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Electronic Communications Committee (ECC)
within the European Conference of Postal and Telecommunications

ECONOMIC AND REGULATORY ASPECTS OF IP TELEPHONY

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ECONOMIC AND REGULATORY ASPECTS OF IP TELEPHONY

1 INTRODUCTION

IP telephony¹ pose new challenges to the telecommunications market that need to be tackled, in middle term, by regulators, such as the interconnection rights and obligations of the various Internet players in relation to the public telephone network.

This report discusses some of the economic and regulatory aspects of IP telephony and, to some extent, when seen in its broader context, the digital convergence.

The discussions of the report are mainly based on comparisons between the two merged communications models in IP telephony, the Traditional Telecom and Data networks as the Internet.²

This report is intended to promote a greater understanding of the issues and to facilitate further discussions, not to propose any specific regulatory actions or recommendations.

The increasing use of IP based data networks for communication services, including applications such as telephony, has become a pivotal issue for the telecommunications industry worldwide. The possibility of transmitting voice using IP-based networks creates challenges and opportunities. The two network types that have emerged under very different circumstances are:

- The Public Switched Telephone Network (PSTN)³, based primarily on circuit-switched technology;
- IP based networks, which are data networks based on packet-switched technology.

The PSTN was developed and extended globally with one prime service in mind, that being universal inter-personal voice communications. The exact technology on which this service is based has evolved over time but the way universal communication service is provided by the PSTN has remained constant regardless of underlying technology. Such properties characterise what we will call the “traditional telecom model” for service provision.

Data networks, such as IP-based networks (the Internet for example) have been developed with a set of services in mind, including applications such as electronic mail, file transfer, Web browsing and voice applications.

Data traffic carried over the telecom network has been increasing. This has led to the conclusion that, since the telecom networks are also used for the transport of data, it may be adequate to migrate voice telephony services onto a unique data network used for both voice and data.

¹ The ITU states the following working definitions in the Report of the Secretary -General on IP telephony (31 January 2001), World Telecommunication Policy Forum (WTPF 2001): “IP Telephony is used as a generic term for the conveyance of voice, fax and related services, partially or wholly over packet-switched IP-based networks. IP telephony may also include applications that integrate/embed the transmission of voice and fax with other media such as text and images. The term IP telephony is used interchangeable with VoIP (voice over Internet Protocol). The term Internet Telephony is used when referring to IP Telephony or VoIP conveyed partially or related to the working definitions made by ITU in the Report of the Secretary -General wholly over the Internet.”

² The Internet is here referred as "the public Internet", the well known largest globally connected set of backbone data networks, using the Internet Protocol and providing universal accessibility by sharing a common IP address space.

³ The term PSTN (public switched telephone network) is used in this document as a synonym for traditional circuit-switched telephone networks offered by Public Telecommunication Operators (PTOs), as well as Integrated Services Digital Networks (ISDN), and Public Land Mobile Networks (PLMN). The PSTN is mainly based on circuit-switched technology but it can also incorporate packet-switched technology. Generally, with convergence, today's telecommunications networks and transport technologies are increasingly complex and difficult to categorise.

2 THE MIGRATION OF THE TELECOM AND DATA NETWORKS

A fundamental paradigm shift has been underway in the telecommunications industry- a shift from traditional PSTN circuit-switched voice networks to packet-switched data networks, using Internet Protocol technology.

The predicted migration of the telecom network transport technology onto the IP protocol would become one of the main technological evolutions that the telecom network has incurred in its long history. Still, this evolution raises fundamental questions relating to regulatory and economical aspects which go far beyond the transport technology itself; this spreads, among others, to the nature of the services that such a network is able to provide and the way in which they are provided.

The key question of concern here is: following an eventual migration of the network onto a transport technology drawn from data networks, what services will the telecom network offer and under what model? In other terms, will the evolved network resemble a data network that provides in addition new voice services, or a telecom network whose transport technology evolved, or a new breed of network that takes elements from both of its “originators”?

In order to simplify the discussions initiated by these questions, a comparison is made below in Table 1 between the two communications models that underlie the Telecom and Data networks focusing on the way applications are offered and used over them.

The table 1 below summarises the six main respective characteristics of traditional telecom and data network models.

Traditional telecom network model	Data network model
Three-party model (caller-network-called) and communication service provided by the network	Two-party communication model (client/server or peer-to-peer) based on a three-party transparent transport service provided by the network
Communication service provided and controlled by the network	Communication service controlled by communicating parties based on the available transmission capabilities
Communication protocols defined by network and transparent to communicating parties	End-to-end communication protocols agreed by communicating parties
Quality of Service guaranteed by network and possibly negotiated with the end users.	Communicating parties provide the network with information about the quality of service needed for the communication
Global reachability of communication service through interconnection agreements between sub-networks at service level	Communication transmission coverage can be universal (Internet) but no network interconnection agreements at service level ⁴ (because the network does not provide services above the transmission service)
Charging based on usage of the communication service in a time-metered basis	Charging based on flat rate ⁵ or volume of transported data

⁴ Interconnection agreements on data networks may also cover the service level (e.g. quality of service guarantee).

Table 1 : Comparison of traditional telecom and new data network models

Although, strictly speaking, the concept of "communication service" covers every kind of service providing long-distance communication capabilities, for simplicity in the table 1 and in the remainder of the report the term "communication services" refers to "end-user communication services", i.e. services that satisfy end-user communication necessities). It is seen being different from the "transport service", which normally works on a machine application level (these applications complement the simpler transport service to provide an end-user communication service).

The traditional telecom model is basically characterised by the fact that the communicating parties have to go through the mediation of network functionalities that control the communication service. This is not linked to technology – for instance availability of simpler user devices - but to the fact that the network's basic "purpose" is to offer specific communication services.

Data networks, though fundamental for the proper operation of the closely interconnected computing devices of today, are not built with an objective of supporting a specific application. The network duty is to transport data for multiple applications whose logic are hosted by the external computing devices involved by the transmission interchange. Those applications know and control the underlying transmission service end-to-end⁶. In terms of the Open System Interconnection (OSI) reference model, the Application to Transport layers are hosted by the communicating devices that directly communicate between each other (hence the "two-party" term) using the network layer service provided by the data network.

There is a clear consensus on the importance and the advantages of layering abstractions and, the layering abstraction used in the OSI Reference Model and in Internet parallels, is well established. One prediction states that the traditional telecommunications infrastructure will ultimately ride on top of an IP infrastructure, and being clearly layered, with no direct interaction between the two.

The exact direction in which IP-based technical network standards will evolve to support real time services, such as voice and video, is still somewhat unclear. IP networks, following the data network model, have typically placed application services at the "edges" or "ends" of the network rather than integrated into the network itself. It is argued by some that this "end-to-end" architecture offers more flexibility, allowing new applications and services to more easily emerge.

In addition, above the IP level, new protocols are being defined, some with particular respect for voice telephony. Note here the ITU-T recommendation H.323⁷ and Internet Engineering Task Force, IETF developed Session Initiation Protocol (SIP). On the other hand, others would argue that users are more interested in subscribing to managed services and should not be concerned with managing intelligence (e.g., through software upgrades) in end-terminal devices.

⁵ Usually, this way of charging derives essentially from the difficulties that arise on billing the service itself, but it may also be a result of a commercial choice.

⁶ Server machines managed by the data network operator are of course essential for the support of the communication applications ; however, their role is limited to "translation purposes" (like translating a web site name onto an IP address for web browsing) or data hosting for better efficiency - as for the mail applications; they do not interfere with the way the network operates to transport user data or keep a state for a given communication.

⁷ ITU-T Recommendation H.323 on Packet-Based Multimedia Communications Systems.

See also : http://www.tmcnet.com/articles/itmag/1000/1000spec_focus.htm

3 THE NEED FOR CLEAR DEFINITIONS IN VARIOUS SCENARIOS OF IP TELEPHONY

There are several technology scenarios under which voice is carried on IP networks - often implying different treatment from a policy or regulatory perspective.

There is no consensus on an exact definition of IP telephony, Voice over Internet Protocol, or "Internet Telephony" (some working definitions exist and were developed particularly by the ITU). All of these terms are used to define the many different technical solutions for voice carried over IP networks. The following descriptions will serve to highlight the complexity of this issue:

- One scenario is where IP-packetized voice is carried solely across the public Internet between computers. This scenario, as far as the service provided to the end users is a pure transport service, can not be considered as "IP Telephony";
- Another scenario is where IP is just used as an underlying transport technology for networks that provide a voice service equivalent to the one served by PSTN services. In this scheme, signalling and network intelligence still use the Signalling System Seven (SS7), protocol widely used on the PSTN. In this case the use of IP technology remains transparent to the end-user, that receives the traditional telephony service, so this scenario can not be considered IP-Telephony;
- A third scenario is where IP Telephony is based on full end-to-end IP technology (e.g., on private IP networks or next generation mobile/fixed networks). This scenario does not use SS7 signalling but use instead new "soft switch" technology to manage network call control and provide intelligent network management - including well-known telephony network features, such as busy tone, call forwarding, call data records for billing, etc. Additionally, in this scenario the IP network will also incorporate telephony specific functionalities (media control devices). Both call control and media control functionalities will interact with user's terminals in order to provide the end-to-end IP telephony service;
- Finally, there may also be use of gateways or interconnection between the Internet or private IP networks and the PSTN. ITU-T Recommendation E.370 discusses in more detail various scenarios and principles related to interworking between PSTN and IP-based networks.⁸

Note that in the two last scenarios, some or all the voice-specific IP functionalities can be provided by third parties other than the IP network operators, so IP telephony can be provided as overlay services over pure IP transport networks.

4 ECONOMIC ASPECTS

To develop IP based networks for only the voice service is unlikely to be cost effective. The IP telephony development is a part of the process of the digital convergence and it has to be recognised that transmitting voice traffic is a part of a strategy to use IP technology for offering a varied set of multimedia services.

4.1 Operators Perspective

There is considerable debate as to whether, in the context of IP telephony, the cost of building and maintaining IP networks for operators is significantly lower than those of circuit-based networks. This appears to depend on a number of factors, including, for instance:

⁸ <http://www.itu.int/itudoc/itu-t/com2/reports/r077.html>

- Whether a particular investment in IP is as a new-build network, or as an upgrade or overlay to an existing network. The incentive to choose IP may be greater for new, or substantially new networks, where both voice and data services are planned as offerings over an integrated IP network;
- Whether a particular carrier is an incumbent or a new market entrant. New market entrants, with no existing network to preserve, may be first movers towards an IP underlying infrastructure;
- The extent to which innovative IP - based value-added services are being offered. In economies where local call charges are free (i.e., bundled into the access charge), new market entrants may offer value added services that allow, for instance, voice users to retrieve e-mail or the provision of voicemail and fax communication services over an IP platform;
- That the in going and outgoing traffic are very different and as a consequence the costs are unequally partitioned, in particular the costs of international leased circuits necessary for IP connectivity.

In reviewing these factors, it seems likely that the pressures and incentives to shift towards IP Telephony will vary among economies at different states of development and with differing degrees of market competition:

- In countries where **prices for international traffic are high**, the main opportunity for IP Telephony will be for price arbitrage of simple voice transmission, albeit possibly at a lower quality of service. In many of these countries, however, outgoing IP Telephony is banned. Thus, the main form of IP Telephony is for incoming traffic. Even though the use of IP Telephony for incoming traffic may be no more legal than for outgoing traffic, it is harder to detect and block;
- In countries where **prices for international traffic are falling** - for both retail (consumer) and wholesale (settlement) rates - IP Telephony traffic may already be playing a role in promoting price competition or in providing an alternative to the services of the fixed-line incumbent. However, a critical factor is how easy it is for subscribers to use the service⁹;
- In countries where **prices for international traffic are already low**, due to the effects of competition, IP Telephony may only have relevance for reasons other than price arbitrage. In this scenario, the market opportunity for IP Telephony is likely to lie, on the one hand, in the prospects of value-added integrated services for users and, on the other hand, potential cost reductions for PTOs.

To better understand the interplay of these factors, there is a need to establish a reliable empirical analysis, which necessarily includes an analysis of the cost structure aspects of IP-based and traditional telecommunications networks.

4.2 Users Perspective

While the long-term potential for IP Telephony lies in the new functions and applications it makes available, the short-term advantage lies in cost-savings compared with conventional circuit-switched telephony. For consumers, IP Telephony can be *cheaper* than a circuit-switched call, especially for calls originating in non-liberalised markets, that are carried over the Internet and/or which generate advertising revenue.

If all other factors - quality, convenience, reliability, etc. - are equal, the choice to use IP Telephony is an economically rational one. But current IP Telephony offerings do not always match up to

⁹ Presently, services based on IP are as easy to use as traditional ones. In fact, users even do not detect the eventual differences that might exist since the "interface" is quite similar.

consumer expectations. At present, consumers must generally make a trade-off between price and quality. Willingness to make that trade-off will generally depend on price sensitivity, the perception of the quality of service (e.g., transmission quality, user-friendliness, convenience) as well as the interest of consumers in using some of the more advanced IP Telephony services.

In addition, IP Telephony offers a plethora of converged services to the users, which provide flexibility and various options to the consumers. It can also allow consumers to reduce the inconvenience of using different devices for different applications.

On the other hand, the more functionalities reside in the user terminals (as is supposed to be in case of IP Telephony), the more expensive will be these devices. So the substitution of the traditional PSTN by an all-IP integrated network will have a shift of costs to the user's side, that the market must be willing to accept.

In the broader context of the digital convergence, the service providers' control over the end-user will be more limited as the consumer acquires ownership of terminal equipment, in-premises distribution, content and software interfaces, through lease or purchase. The service providers then must compete not only with other service providers, but also with equipment manufacturers. It may be argued that some of the users, as private consumers, will be more interested in subscribing to managed services and will choose not to be concerned with managing intelligence (e.g., through software upgrades) in end terminal devices.

4.3 Two Charging Principles

Since a data network service is basically a transport media the charges might be for the volume of the transported data or even a flat rate that generally gives right to send and/or receive a given amount of data.

A widespread conception existing today is brought about by comparing the per-minute charging model of the telecom network to the volume – or flat rate - charging model of data networks. This being related to their respective transport technologies (circuits versus packets), the latter mode being considered more “effective” especially for “similar” services (voice transport).

Voice telephony might not only be seen as voice transport but also as a service with many other attributes such as:

- provision of an address;
- permanent network access;
- network operator responsibility for proper service completion.

The per-minute charging model of the telecom network would therefore be linked to its nature as a high-level application service rather than to its support by a circuit-switched technology.

Data network charging is based on volume or flat rate because of the nature of the service provided, that is, data transport. The network added value here is basically that of transporting a given volume of data from one point to another. It might therefore be seen as natural that the charging metric is related to that volume irrespective of the used technology.

However this is strictly applicable to IP network operators providing only transport services, if the network (or third parties) provide additional voice-related functionalities that will be normally charged apart, following so the flat rate or the per-minute charging strategies.

From the strict economic point of view, and in the light of the recent ICT sector crisis, it has become necessary to clearly understand these two charging models and their impact on both operator and service provider revenues. The question whether flat rate or volume based charging will be able to keep afloat the universal and telecom infrastructure, its multiple technological facets (fixed, mobile, wireless ...) and pay for further investment evolution is controversial.

The merger of the two communication models places the revenue value chain at the heart of the debate, as a prerequisite for the successful, widespread merging of IP-based transport and user applications in the current telecom environment.

4.4 Predictions of the Marketplace to Come

The business implications of the digital convergence will be significant. The development towards disintegration and specialisation along the communications value chain is already visible. The vertical end-to-end integration structure of the traditional telecommunications industries will be more or less replaced by a focus on specialised, horizontal segments of the market¹⁰.

5 REGULATORY AND POLICY ISSUES

IP-telephony raises unique policy issues. Some of the legal questions arise from the difficulty in applying existing regulatory classification to the Internet based services, others from the significant changes in market structure, the organisation of the industries transformed, and the nature of the globalisation.

Related to the different national circumstances, such as the overall regulatory system, market conditions and degrees of liberalisation, national policy makers in ECC member countries present various regulatory arrangements. Some countries even prohibit IP telephony.

It will be important for most regulators to find the regulatory balance that will stimulate competing network infrastructures and the interoperability of services provided, while ensuring that bottlenecks in the market do not constrain the emergence and growth of innovative services that benefit end-users, and the community as a whole. A simplified regulatory structure is considered by many to be an important element in establishing favourable market conditions for investment in IP-based networks.

5.1 Quality of Service and Interconnection Models

In a telecom network, whose operator derives revenue from provision of the service, service denial is preferred to bad service. Good service quality is guaranteed by proper network resource reservation all along the path linking the communicating parties. Quality of service – good service and service denial reduction - is closely linked to proper network dimensioning both at access and core network (within an operator network and at inter-operator network boundaries) levels. The cost of quality of service is not only connected to the actual transport resources reserved for a given communication, but also, and more important, to the involvement of network devices i.e., dialogue and state maintenance for the call duration.¹¹

In IP data networks that provide only transport services, the default strategy for handling user traffic – and the one that is widely used today within the Internet - is that of “best-effort”. A network device treats user packets as they arrive congestion over communication routes may lead to packet loss or delay. Resources can be reserved in a data network and relative preference can be associated to data packets of a given traffic with respect to others for treatment by network devices or loss in case of congestion. However, since the network may not be a priori aware of a given application

¹⁰ See for example, Digital Convergence and its Consequences, a Report on the Digital Convergence and Market Structures, June 1999. Milton L. Mueller, (Associate Professor at Syracuse University, School of Information Studies). <http://dcc.syr.edu/rp1.pdf>

¹¹ As a case in point to the above assertion, in developed countries, where telecom service tariffs are becoming closer to the base cost due to competition, the spread between local and long distance calls – that consume much more transport resources - has reduced dramatically.

needs or even of its mere existence, it may be up to the end-user¹² to specifically express those requests to the network.

It is then important to notice the consequences that can occur to the network and/or the customer, particularly in case of Quality of service problems, in those scenarios where the network (or part of it) is not aware of it being used to transport voice services.

At network interconnection points, Service Level Agreements (SLA) govern the relationship between operators. Here again, as for user access, a SLA in general may not be specifically linked to any particular application, certain SLA may not even ensure the continuity of the preferred treatment of a given traffic flow or that of a given circuit.

On a more general basis, the question of the quality of service is of particular importance in any interconnection model. The particular consequences of regulatory choices in the matter of interconnection have to be particularly balanced in regard of questions like the universality of telecommunications service.

5.2 Technological Neutrality

Technological neutrality is a principle that can be generally characterised as an effort to apply regulations in an even-handed manner to similar services, regardless of the technology used to provide these services. Unless other policy imperatives take precedence, the purpose of this concept is to support competition policy by ensuring that one provider is not given more favourable regulatory treatment than another when providing equivalent services. There is, however, a range of interpretations of this concept and various Member States have implemented it in different ways.

One view of technological neutrality is linked to the concept of functional equivalence of services, irrespective of the technological platform, and provides that a basic public telephone service, even if provided (partly or entirely) over an IP-based network, should not escape from justified regulation. With that perspective, the definition of the voice telephony service must be based on functional criteria that can be evaluated independently of the technologies used.

Applying equal regulatory treatment to roughly equal services is seen as a means to neither favour nor disadvantage new or traditional technologies. As a result, appropriate telecommunication regulations might be applied to services such as IP Telephony. For example, regulations on emergency number services would be applied to all operators providing voice services, regardless of the technology used.

5.3 Voice vs. data

Another, and perhaps the most important regulatory distinction in many countries, is whether IP Telephony constitutes voice or data. IP Telephony services can, in some cases, achieve a level of functional equivalence to traditional telephony services, making the means of transmission irrelevant to the user. Still, the voice/data distinction is often used as a definitional tool to implement policy, even though some believe that this distinction is becoming less sustainable as IP Telephony technology and operators are creating new services that integrate voice with the Internet, data services and other media.

Moreover, the EU perspective can help clarify the question. In this regard, the 1998 EC notice concluded that at that time Internet voice services could, in principle, not be considered as voice telephony, because they failed to meet simultaneously each of the four elements of the definition of voice telephony pursuant to the Services Directive, namely:

- voice telephony is offered commercially as such;

¹² The term “end-user” should be understood here in its broader meaning (example: application driver on a computer device).

- it is provided for the public;
- it is provided to and from public switched network termination points,
and
- it involves direct speech transport and switching of speech in real time, in particular the same level of reliability and speech quality as produced by the PSTNs.

The new directives recently approved in the wave of the Review of the regulatory framework for telecommunications services put an end anyway to this distinction. In the new package, all electronic communications, whatever their commercial features, will be submitted to the same legal regime¹³.

5.4 Global Accessibility

Access to the PSTN is provided by every sub-network operator (or ‘public¹⁴ network operator’) to his subscribers. Operators generally charge a basic fee (subscription) that barely covers the costs of access provision; the bulk of their revenues being generated from the service usage triggered by a universal and ubiquitous access¹⁵. Access universality is guaranteed by the interconnection agreements that link operators; the benefits of augmenting its subscriber base by one operator are automatically shared by other operators by augmenting the global number (today 1.2 Billions worldwide) of subscribers that can be reached through the telecom network. Universal access, of course, implies the existence of an addressing scheme that is consistent and universally acceptable, it also implies mutual operator obligation for proper completion of calls with good quality within their network (whether they are used only to transit a call or to complete it to final destination).

Data network deployment follows a pattern that is very distinct from that of traditional telecom networks. Since revenue is not generated by selling end-user services but basically by offering a general purpose data transport service, it is natural that data networks, whether private or public, initially addressed almost only corporate or academia users¹⁶. When the need occurred to offer to the general public access to the Internet, following the introduction of personal computers sufficiently powerful to host them, the easiest solution was the use of modems and connect through the telecom network because of its ubiquitous access, especially in developed countries.

Interconnection agreements between data operators being independent from applications, universality of reach is provided on an application per application basis in an ad-hoc manner.

Of course each network provides a transport address – for instance an IP address – to all of its connected users. Such addresses, however, may have only local significance or not be permanent.¹⁷

¹³ Communication from the Commission (2000/C 369/03 in the Official Journal of the European Communities).

¹⁴ The term “public” should be understood in its plain English meaning, i.e., open to the public. It does not imply any assumption on the ownership structure of that operator.

¹⁵ The emergence of subscription schemes – triggered by mobile operators and spreading to fixed ones - where a subscription provides not only an access to the network, but includes a given amount of service usage (minutes of calls) and of prepaid cards for mobile networks are marketing innovations that prove the point. They are both based on the idea that access to the network “is only sold” when associated with service usage.

¹⁶ In the “short life” of the Internet this lasted from its inception in the late sixties up practically to the mid/late nineties.

¹⁷ As is the case for persons using the service of an Internet service provider. One has to note here that a telephone – or E.164 – number should not be amalgamated with a transport address. It is an application address for the worldwide voice telephony application supported by the telecom network.

Therefore, many applications – like Web browsing or electronic mail - use symbolic addresses that are translated by the cooperation of decentralised network servers that translate that symbolic name onto a valid transport address for the destination. Therefore a network interconnection agreement per se is not sufficient to ensure access universality; each user and network operator has to determine for each application the name of the translation server that has to be addressed for a proper completion of a communication¹⁸.

6 NAMING, ADDRESSING AND NUMBERING

The questions of numbering and naming systems have a pivotal role as they represent one of the most valuable asset of operators and service providers for control over the end-user.

The general question seems to be whether legacy regulations on numbering suit to convergence developments. Possible economic consequences of these developments should be also tackled as well as their impact on the industry.

The ENUM concept has highlighted the increased need for coordination between the regulatory authorities responsible for traditional telecom and data networks numbering, and those responsible for Internet naming and IP addresses. In order to develop an efficient coordination and cooperation, it will be of highest importance for regulators to develop knowledge about the Internet naming and addressing system and the related issues.

The possible increased demand for E.164 numbers needs to be addressed, as IP telephony in some applications need both Internet addresses and E.164 numbers.

Questions related to the market entrance and the NRA requirements for new Internet Service Providers (ISP) to allocate E.164 numbers need to be considered as well.

6.1 ENUM

The ENUM protocol¹⁹, adopted in 2000 by the Internet Engineering Task Force, (IETF), defines the mapping of ITU Standard E.164 telephone numbers into Internet domain names. It provides a way of making the telecommunications and Internet networks interoperable²⁰.

ENUM represents the emerging new convergent services, based on the idea of unified messaging. ENUM will facilitate the development of IP telephony as it provides a solution to the problem of addressing calls that pass from the PSTN to IP address-based networks and vice-versa.

The [Internet Architecture Board](#) (IAB) and [ITU-T Study Group 2](#) are discussing collaboration on the operational, administration and delegation issues related to deployment of ENUM protocol-based services.²¹ ETSI SPAN is currently working on a new standard titled "ENUM Administration in Europe".²²

The main issues are raised by the implementation of ENUM in the Internet Domain Name System (DNS) and especially the populating of domain names corresponding to E.164 telephone numbers into a common designated domain.

¹⁸ In the case of the Internet, universal addressing is provided by IP addresses and the use of a translation server (i.e. DNS) is not essential for "proper completion of a communication".

¹⁹ <http://www.ietf.org/rfc/rfc2916.txt?number=2916>

²⁰ It has to be noted that a gateway between PSTN and IP networks can also be achieved using existing gateway.

²¹ <http://www.itu.int/osg/spu/infocom/enum/index.html>

²² Details of ETSI Work Item 'DTS/SPAN-110106', under which "ENUM Administration in Europe" is occurring can be found at http://webapp.etsi.org/workprogram/Report_WorkItem.asp?wki_id=14414.

E.164 numbers will be inserted in a DNS-based tiered architecture. The ITU is currently discussing ENUM implementation issues with the prime objective of ensuring the continuing integrity of the ITU E.164 numbering plan. Other issues that are yet to be agreed at the ITU and are still under discussion, are concerned with the management of ENUM domain names and an eventual subordination, at each level of the architecture to the management of the ITU E.164, in order to keep the systems consistent and to ensure that services can be appropriated by a wide range of customers.

Conditions for insertion of national numbering plan are a national matter for each Member State of the ITU.

Other issues, specific to ENUM implementation, concern privacy and data protection, service and infrastructure developments, financing, competition and security aspects.

7 A WAY FORWARD

7.1 A Need for Standardisation

The main objective of standardisation is to ensure that products can be connected and that services are interoperable. The role for standardisation in the 21st Century is of a contemporary nature where standardisation groups have to consider both technical and social-economic issues. The process of the digital convergence and the migration between telecom and data networks will take place in various specific standards designed to bring them together.

From a telecommunications perspective, globalisation, liberalisation, and convergence, which came into force with new millennium, offer both challenges and opportunities. The changed regulatory and technological environment of the information and telecommunication industries has deeply affected the process of standardisation of related services, applications, and technologies. Interoperability was previously a property of national telecommunication networks, solely elaborated and agreed upon in public standardisation bodies. Today, the global telecommunication network is not simply a network for carrying telephone conversation but a platform for different media forms.

Seen from the data networks and specifically the IP protocol based Internet, standardisation can also extend industry access to world markets and market intelligence, reduce development costs and lead to economies of scale.

The role of the government in the mainly socio-economic standard making process has been extensively debated. One view is that the appropriate role for government in standards making is one which encourages generic open information systems platforms and processes, promotes open technology transfers among the broadest possible range of innovators, developers, and users, and allows for a robust competitive marketplace to determine winners and losers. Another question is whether government should play an active role and participate in the standard setting.

7.2 A Regulation to Find

The below rationale is based on the Coase's Theorem²³.

“Without regulation, a dominant network may be able to impose crippling disadvantages on potential competitors. The result may be exploitation of customers and potential competitors as well as inefficiencies that inflict significant net losses on society. But will a regulatory remedy do more good than harm? The problem is that regulation itself can also impose significant costs. This is particularly problematic when regulators “get it wrong,” an outcome which is hardly unprecedented and the more likely the more information is required to “get it right.”

²³ The Coase Theorem states that parties will negotiate efficient solutions to rights allocation problems, so long as the rules are clearly stated and transactions costs are low. Ronald H. Coase, "The Problem of Social Cost," *Journal of Law and Economics* v. 3, no. 1 (1960), pp. 1-44.

The consequence of this is that an ideal solution should minimise the information regulators need. The adequate information needed has to be discussed and evaluated.

Two criteria can be used to judge potential mandatory interconnection regimes. The first criterion means that the correct pricing signals are sent to networks making investment and make/buy decisions, and thus potentially also to consumers making subscription decisions. The second criterion means that regulators do not need many facts or much data to administer the regime. Ideally, regulators could limit themselves to stating fairly simple principles or rules and allow the parties to negotiate efficient solutions suited to their particular circumstances. In such a regime, disputes would be resolved primarily through ordinary commercial procedures, such as negotiation and arbitration. It is proposed that an interconnection regime that meets these two criteria, efficiency and simplicity, would permit an efficient and competitive telecommunications system to develop and enable it to adapt rapidly and smoothly to changing technologies and market conditions.”

In the particular case of IP Telephony, the role of regulators cannot be minimised beyond a certain point. Indeed, the very different states of development of IP networks and telephony networks, imply to get a certain level of information:

- Information about the settlement regime which can have implications on network development. Then evolution of such arrangements can have policy implications;
- Information about the standardisation and the interworking requirements between the different protocols is also essential, the universality of the PSTN is an achievement which has to be kept;
- Information about the IP network development and its cost implications.

With that understanding, the regulator has a clear role to “watchdog” the evolution of the market.

In addition to the above mentioned, the principle of technological neutrality confirms that there is no particular approach to create in order to regulate IP telephony.

Policy decisions are best made with knowledge and comprehension of the potential implications. Related to the pace of change in the markets and the technology it will be more difficult to make predictions about the future and develop the regulatory directions needed.

For IP telephony, and the broader context of the digital convergence, a better understanding of the relationship between the Internet and telecommunications policy will facilitate decision making about when and to what extent actions are regulatory appropriate. Related to this, it will be useful, for the responsible regulators, to possess competence in the IP protocol in general and the Internet in particular.

8 RELATED DOCUMENTS

- 1) Report of the ITU Secretary-General on IP Telephony. Final Report 31 January 2001. ITU World Telecommunication Policy Forum (WTPF 2001), 7-9 March 2001, Geneva.
- 2) Telecom network migration to IP and its impact on the future of telecommunications. A position paper prepared for the ECTRA APRII Meeting, Berlin, September 26-28, 2001 Souheil Marine, Alcatel, Vélizy, France.
- 3) ECTRA PT TRIS Summary Report on IP telephony, ECTRA (01)14-E. XXXIVth ECTRA Plenary Meeting (Slovenia, 20.03.2001).

9 GLOSSARY OF ACRONYMS

DNS	Domain Name System
ECC	Electronic Communications Committee
ETSI	European Telecommunications Standards Institute
ETSI SPAN	ETSI Services and Protocols for Advanced Networks
EU	European Union
IAB	Internet Architecture Board
ICT	Information and Communication Technology
IETF	Internet Engineering Task Force
IP	Internet Protocol
ISDN	Integrated Services Digital Networks
ISP	Internet Service Provider
ITU	International Telecommunication Union
ITU-T	ITU -Telecommunication Standardization Sector
OSI	Open System Interconnection
PLMN	Public Land Mobile Networks
PSTN	Public Switched Telephone Networks
PTO	Public Telecommunication Operator
QoS	Quality of Service
SIP	Session Initiation Protocol
SLA	Service Level Agreements
SS7	Signalling System Seven
VoIP	Voice over IP
WTPF	World Telecommunication Policy Forum

