records and any other items considered to be relevant; it may block unlawful processing operations and will refer information to the judicial authorities.

7.3   Data Protection Code

The Data Protection Code was adopted as a Legislative Decree on 30 June 2003 and entered into force on 1 January 2004. It replaces the previous Data Protection Law (Law N. 675/1996) as well as a number of other legislative and regulatory provisions. It is meant to update, complete and consolidate Italy's data protection legislation, introducing important innovations and conforming national legislation to European regulations, in particular Directive 95/46/EC (Data Protection Directive) and 2002/58/EC (Directive on privacy and electronic communications).

The Code is unique in that it brings together all the various laws, codes and regulations relating to data protection since 1996. There are three key guiding principles behind the code, which are outlined in Section two are:

- Simplification
- Harmonization
- Effectiveness

The code is divided into three parts. The first part sets out the general data protection principles that apply to all organizations. Part two of the code provides additional measures that will need to be undertaken by organizations in certain areas, for example, healthcare, telecommunications, banking and finance, or human resources. Part three relates to sanctions and remedies. It is expected that the second part of the code will be developed further through the introduction of sectoral codes of practice. Seven codes are planned (including surveillance, with particular regard to video surveillance, human resources, private investigators, and advertising/marketing) which will be developed in consultation with industry groups.

The code applies to all processing within the State and its territories. It will also affect outside organizations that make use of equipment located within Italy, which could include for example PCs and other computer-based systems (see Section 5 of the code). This means that the use of cookies is covered by the Italian code, which will have important ramifications for online businesses. If an organization outside the EU is processing data on Italian territory, it must appoint a representative in Italy for the application of Italian rules (this will be necessary for notifying with the *Garante*, and providing data subjects with information notices).

7.3.1   Data Retention in Italy

In July 2005 new legal requirements on data retention came into force in Italy[30].

Internet cafes and public telephone shops with at least three terminals must seek a license permit within 30 days from the Ministry of Home Affairs. They must also store traffic data for a period which may be determined later by administrative decree. WIFI hotspots and locations that do not store traffic data have to secure ID information from users before allowing them to log on. For example, users may be required to enter a number from an ID card or driving license. It is not clear how this information is validated. Mobile telephony must identify them selves before service activation, or before a SIM may be obtained. Resellers of mobile subscriptions or pre-paid cards must verify the identity of purchasers and retain a photocopy of identity cards.

Data, including location data, on fixed line and mobile telephony must be retained for 29 months. There is no requirement to store the content of calls. Telephony operators must retain a record of all unsuccessful dial attempts. ISP data Internet service providers must retain all data for at least six months. The law does not specify exactly what traffic data must be retained. There is no requirement to store the content of Internet communications.

The legislation of July 2005 enables data retention by outlawing all the relevant data protection provisions until 31 December 2007. Under the data protection provisions, service providers are obliged to anonymise or delete traffic data when they no longer need it to process the communication or to send bills (with a maximum of 6 months). The traffic data, which will now be retained, can be used for anti-terrorism purposes and for general penal enforcement of criminal offences. Italy already required the retention of telephony traffic data for 48 months, but without location data. Italy has adopted the EU Directive on Privacy and Electronic Communications 2002 but with an exemption to the requirement to erase traffic data.

7.4   Security requirements for NGN

The open and distributed nature of convergent and NGN architectures enables easy access to the services, information, and resources, together with the constant abuse of hackers, curious individuals, fraudsters and organized crime units. Fraud perpetrators introduce new, complex techniques of fraud daily, possessing the knowledge to circumvent all network security mechanism. Their intrusion is nearly impossible to detect, causing immense damage to operators, service providers and end-users.

The infrastructure of NGN is packet based and multilayered, with open, distributed architecture and no ingrained security mechanisms. Specifically in Italy, where the impulse of "*e-*" is starting to become a must, mission-critical applications, used for the transmission of high-profit services such as voice, e-commerce, and financial transactions, are run over these exposed networks.

Furthermore, the implementation of all-IP networks, pushed by almost all Italian telecommunication players pose a severe security issue; since the user authentication is based on the IP layer, IP packets sent over these networks can easily be marked with a "borrowed" IP address (*IP spoofing)*, enabling unauthorized users to impersonate legitimate ones. These intruders abuse services and benefits at the expense of legitimate users, who are often completely unsuspecting until the bill arrives. The possibility that an IP address may have been altered causes data issued by the IP layer to become both insufficient and unreliable.

An inherent lack of embedded control mechanisms in the network infrastructure, both IP and Web-based applications, contributes to low network survivability. Lack of traffic management control mechanisms enables "bandwidth theft," that is, one user will transmit a larger amount of traffic than allocated to him, leaving other users with less bandwidth for their own use. Unmanaged congestion and lack of overload control enable sabotage in the form of denial-of-service attacks on various services. One way to do this is to flood the server with repeated, legal service requests in an attempt to overload it, causing severe degradation or complete unavailability of the service to legitimate, and paying users.

New billing schemes are being introduced based on content and quality, creating yet another point of weakness for criminal abuse. The better the service, the higher the profit, not to mention the availability of the scheme procedures themselves; such potential inevitably accelerates the creation of new and sophisticated fraud methodologies.

The international bodies are being very active in identifying the security requirements for the ideal implementation of NGN, but the concreteness of possible action plans in mitigating security threads is much related to the operational context and the reality.

It is therefore more useful to provide in a table a snapshot of some of the possible security issues within the Italian context and provide as well a possible course of actions to reduce such risks (see Table 7.1).

Table 7.1: Security requirements on NGN (in the Italian context)

Threads	Possible course of actions
• Can be easily concealed by hackers • Makes security mechanisms extremely difficult to maintain • Inadequate passwords • Incorrect configuration of firewalls • Low employee awareness of security risks • Insufficient knowledge of NGN environments • Enables fraud to be committed from multiple points in the network simultaneously • Tools, scripts, and detailed hacking instructions are publicly available on the Internet • "Always-on" access technologies put domestic users at higher risk	• Maintain the integrity of the entire security infrastructure • Act against the adversary and not against the specific attempt • Enable easy, correct configuration • Support swift, cost-effective integration of new technologies, products, and services • Be equipped with an intelligent means of data collection • Detect and present results on-line, enabling immediate counteraction before severe harm is done • Assimilate the now familiar pattern to prevent its recurrence

Source: Cisco Systems

7.5 Authentication and authorization

Shared mediums of communication such as modems, wireless transmission and others, enable several indiscretions, including violation of privacy caused by unlawful access to another user's service, password sniffing (the illegal obtainment of user passwords) and impersonation of authorized, subscribing users to access the services allotted to them.

These kinds of threads are generally falling under authentication authorization area. Lots of work has still to be done in order to define what could be the best approach in authenticating against a NGN-like infrastructure.

Due to the nature of an open and distributed NGN, and in order to facilitate the user in accessing a specific service, the authentication process should be done only once, masking all the passages from one infrastructure to another and from one service provider to another.

In the Italian context, the authentication issue on integrated and convergent environments has not been investigated yet. However, a remarkable result has been obtained by the Italian Data Protection Code which reads as follows: [31]

Section 31, Art. 1 - Personal data undergoing processing shall be kept and controlled, also in consideration of technological innovations, of their nature and the specific features of the processing, in such a way as to minimize, by means of suitable preventative security measures, the risk of their destruction or loss, whether by accident or not, of unauthorized access to the data or of processing operations that are either unlawful or inconsistent with the purposes for which the data have been collected.

Section on "Computerized Authentication System", Art. 2. Authentication credentials shall consist in an ID code for the person in charge of the processing as associated with a secret password that shall only be known to the latter person; alternatively, they shall consist in an authentication device that shall be used and held exclusively by the person in charge of the processing and may be associated with either an ID code or a password, or else in a biometric feature that relates to the person in charge of the processing and may be associated with either an ID code or a password.

Section on "Computerized Authentication System", Art.3. One or more authentication credentials shall be assigned to or associated with each person in charge of the processing.

Section on "Computerized Authentication System",Art,4. The instructions provided to the persons in charge of the processing shall lay down the obligation to take such precautions as may be necessary to ensure that the confidential component(s) in the credentials are kept secret and that the devices used and held exclusively by persons in charge of the processing are kept with due care.

*Section on "**Computerized Authentication System**", Art.5. Where provided for by the relevant authentication system, a password shall consist of at least eight characters; if this is not allowed by the electronic equipment, a password shall consist of the maximum permitted number of characters. It shall not contain any item that can be easily related to the person in charge of the processing and shall be modified by the latter when it is first used as well as at least every six months thereafter. If sensitive or judicial data are processed, the password shall be modified at least every three months.*

*Section on "**Computerized Authentication System**", Art.6. An ID code, if used, may not be assigned to another person in charge of the processing even at a different time.*

*Section on "**Computerized Authentication System**", Art.7. Authentication credentials shall be deactivated if they have not been used for at least six months, except for those that have been authorized exclusively for technical management purposes.*

*Section on "**Computerized Authentication System**", Art.8. Authentication credentials shall be also deactivated if the person in charge of the processing is disqualified from accessing personal data.*

*Section on "**Computerized Authentication System**", Art.9. The persons in charge of the processing shall be instructed to the effect that electronic equipment should not be left unattended and made accessible during processing sessions.*

*Section on "**Computerized Authentication System**", Art.10. Where data and electronic equipment may only be accessed by using the confidential component(s) of the authentication credential, appropriate instructions shall be given in advance, in writing, to clearly specify the mechanisms by which the data controller can ensure that data or electronic equipment are available in case the person in charge of the processing is either absent or unavailable for a long time and it is indispensable to carry out certain activities without further delay exclusively for purposes related to system operationality and security. In this case, copies of the credentials shall be kept in such a way as to ensure their confidentiality by specifying, in writing, the entities in charge of keeping such credentials. Said entities shall have to inform the person in charge of the processing, without delay, as to the activities carried out.*

*Section on "**Computerized Authentication System**", Art.11. The provisions concerning the authentication system referred to above as well as those concerning the authorization system shall not apply to the processing of personal data that are intended for dissemination.*

These measures are clearly related to the Customer Premises Equipment (CPE) and seem to take in consideration the authentication to be performed on a device assigned or utilized by the user.

The concept of authentication, applied to the NGN is wider and involves the transparent access by the users to a specific service, through techniques such Single-Sign-On (SSO).

8 BRIDGING THE DIGITAL DIVIDE IN ITALY

8.1 Introduction

The recent i2010, the European initiative for the Information Society proposed by the Commission on 1st of June 2005, framed the broadband territorial digital divide into the wider framework of e-Inclusion.

By calling for a comprehensive approach, it recalled that "*during 2005, the Commission will address e-accessibility through a mix of research and stimulation measures to make ICT systems easier to use for a wider range of people. It will give guidance to extend the geographical coverage of broadband in under-served areas and will review the scope of the Universal Service Directive in 2005 and the directive as a whole in 2006. In 2006, the Commission will also review the contribution of ICT and digital literacy to key competences targets in the 'Education and training 2010' initiative.*"
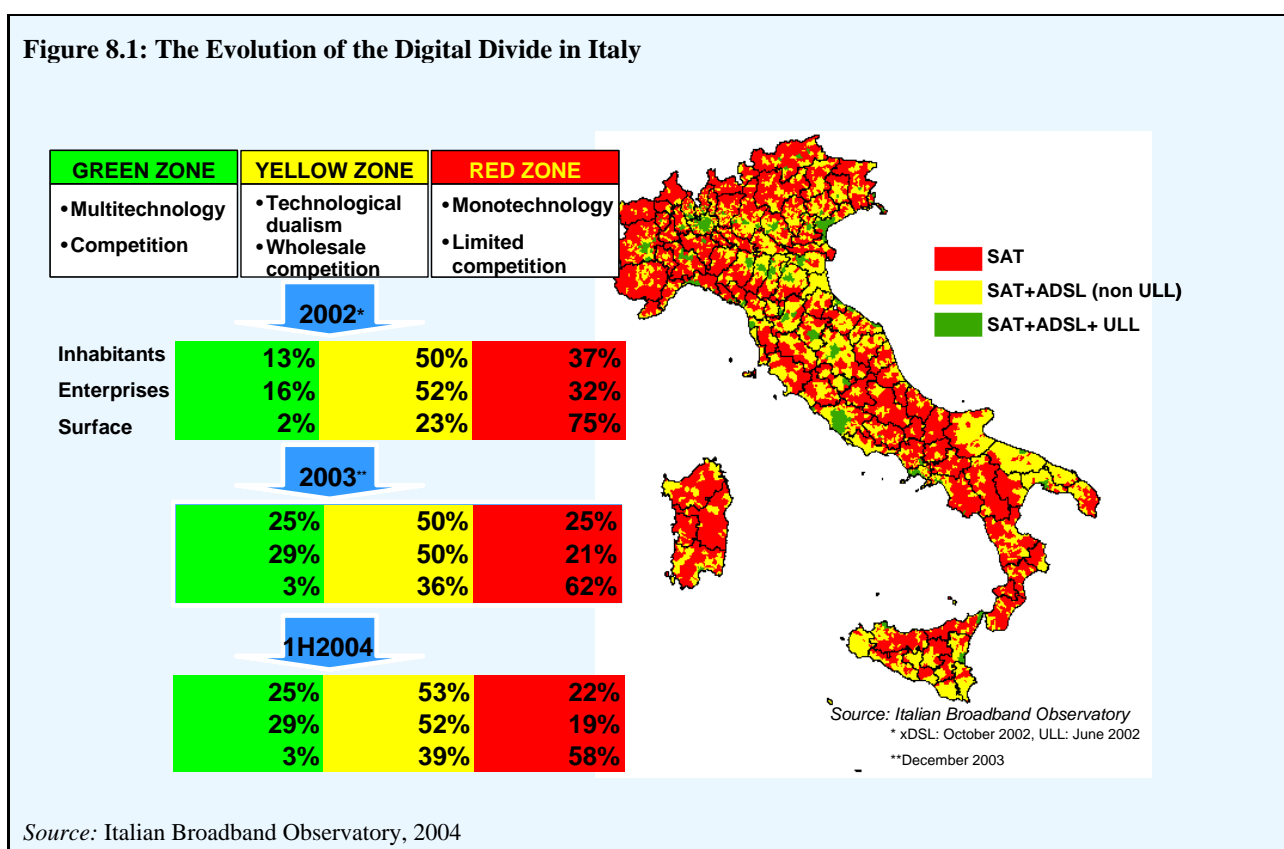
The new strategic framework for the European Information Society "i2010 – A European Information Society for growth and employment" places particular emphasis on tackling the issues of both geographical coverage of broadband and the social and economic digital divide.

The delivery of advanced applications allows individuals and organizations to communicate and access services regardless of their geographical location. It enables businesses to communicate with clients and suppliers and limits business migration to urban areas.

8.2 The digital divide in Italy

Broadband allows households to access advanced e-government, e-health and e-learning services, improving their quality of life and their participation into the social and democratic life. By its own nature, broadband bridges distances and is particularly beneficial to the development and attractiveness of remote and rural areas. Nevertheless, broadband roll-out also in Italy has been concentrating in more populated areas.

A recent investigation from the Italian Broadband Observatory (a project monitoring the development of broadband in Italy) has revealed that around 4'400 out of 10'400 local exchanges are not connected to the backhaul broadband infrastructure.

Figure 8.1: The Evolution of the Digital Divide in Italy

	GREEN ZONE	YELLOW ZONE	RED ZONE
	• Multitechnology • Competition	• Technological dualism • Wholesale competition	• Monotechnology • Limited competition

2002*

Inhabitants	13%	50%	37%
Enterprises	16%	52%	32%
Surface	2%	23%	75%

2003**

	25%	50%	25%
	29%	50%	21%
	3%	36%	62%

1H2004

	25%	53%	22%
	29%	52%	19%
	3%	39%	58%

SAT
SAT+ADSL (non ULL)
SAT+ADSL+ ULL

Source: Italian Broadband Observatory
* xDSL: October 2002, ULL: June 2002
**December 2003

Source: Italian Broadband Observatory, 2004

This evaluation has also estimated that closing the digital gap will require an investment of €1'8 billion for connecting the remaining 4'400 local switches to the broadband backhaul, and around €1'1 billion for service provision (upgrading switches and network) for a total of €2'9 billion to be realized within 2-3 years. The investigation revealed that while an average of 76 per cent of the Italian population can access ADSL services, the average is significantly lower in the Mezzogiorno regions (coinciding with the Objective 1 areas), with examples of 54 per cent accessibility in the Southern region of Calabria, 48 per cent in Basilicata and 64 per cent in Abruzzo.

8.3 Broadband action plan

Infratel's own investigation, which aimed at verifying broadband ADSL availability on Fixed Telecom Italia infrastructure for all 8'101 Italian municipalities, revealed that May 2004, 5'951 municipalities (24 per cent of the population and 22 per cent of enterprises and public administrations) do not have access to ADSL.

Infratel's action plan is based on the following approach:

- Avoid duplication of investments by reusing existing infrastructure as much as possible;

- Use the most modern, reliable, future proof, technologies;

- Open the use of infrastructure to all operators and to public administrations interested without discrimination;

- Identify pilot projects in Puglia, Basilicata, Calabria, Sicilia, Defence Ministry and industrial districts (based primarily on the verification of demand for broadband);

- Identification of modalities of collaborations with partners and local users;

- Definition of action lines for the 2004 budget and business plan for 2005-2008.

Infratel is currently developing an operative model aimed at attracting additional resources from a variety of sources including regions, local branches of the public administrations, telecom operators, private enterprises and Innovation Italia.

All Information Society actions (strategies and programmes) are expected to be agreed and implemented by central and regional/local government through specific framework agreements.

The first call for tender, published by Infratel on 22 March 2005, foresees an investment of €127 million for the building of 1'800 Km of optical fiber network, including 600 Km of MAN (Metropolitan Area Network) covering 30 major cities and a backhaul infrastructure connecting 265 municipalities (currently without broadband service) with the backbone network.

8.4   Digital Terrestrial Television

The television broadcasting system has made great steps forward and Digital Terrestrial Television can no longer be considered a flash in the pan. While up to a few years ago the whole system seemed to be stagnating, the go-ahead to digital terrestrial television has given a decisive jolt to the reorganization of television broadcasting by designing new scenarios that are modeling attractive business opportunities, new content and technological innovation on the part of all the players involved in the transition from analogical to digital. Moreover, it is an innovation that interests Italy from the most advanced and experimental point of view, with the Gasparri law[32] that has introduced the interactive aspects of digital terrestrial broadcasting.

Across Europe, interactive services using the DVB Multimedia Home Platform (MHP) standard have been launched on cable, satellite and terrestrial platforms. While not formally mandated by the European Commission, MHP has been embraced as an open and interoperable standard that can be actively encouraged and promoted. Already, several countries have launched MHP-based interactive services on the terrestrial platform.

But the turning point for MHP has been in Italy where interactive content has been a cornerstone of the launch of DTT services. Broadcasters have provided a wide range of MHP-based interactive services such as digital teletext, news information, weather forecasts, audience polling and an EPG. Furthermore, the government seeks to develop "t-government" services in an aim to help bridge the digital divide. Government subsidies are available to encourage households to purchase interactive set-top boxes.

Of course MHP is not the only interactive television service system in the market. Proprietary systems such as MediaHighway and OpenTV have been installed in a large number of set-top boxes, often for cable and satellite platforms.

As of January 2005, 1'5 million MHP-enabled receivers for digital terrestrial television had been sold in Italy. A government subsidy (€110 million for 2004) accelerated the deployment of MHP boxes, although 200,000 were sold without subsidy. In October 2004, MHP set-top boxes were available for €151 in store, or just €1 with the subsidy. The subsidy for 2005 is €70 and the retail price is down to around €99. The success of the project has been attributed to factors such as the presence of free interactive content from the beginning with effective marketing. The wide range of services on air includes news, weather, audience polling, the ability to send and receive text and multimedia messages through the set-top box, and travel booking services.

A variety of problems have still to be confronted and solved, as may well be imagined for an experimentation of a profoundly structural nature both in terms of the investment needed and the numbers involved. But there is great enthusiasm for the new challenge and a desire to find ample space for sharing experiences and comparing notes, as long as the planned switch-off date, January 2006, is reached with everything in order.

8.5   E-Government Strategy in Italy

The Italian Department for Innovation and Technologies recently presented the final version of the 'Digital Administration Code', a new legal text that aims at providing a clear framework for the development of e-government. Meanwhile, a directive setting out e-government priorities has been officially published, and the Italian Cabinet has approved a decree giving registered electronic mail the same legal status as recorded delivery letters. In addition, the creation of a new electronic network connecting the entire public sector has also been officially approved.

The 'Digital Administration Code' is a new legal text that aims at providing a clear framework for the development of e-government and for the emergence of an "efficient and friendly" public administration. It contains a number of rules, obligations, recommendations and targets to boost the use of information and communication technologies (ICTs) in the Italian public sector. According to the Italian government, the new legislation will contribute to removing obstacles to further e-government development, such as "cultural difficulties" and "obsolete norms". The code was initially unveiled in November 2004, and its final version was presented by the Italian Minister of Innovation and Technologies Lucio Stanca on 9 February 2005.

The code will provide a single, consistent legislative framework for applying digital technologies in government. This will lead to greater efficiency and savings between EUR 4 and 5bn a year in central government alone, and among other things, the Code must prevent, through concrete measures, the widening of the digital divide in the Italian society.

Meanwhile, a directive for the digitization of public administration was published on the Italian Official Journal on 12 February 2005. The directive sets out priorities and guidelines for the transition to the second phase of the Italian e-government programme, officially approved in November 2003. This second phase is expected to consolidate the shift towards federalism in Italy by bringing local administrations closer to citizens and enterprises, by stimulating local self-government capabilities and by providing a common

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Box 8.1: Italian decree gives registered e-mail legal status

A decree adopted on 25/03/2004 by the Italian Government puts Italy at the digital forefront in Europe by giving registered electronic mail the same legal status as recorded delivery letters.

The measure, which is based on the recognition that "electronic-mail is, increasingly, becoming an instrument of daily communication" and that it can deliver key benefits to the public sector in terms of speed, efficiency and cost savings. The number of e-mail messages handled by Italian public administrations reached 31 million in 2003, up from 14.6 million in 2002. And the total cost of sending conventional postal mail is estimated at €20 per letter, compared with about €2 per e-mail.

Further development of e-mail use by public bodies nevertheless requires guarantees similar to those of recorded delivery letters to be available. To this end, the decree provides the legal basis for the 'certification' of both the sending and reception of electronic mail. The sender will get a receipt from its mail service manager (i.e. Internet Service Provider - ISP), constituting a legal proof of the shipment of the message and attached documentation. Similarly, when the message is delivered to the adressee, the adressee's ISP will send a receipt to the sender certifying the effective or failed delivery of the message, mentioning the date and time of delivery, regardless of whether the adresee has effectively opened the message or not. The adressee's ISP may also in some cases send the issuer a full copy of the message delivered for confirmation. The ISPs will keep records of the operations carried out for a period of 24 months, which will have the same legal value as the receipts issued and may be requested if receipts are lost.

The decree establishes an official register of certified e-mail managers, which will be maintained and controlled by the National Centre for IT in Public Administration (CNIPA). Some 20 ISPs have already asked to be included in the list of certified e-mail account managers. A certified e-mail service is already operational in Italy's central administration, and there are about 50 projects to implement such services in local administrations.

Source : http://www.thestandard.com/article.php?story=20040326213159853

strategic vision to all the actors involved in the process. Among other things, the directive asks public bodies to measure the level of user satisfaction with existing e-services, call for measures to rapidly extend the uptake of digital signatures, and urges public bodies to communicate via e-mail. In this respect, the Italian Cabinet has recently approved a decree that gives registered electronic mail the same legal status as recorded postal letters. The decree regulates the use of registered e-mail both for communications with public bodies and among citizens and businesses.

Another recent important development for Italian e-government was the final approval given by the Council of Ministers in early February to the 'Public Connectivity System' (PCS), a key infrastructure designed to enable digital communications and interoperability across the whole public sector. The PCS network, which will allow secure electronic communications among all 15,000 central and local government offices, will be the keystone for the implementation of the Digital Administration Code. Over the next few months, a new network will also begin linking all Italian government offices throughout the world.

8.6   New services for a new environment

Despite economic and social advances, a segment of the Italian society still remains marginalized, in this sense e-government, t-government and m-government could help significantly to bridge this digital divide. Such services can be seen as an important step towards the concept of ubiquity, where users are able to access specific capabilities in "always-on modalities". See below interesting examples of e-government services that use different telecommunications frameworks.

Further to the completion of two experimental phases during which over two million electronic ID cards were produced and distributed, Italy will now step up the implementation of the new personal identification documents and – in principle – add biometric identifiers to the cards. (See Box 8.2).

8.7   A big step toward seamless connectivity

From different sources has been predicted that mobile phones will soon be the most common consumer

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Box 8.2: Italian e-ID electronic card

Italy has just placed orders for $15 million worth of optical memory cards for use in its two national biometric ID programs - the citizen ID card and the new foreign worker ID card. In May 2005, the Italian legislature decreed that paper-based citizen IDs can no longer be issued after January 1, 2006. Deliveries of cards for the citizen ID program are scheduled to be completed by LaserCard in December 2005. It is likely that the expenditure on cards will be around $40 million per year.

The Italian government is currently planning for the entire adult population to have new citizen IDs within about six years. The citizen card has a five-year validity period after which the citizen will require a new card.

Developed in close cooperation with various agencies of the Italian government, the foreign worker card uses the same LaserCard optical memory platform and follows the same format as the citizen ID card. Each card contains a secure one megabyte optical memory stripe in which an individual's demographics, color facial image, digitized signature, fingerprint and other biometrics are recorded. These highly-secure LaserCards are also "chip-ready", enabling the Italian government to add an integrated circuit chip. The chip is used for the delivery of e-government services. The optical memory is present for fundamental card security and, by taking advantage of the Logical Data Structure standard for optical memory developed by the International Civil Aviation Organization (ICAO), offers international interoperability at the level of the card's digital data. According to the Italian Interior Ministry, the citizen ID is already recognized as a travel card for border entry by some 32 European and North African countries.

The Italian government undertakes an extensive security authorization and personalization process prior to issuing cards. This process includes multiple levels of government-controlled approvals between each stage of card production, registration, activation and issuance. The high data capacity and data permanence of optical memory are ideally suited for this process. Each approval step in the process will generate a digitally signed record of that step, including where, when, and by whom it was approved, which is then saved as a digital certificate onto the optical media of each card. Each subsequent step generates a new "digitally signed envelope" over all the previous steps. In addition, custom architecture built into centralized and distributed LaserCard Encoders helps protect the entire process from being compromised by criminal activity. These multiple layers of protection are designed to help make the card-issuance process highly secure.

Source: http://www.interno.it/news/articolo.php?idarticolo=15429

electronics device on the planet. By the end of 2009, people around the world will use more than two and a half billion handsets to stay connected, surpassing even the most wildly optimistic expectations.

Recognizing the convenience and cost savings of using one handset and one phone number, and managing only one phone bill, the telecommunications industry has envisioned fixed-mobile convergence (FMC). Until recently, however, the necessary technology was immature and customer interest was low. Now that consumers and businesses have discovered the promise of FMC, their demands - and the migration to all-IP networks - are pushing FMC into reality.

The USE-ME.GOV ('Usability-driven open platform for mobile government') project. The project is designed to support and encourage the access to new e-government services at any time and anywhere through the use of mobile communications, Internet technologies, and open source software. (See Box 8.3).

Box 8.3: M-government services

Based on co-operation between public administrations, ICT companies and universities, the project will launch three pilot services in the coming months aimed at testing the delivery of healthcare, school, and local council information to users via mobile phone. A fourth pilot service allowing citizens to send complaints by text message will also be launched before the end of the year.

Each service will pursue a number of goals and offer advantages to users. For example, the 'City Information Broadcasting' pilot to be carried out in the Italian city of Bologna will exploit mobile communication services as a complementary and effective means of communicating up-to-date information to citizens such as traffic-related announcements, strikes and emergencies. The pilot service, which will also be used for the promotion of city events, will provide users with customized information tailored to their needs, interests and itinerary.

Source: http://www.cnipa.gov.it/site/it-IT/Attivit per centC3 per centA0/Tecnologie_innovative_per_la_PA/M-government/Seminario_di_formazione/

8.8 T-Government Services

On 5 March 2005 the Italian government announced it would help to fund 29 projects for delivering public services over Digital TV. The projects cover a broad range of services - from employment to social services and from tourism to healthcare – and engage the regional, provincial and municipal levels of government, as well as several national and local TV broadcasting companies.

Among other things, the projects aim at increasing the uptake of electronic public services; these projects are away to deliver e-services to enlarge portion of the population, particularly to those citizens who do not have Internet and DTV access. See Box 8.5 for an example of T-Government services.

8.9 Wi-Fi: a new technology to bridge the digital divide

When the Communications Ministry promulgated Wi-Fi access in 2003, it was immediately perceived as the "hot new thing" for those mobile users demanding immediate access to e-mail and the Web. A world bristling with thousands of hot spots was forecast, but so far, reality has fallen short of expectations.

After almost two years, a new decree has been promulgated. The new decree aims at exploiting this new technology to bridge the digital divide not only in defined areas such as restaurants, hotels and fast food chains where people can have the opportunity to connect to the Internet with broadband wireless access but everywhere.

The regulation offers the opportunity to install networks, such as Radio LAN, to supply the public with access to electronic communication services on a band with a frequency range of 2.4 to 5 GHz by a simple authorization. Retailers who intend to offer the public Wi-Fi services must present the Communications Minister with a request to that effect, which gives the retailer the right to set up the service immediately, whilst respecting the conditions indicated in the regulation.

To avoid interference with other services and use the permitted broadcast power, the authorized subjects must respect the National Frequency Distribution Plan technical operating rules for using 2.5 and 5 GHz bands. This is because the frequencies used are collective and not assigned exclusively to each operator, as in the mobile telephone system.

The regulation also governs the use of Wi-Fi equipment for the public, spots open to the public and areas with high public attendance. The regulation also demands respect for security rules and the integrity of networks. It asks the retailers to use an identification code for users who access the public network. The installation of the Wi-Fi network should be set up in line with the principle of non-discrimination between the Radio LAN system and the other competing technology.

A large number of licenses have been issued so far, to companies ranging in size from Telecom Italia, to very small companies such restaurants and Internet cafes. Unfortunately there is no massive penetration of hot spots in Italy, which means that finding a hot spot can be difficult. Access points are mostly located in top range hotels, major airports and railway stations, Internet cafés and shopping centres.

Under Italian law, all users wishing to access a wireless network must register with a provider, and payment – which can be calculated in terms of time online, downloaded bytes or a flat fee – can be made with a pre-paid card or credit card. One problem with this is that the various service providers do not have commercial agreements that allow roaming between companies. This means that access via a provider bought at Rome's Termini railway station cannot be used at Milan's Malpensa airport, which may be covered by another provider. Moreover, some industry experts are very concerned about the disregard for Wi-Fi security. Almost all Italian access points are open; they are not encrypted, which means that data is easily intercepted.

8.10   Italian Best Practice – "Being Digital in the Aosta Valley"

As already mentioned the digital divide issue is not limited to the access by users to some specific technologies or means of communication, but it embraces a wider scope including difficulties of developing knowledge, acquirint know-how; in other words, remaining isolated from the cultural, political and economic mainstream.

Specifically, in Italy the digital divide is transversal to a specific technology, implying not only broadband and wireless but also TV and radio communication (mostly in the mountain areas), as well as mobile coverage.

The phenomenon certainly less of a problem than in the least developed countries, where even a telephone call can be a difficult task to perform. Nevertheless, compared to general European levels of ICT penetration, Italy is not completely in line with the average growth in bridging the digital divide.

Box 8.4: City of Parma: citizen services on digital television

The interactive TV portal of the City of Parma has just launched a new e-government feature to deliver home services to citizens. A new innovative service is now available on Digital Terrestrial Television: users can log on with Electronic ID Card and access public information and interactive services.

Awarded and funded by the Ugo Bordoni Foundation to further "develop e-government services by means of digital terrestrial television (t-government)", the project delivers content through a multi-channel access – as opposed to all other provisioning channels used by the City (web, contact center) - thus complying with two main requirements: highly interactive t-government services and procedures based on smart card user identification and certification to allow on air payments.

Enterprise Digital Architects has followed FUB indications to guarantee accessibility and usability so that, all services and text are planned to allow the clearest, most immediate and necessary visual and textual communication.

Private TV Tele Ducato broadcasts the interactive portal. As a result of the integration between the Enterprise Service Center and City of Parma systems, hosted by ITCity, citizens can access to highly innovative and technological DTT services.

Besides delivering institutional public information and thematic and general purpose info, the TV portal allows the Citizen to log on with the ID Card and check the status of requests at the register's office as well as pay fines with a credit card. The data will then be processed by the payment gateway through standard security systems.

Source: Enterprise DA

With the interventions by the government, in terms of investments and regulations, a big step forward has been achieved, and now the results of the actions taken should be visible soon.

One of the most important areas identified by the Italian Ministry of Communications is Research & Development, as well as related experimental trials. The aim of these trials is to investigate the impact and the potential of new emerging technologies and to perform quality tests on technologies that will be later provided to the users.

Box 8.5 shows an interesting trial on WIMAX in two Italian regions. With this strategic direction, the Ugo Bordoni Foundation has started a series of experiments to evaluate the reliability of possible new technologies, to investigate concretely the concept of Ubiquitous Network and Next Generation Networks, to implement network and service convergence projects aimed to deliver "always-on" ubiquitous and platform independent ICT services to the users.

In particular, during the last few months of 2005, the Foundation, supported by the Ministry of Communications and the Aosta Valley, has started a trial to deploy Digital Terrestrial Television (DTT) and Wireless broadband in a convergent manner.[33]

The geographical location has been chosen for its geomorphology, which means that the transmission of terrestrial signals is difficult. If the experiment proves successful, the results could surely be exported and could represent an Italian best practice with the following important outcomes:

- Concrete implementation of Ubiquitous and Next Generation Networks-like services;
- Concrete attempt to investigate the ICT service convergence concept, integrating two of the most innovative communication technologies in Italy (DTT and WIMAX);
- Concrete attempt towards bridging the Italian digital divide, providing all users identified during the project scope, with a set of ICT services belonging to specific areas of interest, ensuring the QoS and the required service level. Some of these area of interest, such as medical services, food safety, secured daily life, finance for small and medium sized enterprises, education, employment, work and e-government, if properly promoted, will bridge the digital dived and facilitate people's life.

The technical solution proposed is based on a new network architecture intended to make an extensive use of radio-technologies, called **Radio Access Integrated Network (RAIN)**. The architecture consists of a radio backbone which feeds IP and DVB-T signals (the DVB-T signal only when & where necessary, waiting for IPTV), using different carriers in UHF, with a frequency of 5GHz and 3.5GHz.

The backbone is called **Service and Technology Integrated Network (STIN)** and uses HiperLan/WiMAX technology.

The local access network, **Access and Distribution Network (ADN)**, is a multi-layer network with a central main station, coincident with the first layer net-hub, that could be located at the city hall, the school, etc., and secondary layers served by simple repeaters. This AND uses specific radio technologies such as TDT, DVB-H, WIMAX, and WiFi.

The experimental approach gives a large amount of flexibility with respect to what type of service or network topology the technology is used for. Manufacturers are already working on new innovative

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Box 8.5: Marconi supports Ugo Bordoni Foundation's WIMAX trials in Piedmont and Sicily

Marconi Corporation announced that it has been selected to support the widest public trial of Worldwide Interoperability for Microwave Access (WiMAX) to date, providing WiMAX connectivity in Italy's Piedmont and Sicily regions. The selection was made by a working party including representatives from the Italian Ministry of Communications, the Italian Ministry of Defence and the Ugo Bordoni Foundation, which is coordinating the trial at national level.

Marconi was selected for the trials by the working party due to its ability to provide indoor self-installable and outdoor customer premise terminals, which work in line-of-sight and non-line-of-sight environments, allowing the AS.MAX product family to operate in urban, suburban and rural areas. The success of the trials will underline the effectiveness of WiMAX and provide a scalable, customizable and competitive Wireless Asymmetric Digital Subscriber Line network allowing operators to bridge the digital divide in a number of Italian regions.

Source: http://uk.biz.yahoo.com/050912/183/frv82.html

telecommunication architecture applications, such as the spreading of self-building networks.

In terms of experimentation planning, three geographical areas have been identified, as shown in Figure 8.1:

- Grand Combin region, where specific experiments will be performed, aimed at bridging the digital divide and bypassing the problem of a scarce distribution of TV signals, even in analogical format. The trials will allow to broadcast the DTT signals and the related interactive channels in a large area as well as to have a drastic reduction of environmental impact in terms of electro-magnetic emissions.

- Valdigne region, where the trials will be focused on digital mobile television: experiments including **DVB-H**, in UHF band, as well as **terrestrial DMB**, in VHF and L bands, will be carried out. In this case, the interactive channel will be implemented using GPRS, EDGE and UMTS technologies.

- Ayas/Evançon region, where **wireless IPTV** applications will be tested using, in the radio network, WiMax/HiperLAN/WiFi links. A challenge for this trial will be the implementation of severe video coding (e.g. MPEG4) and Multicast functionality on wireless IP.

Figure 8.2: The three trial areas
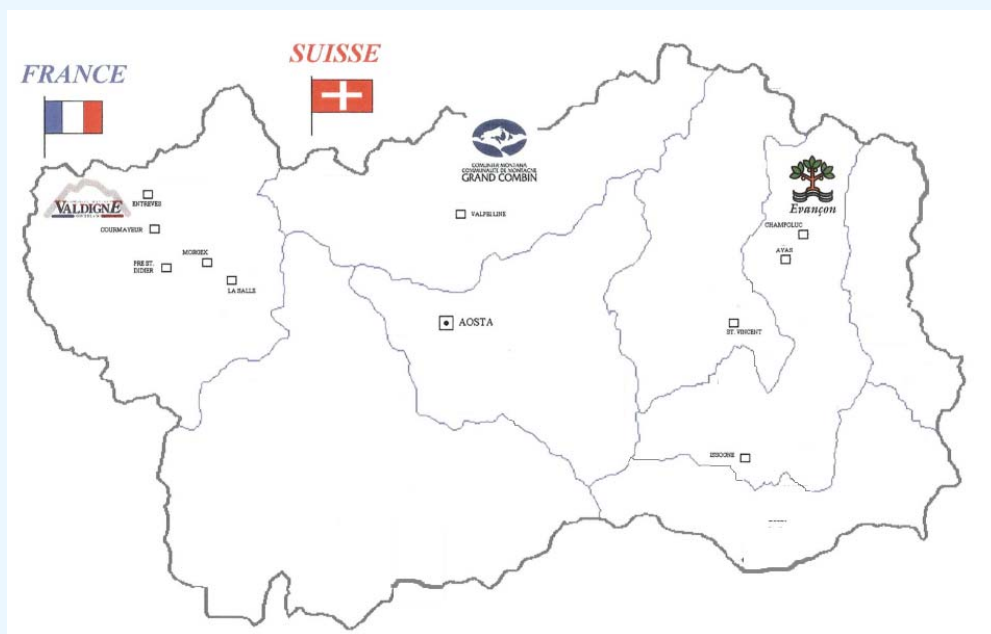
Source: Being Digital In Valle D' Aosta, Dario di Zenobio, Ugo Bordoni Foundation, October 2005

9   CONCLUSION

The weaving together of digital networks and information with the social networks of the twenty-first century has very significant implications for all of us. No matter how we choose to define the 'information society', there are many unanswered questions about how to, and the extent to which we should, promote developments that give an increasingly central place to the use of ICTs in our lives. Regardless of whether we believe that today's information societies are fundamentally new, or that they are simply an extension of certain features of existing societies, the global spread of networks means that there are major implications for those who can participate easily and effectively and for those who cannot.

With the rapid growth of mobile communications and broadband technologies, it is becoming increasingly apparent that fixed and mobile telecommunications are likely to converge on technically similar core network and service platforms. The mobile Session Initiation Protocol (SIP)-based IMS (IP-based Multimedia Subsystem), is IP end-to-end, so that advanced applications and services can be supported

seamlessly across all networks. SIP-based IMS represents a global view – which means that tomorrow's entire multimedia mobile world is likely to be IMS-based. SIP is also at the heart of the Internet, particularly for the support of interactive multimedia sessions, and offers inherently advanced features such as Presence Management, Instant Messaging and Group Communications Management. There is therefore an obvious economic benefit in creating a truly converged mass market based on IMS platforms, with potentially enormous economies of scale. In addition, the development of NGN is timely; there is strong demand from industry, both for new generation multimedia services using xDSL or Wireless access, and to furnish a replacement for the obsolescing Public Switched Telephone Network (PSTN). If work continues to progress as planned, within a few years, the same core IMS implementation should be possible for both fixed and mobile telecommunications, and the industry will be ready to deploy and exploit multimedia applications for the ultimate benefit of the end-user.

However product maturity, system stability and generally all-round management capability might still be an issue. Functions in support of service selection, QoS, billing and security are important areas of required attention and further investigation. An important step forward achieved with SIP application servers is the integration between communication and Internet technologies. This has major implications for enabling the creation of many new innovative services for NGN networks. Network Operators/Service providers should also consider the implication of this approach with respect to the balancing of Intelligence at the edge or in the core of the network: Service providers should find their best synergy between edge and core, offerings and accepting edge solutions as an opportunity rather than a threat. The new emerging terminals support this edge model and will enable the provision of many new and innovative ubiquitous services.

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