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

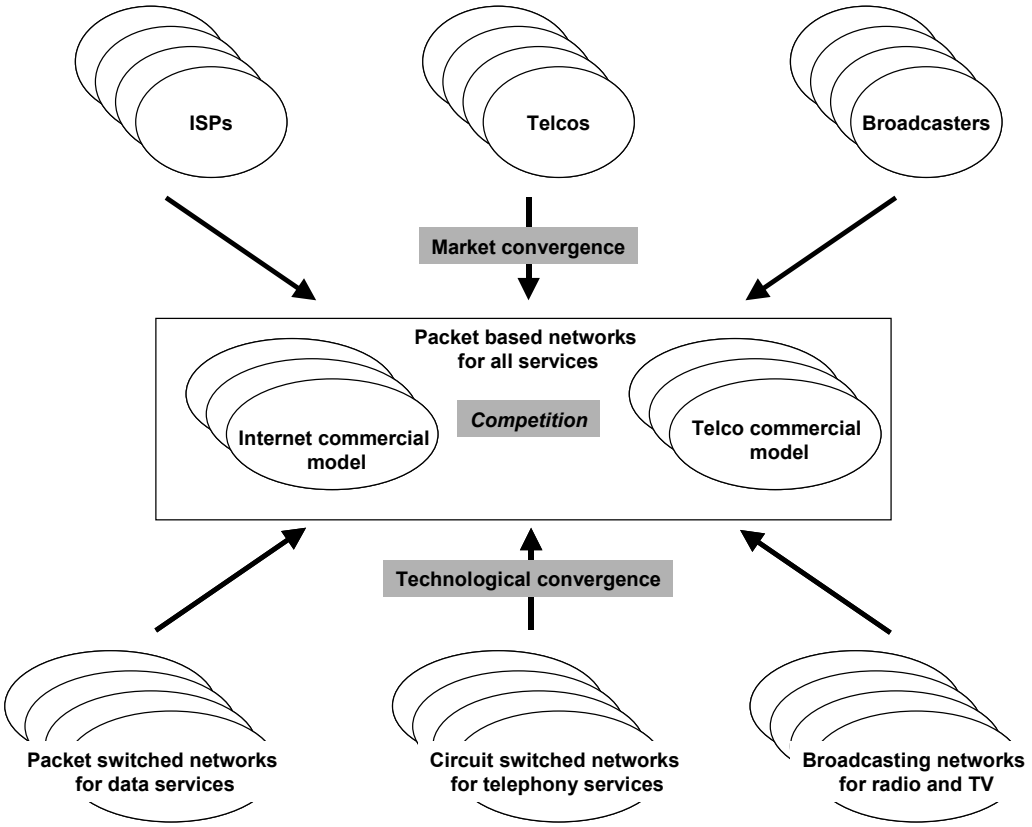
IMPLICATIONS FOR NUMBERING, NAMING AND ADDRESSING OF THE CONVERGENCE OF THE INTERNET AND THE TELCO NETWORKS

Bornholm, October 2003

EXECUTIVE SUMMARY

This report is essentially in two parts.

The first part provides a general analysis of what convergence means and what are the likely ways in which the telecommunications market may develop. It pays particular attention to the growing competition between the traditional telco approach to networks and the Internet approach. The following diagram summarises the process of convergence.



This analysis has led to the following conclusions, which are presented together with their implications for numbering, naming and addressing.

1 The public Internet will become increasingly important for communications including real-time communications such as voice.

Implication: Adequate management of the naming and addressing resources on the Internet is needed to satisfy the various commercial and governmental requirements

2 The different economic models of the telcos (intelligent network with controlled usage and time based charging) and the Internet (dumb network with open usage and subscription based charging) will increasingly compete with each other, and there is a possibility that basic communications will become a subscription charged utility in the future. This means that the future development of the DTN (Developing Telecommunications Network) based on the current telco commercial model is not assured, creating an unprecedented degree of uncertainty in the market place. Consequently the development of future services will become increasingly diverse and unpredictable.

Implication: Adequate address space is needed to allow a variety of approaches to networks to be tried in the market place even though some may fail.

3 E.164 numbers will be used in three ways for services that are provided over IP:

- Migration of telco services with E.164 numbers to IP
- New telco services on IP that will require E.164 numbers
- New services on the Internet that will require E.164 numbers.

Implication: These developments will lead to increased demand for E.164 numbers and increased diversity in the services that they are used for.

4 Whereas in the past new services were developed cooperatively by the telcos through standardisation bodies such as ITU-T and ETSI, service development through these bodies for fixed networks has largely ceased, although it is continuing to some extent in the mobile area for third generation systems. Innovation in services is now focused on the Internet where services are created at the edge of the network and "terminal functionality" is provided through downloadable software. Service innovation is also fragmented with various companies developing similar but incompatible services such as Instant Messenger. The main area of growth at present is distributed customised applications.

Implication: Naming and numbering in the future will have to be able to support a much less stable service environment because they can no longer be related to well-defined services. This will in turn lead to a loss of the information that can be deduced from numbers such as service type, tariff level and location. Consequently there will be a need for more comprehensive directories and other sources of service-related information.

5 The availability of the Internet as a "dumb network", and the scope for creating and running services from outside the network is stimulating the development of intelligent software based terminals that use general purpose hardware such as PCs and PDAs.

Implication: This will lead to reduced control over how numbers and names are used and increased threats to the integrity of the E.164 numbering scheme (ie use of numbers for services for which they have not been assigned, and the adoption of numbers without regard to the formal assignment processes).

6 There is growing user demand to make services more user friendly especially as sophisticated telecommunications becomes a pervasive part of society and not just a tool for people who are better educated or interested in computing. These objectives are driving new initiatives to simplify identification and to reduce the number of identifiers that users have to handle. More information on the current concepts that are being developed is given in a later section.

Implication: There may be a need for better centralised directories and other support functions especially for information relating to new services in order to support greater user friendliness.

7 There is a strong trend towards the separation of network operation and service provision. This separation is already an integral part of the structure of the Internet but it is being adopted also by the telcos in their plans for DTNs. This separation of service provision is likely to result in services being provided from outside the country where they are used.

Implication: As above. There will also be problems in the loss of reliable geographic information, the control of services and the support of law enforcement, which relies heavily on numbers.

8 As networks become capable of supporting multiple different services there will be increasing pressure to use numbers for multiple services. This development will break the relationship between numbers and network operation and lead to requirements for a new approach to number assignment and personal numbering.

Implication: Numbers will become multi-service in the same way that Internet names are multi-service. This will create increased pressure for individual/personal assignment of numbers and the need for adequate methods of validating people's rights to use a given number. It will also result in loss of information from numbers because the information normally relates to specific services.

9 Numbers are a very useful form of identifier especially for services that are potentially global and are used in a wide range of different cultures. Therefore there is likely to be increasing demand for E.164 numbers not only from both the telco and Internet based communities, but also for purposes that go beyond communications.

> **Implication**: The increased and diverse demands will put pressure on the structure of the E.164 scheme and it will become increasingly difficult to decide what range of numbers to use for new services. The demand for global numbers, ie numbers that are not country specific, will increase. Demand will develop to use E.164 numbers for purposes that are beyond telecommunications.

The second part of the report explores these implications and makes various recommendations for future work within ECC.

The recommendations are:

Recommendation - 1
CEPT as an independent organisation should not become involved in the on-going debate about Government involvement in Internet naming and addressing. The issues are discussed in the Government Advisory Committee of ICANN and the ITU with the European position being prepared in the Internet Informal Group (IIG) convened by the Commission, and there is little point in attempting to duplicate the discussions within CEPT. However these arrangements do not provide scope for participation by all CEPT members who are not members of the EU and CEPT administrations could ask the Commission to expand the membership of the IIG.

Recommendation - 2
Each national government should take steps to ensure adequate coordination between the people responsible for managing E.164 numbers and those responsible for managing domain names, irrespective of the legal and organisational arrangements.

Recommendation - 3
WG NNA should keep an active watch on the development of IPv6 and the usage of IPv4 addresses.

Recommendation - 4
WG NNA should study the issues that will be involved in the introduction of IPv6, preferably through a case study.

Recommendation - 5
WG NNA should develop guidelines to help National Regulatory Authorities handle the wide variety of applications for the use of E.164 numbers for voice communications over IP technology including the Internet.

Recommendation - 6
WG NNA should study in more depth the use of numbers for multiple different services and produce guidance on the problems that can arise and how they can be avoided.

Recommendation - 7
WG NNA should keep a close watching brief on the public and private sector developments for simplifying user identification.

Recommendation - 8
WG NNA should keep a watching brief on the development of directories and if necessary study in greater depth the scope for competition in basic telephony related directories and the possibility of developing more comprehensive directories for new services.

Recommendation - 9
WG NNA should keep a watching brief on the development of number databases for use by network operators and public support functions.

Recommendation - 10
WG NNA should study the numbering and naming aspects of multi-channel access to services.

INDEX TABLE

1 INTRODUCTION

The aim of this report is to identify the main changes in telecommunications that come under the general title of "Convergence" and to analyse their implications for numbering and naming. The report is written from a top-down perspective and so necessarily includes an overview and analysis of the main economic and commercial developments and trends in the market and the likely technological developments that underlie them. This report should therefore:

- Help Governments and NRAs to understand better the process of convergence and in particular the key developments that determine how rapidly convergence will proceed.
- Analyse how users are likely to be affected by convergence and what new user requirements are likely.
- Assess the significance of various recent developments including ENUM, UCI and new commercial identification schemes.
- Identify the main issues for numbering and naming that the ECC will need to study further, covering both policy and technical issues.

The scope of the report is only to identify issues that arise out of convergence. Further separate work is planned to resolve the issues identified. The scope of the report does not cover all forms of identifier, for example, it does not include E.212 or E.118. These identifiers may be affected by convergence and assignment of these identifiers may be needed for services provided on the Internet but these issues a re for further study.

Whilst the report contains a significant amount of material about future markets, the report aims only to indicate the possibilities for commercial development and is not intended to predict exactly where the market will go and certainly not where it should go.

2 DEFINITIONS AND ABBREVIATIONS

2.1 Definitions

The analysis and discussion of convergence in this report uses the following terminology. Some terms may have more than one interpretation, depending on the context, origin, or usage of such terms, and therefore the definitions below are noted accordingly.

Term used	Definition
Assignment	"Assignment" is used for the process of authorising the use of a number or name or range of numbers.
NGN	"Next Generation Network (NGN)" is used in the ITU-T sense of the goal of a near universal future network that lies some way beyond the current developments being undertaken in programmes such as TIPHON and 3GPP IP Multimedia. NGN will subsume the PSTN and most of the Internet and add many new capabilities.
DTN	"Developing Telecommunications Network (DTN)" is a term coined specifically for this report to describe the current telco-led developments such as is being worked on in TIPHON and 3GPP as a pathway towards the NGN. Thus the term DTN will be used in many instances where the reader might expect NGN to be used in a loose sense. Furthermore, the term DTN is used to refer specifically to developments and investments aimed at the support of new services as distinct from the replacement of parts of the PSTN with packet based technology either to reduce costs or to provide public telephony in new building developments.
Quality	"Quality" when used on its own is used in a very broad user-orientated sense and includes concepts such as reliability and availability that are treated separately in standardisation.
Service	"Service" is used as a description of the combination of the form of information transmission offered and the identification system used for the caller and called parties.

Table 1: Definitions used in this Report

2.2 Abbreviations

The abbreviations in this section apply to the use of terms in this report. Some terms may have more than one interpretation, depending on the context, origin, or usage of such terms, and therefore some of the abbreviations below are noted accordingly.

Abbreviation used	Explanation
3GPP	Third Generation Partnership Project
ADSL	Asymmetric Digital Subscriber Line
APNIC	Asia Pacific Network Information Centre
ARIN	American Registry for Internet Numbers
ATM	Asynchronous Transfer Mode
CEPT	European Conference of Post and Telecommunications Administration
CLI	Calling Line Identity
CLIP	Calling Line Identification Presentation
CLIR	Calling Line Identification Restriction
DNS	Domain Name System
DTN	Developing Telco Networks
E.XXX	Number of the appropriate ITU-T Recommendation, e.g. E.164
EC	European Community
EG	ETSI Guide
ENUM	Electronic Telephone Number Mapping
ETSI	European Telecommunications Standards Institute
EU	European Union
GPRS	General Packet Radio System
HF	Human Factors
IANA	Internet Assigned Number Authority
ICANN	Internet Cooperation for Assigned Names and Numbers
IIG	Internet Informal Group
IP	Internet Protocol
ISDN	Internet Services Digital Network
ISP	Internet Service Provider
ITU-T	International Telecommunication Union, Telecommunication Standardization Sector
LACNIC	Latin American and Caribbean Internet Addresses Registry
LAN	Local Area Network
NAPTR	Naming Authority Pointer
NAT	Network Address Translator
NGN	Next Generation Network
NNI	Network Node Interface
NRA	National Regulatory Authority
OSP	Open System Provision
PDA	Personal Digital Assistant
PSTN	Public Switched Telephone Network
RFC	Request for Comments [IETF]
RIPE NCC	Réseaux IP Européens Network Coordination Centre
RIR	Regional Internet Registry
SIP	Session Initiation Protocol
SMS	Short Message System
STF	Special Task Force
Telco	Operators of traditional Telecommunication Networks
TIPHON	Telecommunications and Internet Protocol Harmonization Over Networks
TLD	Top Level Domain
TS	Technical Standard
TSB	Telecommunications Standardization Bureau
UCI	Uniform Resource Locator
UK	United Kingdom
UNI	User Network Interface
VPN	Virtual Private Network
WG NNA	Working Group Numbering, Naming and Addressing

Abbreviation used	Explanation
WiFi	Wireless Fidelity

Table 2: Abbreviations used in this Report

3 POLICY AND REGULATORY OBJECTIVES

3.1 Introduction

Traditional public telecommunications and broadcasting have developed as licensed activities, coordinated at international level by Governments in the ITU and CEPT with national activities under regulatory control. Whilst competition and liberalisation have changed the approach to public telecommunications and introduced many new freedoms, a clear overall framework has endured. All identification issues relevant to telecommunications and broadcasting such as numbering, naming and addressing have been handled within this "Governmental" framework (nearly all have related to telecommunications rather than broadcasting, with E.164 numbers being the main scheme).

In contrast, several data networks especially the Internet have developed outside this framework on the basis of common interests with less formal associations and controls. The various identification schemes used in the Internet, principally Internet names and IP addresses, have been established under IANA and ICANN with little or no reference to Government, and in some of its organisations have positively discriminated against the involvement of representatives of Government. This situation is now changing to some extent with the proposed restructuring of ICANN but the Internet framework remains largely "non-Governmental" compared to the ITU-T framework.

As the Internet becomes increasingly capable of providing an alternative[1] to the traditional methods of public telecommunications and broadcasting, there is a growing awareness of the inconsistency in the degree of involvement of Governments in each framework. This has been highlighted by the proposals for ENUM which involve E.164 numbers from the Government run ITU-T framework being used within the Internet Domain Name System.

At the same time new commercial identification schemes such as Microsoft Passport are developing for use on the Internet but outside the control or supervision of ICANN or even any international governmental control. Figure 1 gives an overview of the changing scenario.

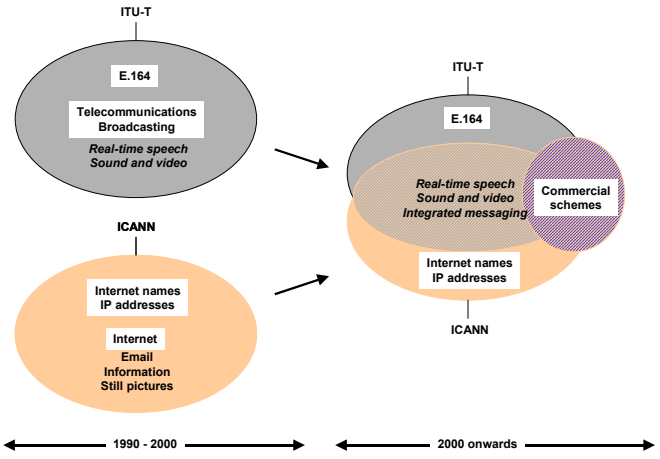


Figure 1: The changing scenario

3.2 ITU-T objectives

The ITU-T is involved in two ways in convergence between the public telco networks and the Internet :

- As a regulatory organisation, it is concerned about the growth of the Internet and its organisation and management that have occurred on a largely commercial or voluntary basis outside the ITU-T framework, and so undermine the

[1] In terms of the functionality perceived by the user, eg an "approximate" alternative.

long standing controls and practices that have been developed within ITU-T. This is especially the case in the areas of responsibility for naming and numbering, which has been brought sharply into focus by ENUM, and in the areas of tariffs and accounting rates, since the Internet is being used to bypass the accounting rate system for communications with developing countries. Network operators in countries that have liberalised their public telecommunications have already moved away from the accounting rate system to some extent.

- As a standards organisation, it is promoting the development of standards for the NGN mainly through the work of Study Group 13, but also involving Study Groups 2,12 and 16. This standards work partly competes with and partly is complementary to the work in ETSI 3GPP and TIPHON.

The role as a regulatory organisation is the role of main relevance to this report.

ITU passed Resolution 102 (see Annex A) in 2002 on involvement with ICANN. The views expressed in the ITU-T by European administrations are quite diverse. Some administrations want ITU-T to have more involvement with ICANN and the Internet especially with regard to ccTLDs, and others want to keep control of the Internet in the private sectors subject to national law. For example:

- Some register strong concern about the principles of the Internet and its naming and addressing operating under ICANN, which has developed historically in the private sector as a commercial organisation run under Californian Law. This view is taken even more strongly by developing countries, especially China.
- Others take a more pragmatic approach, being content that Internet naming and addressing is working satisfactorily in practice and think that it should stay in the private sector and that the reforms in ICANN are meeting the concerns of Government.

Whilst it may be useful for the ECC to discuss these different positions, it is probably impracticable for the ECC to try to resolve them through a parallel debate.

In general terms the objectives of the ITU-T for the NGN have been summarised[2] as :

- to facilitate convergence of networks and services
- promote fair competition;
- encourage private investment;
- define a framework for architecture and capabilities to be able to meet various regulatory requirements;
- provide open access to networks,

while:

- ensuring universal provision of and access to services;
- promoting equality of opportunity to the citizen;
- promoting diversity of content, including cultural and linguistic diversity;
- recognizing the necessity of worldwide cooperation with particular attention to less developed countries.

Overall the goal of the NGN is the development of a single universal network platform that will support all the existing services without loss of performance and also support new services. The vision of the NGN is shown in figure 2

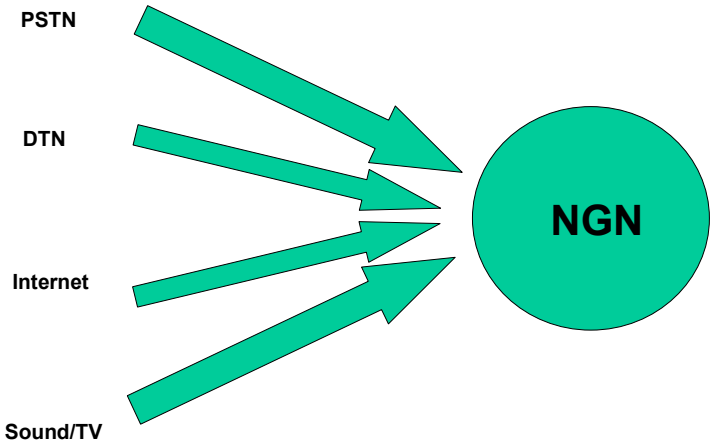


Figure 2: The ultimate goal of the NGN

[2] Taken from SG 13, Q12/13 TD 19 of meeting 29 October - 8 November 2002, reproduced here as Annex X.

3.3 European objectives

A new framework of directives was adopted by the European Union in 2002 and the deadline for implementation in national law is 25 July 2003. The general objectives are described in Article 8 of the Framework Directive (2002/21/EC).

Article 8.1 states that the regulation should be **technologically neutral**.

This means that the aims of regulatory as described in the EU Directives have to be applied for all public telecommunications networks. This includes all packet switched networks like e.g. the Internet.

Article 8.2 requires Member States to **promote competition** by:

(a) ensuring that users, including disabled users, derive maximum benefit in terms of choice, price, and quality;

(b) ensuring that there is no distortion or restriction of competition in the electronic communications sector;

(c) encouraging efficient investment in infrastructure, and promoting innovation; and

(d) encouraging efficient use and ensuring the effective management of radio frequencies and numbering resources.

Article 8.3 requires them to **develop the internal market** by:

(a) removing remaining obstacles to the provision of electronic communications networks, associated facilities and services and electronic communications services at European level;

(b) encouraging the establishment and development of trans-European networks and the interoperability of pan-European services, and end-to-end connectivity;

(c) ensuring that, in similar circumstances, there is no discrimination in the treatment of undertakings providing electronic communications networks and services;

(d) cooperating with each other and with the Commission in a transparent manner to ensure the development of consistent regulatory practice and the consistent application of this Directive and the Specific Directives.

Article 8.4 requires them to **promote the interests of citizens** by:

(a) ensuring all citizens have access to a universal service specified in Directive 2002/22/EC (Universal Service Directive);

(b) ensuring a high level of protection for consumers in their dealings with suppliers, in particular by ensuring the availability of simple and inexpensive dispute resolution procedures carried out by a body that is independent of the parties involved;

(c) contributing to ensuring a high level of protection of personal data and privacy;

(d) promoting the provision of clear information, in particular requiring transparency of tariffs and conditions for using publicly available electronic communications services;

(e) addressing the needs of specific social groups, in particular disabled users; and

(f) ensuring that the integrity and security of public communications networks are maintained.

The accompanying Universal Services Directive (2002/22/EC) includes provisions specifically for numbering concerning:

- Comprehensive Directory Enquiry services (Article 5)
- Single European emergency number (Article 26)
- European international access code (Article 27)
- Number portability (Article 30).

These requirements of the Universal Services Directive, however, apply only to "publicly available telephone services[3]" and so only involve E.164 numbers. They would include IP technology only where it is used for "publicly available telephone services" but exclude voice communications over the Internet and more advanced services offered over DTNs that would not fit the description of "telephone service".

The accompanying Directive on Privacy and Electronic Communications (2002/58/EC) harmonises the provisions of the Member States required to ensure an equivalent level of protection of fundamental rights and freedoms, and in particular

[3] These services include facsimile and dial-up Internet access

the right to privacy, with respect to the processing of personal data in the electronic communication sector and to ensure the free movement of such data and of electronic communication equipment and services in the Community.

This means that the requirements of the Privacy Directive apply to all public telecommunications, including the Internet.

4 USER OBJECTIVES

No formal user objectives have been agreed for numbering but the following objectives have been proposed from time to time:

- The separate communications requirements of the end-user originating a communication and the end-user receiving a communication are addressed.
- The privacy of end-users is protected.
- Both the end-user originating a communication and the end-user receiving a communication can be confident that the other's identity is authentic.
- The number of communications identifiers associated with an end-user is minimised.
- Communications identifiers associated with an end-user are stable over time.
- End-users are able to easily capture identifiers associated with other end-users with whom they communicate.
- End-users can easily control how and when they are communicated with by other end-users.

  (Identified by ETSI Specialist Task Force STF180, "User Identification solutions in converging networks", at Numbering 2001 conference, June 2001).

- Communications identifiers associated with an end-user are easy to remember or to find.
- Communications identifiers associated with an end-user may be retained when the end-user changes location or changes the operator providing service to a particular identifier.
- Communications identifiers should, where they have a connection with call charges or location of an end-user, enable such information to be readily identified.

  (Identified by Claire Milne, Antelope Consulting, "The Design and Management of Numbering Systems" in Telecom Reform: principles, policies & regulatory practices*, edited by William H. Melody)*

- Communications identifiers have the possibility to be personal to a particular end-user.

  (Identified by Knut Nordby, ETSI Human Factors, "User identification in future networks", presentation at Numbering 1999 conference, October 1999.

In addition, work in the ETSI TIPHON project has identified the following aspects of user friendliness in non-numeric names:

- Ease of being remembered by a human
- Ease of identifying the person or terminal or line from the name
- Ease of being written (or input to a terminal) without error
- Ease of being generated from first principles if the name is not known or has been forgotten (this is an advantage only when there are inadequate directory services).

The work also drew attention to the issues of:

- Use in different languages
- Use in different alphabets
- Replication (ie non-uniqueness) of natural names.

and concluded that the scope for a user-friendly non-numeric naming scheme is quite limited unless the context is restricted such that there is a single language/alphabet and replication is very low. This work also commented that many of the benefits of user friendliness can be achieved in other ways by intelligent terminal software.

The objective for the future is a coherent multi-service network with a separation of service provision and network operation and a simple user-friendly identification system.

5 WHAT CONVERGENCE IS AND WHAT IS DRIVING IT

Convergence means "coming nearer together" but it is a term that is applied very loosely in telecommunications.

The main driver of convergence is digitalisation which reduces all telecommunications transport-services and applications to bit streams. Digitalisation is likely to become universal.

The secondary driver is the ability to provide both connection orientated and connectionless communications on the same packet based infrastructure, where for example. Internet protocols are becoming more widespread but not necessarily universal.

These two drivers are making new networks capable of supporting multiple or all services and applications. Therefore "multi-service" is a major element of "convergence". All services and applications converge on the same networks, and all networks become capable of providing the same services.

The trend towards networks becoming capable of supporting multiple different services has little impact on the use of Internet names as these are capable of being used in connection with multiple services. In respect of E.164 numbers, however, this trend creates pressure to use the same number with several services. One implication of such a development is that the connection that currently exists between numbers and network operation is no longer unique and, to a large extent, ceases to exist. This implication suggests the need for different approaches to assignment of numbers or the greater use of personal numbering, to ensure individual end users can exercise full control over how their numbers are used. A second implication of the use of the same number with multiple services is that information which may currently be derived from numbers, such as the associated type of service, is no longer reliable.

E.164 numbers are used for the routing of calls within and between traditional telco networks, in the same way that Internet addresses are used for the routing of packets on IP networks including the public Internet. However, there is no technical reason preventing services running over the Internet using E.164 numbers for identification of end users. There may be advantages for Internet-based services in using E.164 numbers, in that they are familiar to end users around the world, are simple, and can be used from legacy equipment (such as traditional telephone terminals) which may be supported by these services.

The drivers of convergence mean that E.164 numbers are likely to be used, not only for services provided on traditional telco networks, but also for:

- Services that are migrated by telcos from their traditional networks to IP networks
- Entirely new services provided by telcos on their IP networks
- Entirely new services provided on the public Internet.

There is some important differences between the various networks that are discussed further in section 5:

- The Internet becoming capable of providing telephony and broadcasting services with only minor changes and a continual steady growth in its characteristics,
- the telcos need to develop new capabilities, ie DTNs, to provide new services
- the broadcasters are investing in digital technology and new delivery methods, eg satellite, cable and the Internet, and additional capabilities, eg return channels, although they are not replacing their existing terrestrial radio broadcasting channels.

This technological trend of convergence is driving profound changes in the market place. Because networks become universal transport networks, network operators who previously supported services in a single market gain the scope to play in markets that were originally served by quite separate network operators and organisational arrangements. This leads to market convergence where separate markets of the SPs, telcos and broadcasters are all merging. However this market convergence is bringing the different historical commercial models of the telco and the Internet increasingly into direct competition as each becomes capable of supporting the same services. Figure 3 shows the overall process of convergence.

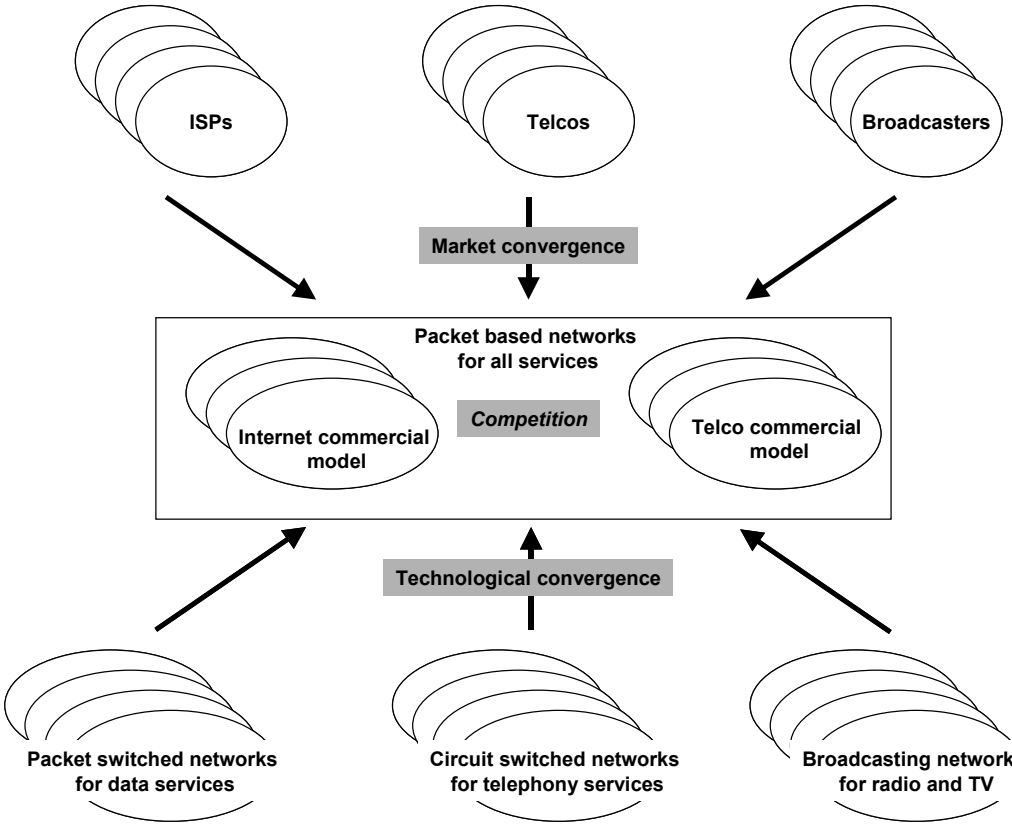


Figure 3: The process of convergence

The works "convergence" may imply to many people a constructive convergence where different entities draw together and produce a synergy that creates new possibilities. The technological aspects of convergence are constructive in this sense as they allow a fuller spectrum of services and provide much more scope for the integration of different service types and roles.

The commercial aspects of convergence are quite different since they will lead to increasing competition between the players whose business were originally confined to single separate markets. Since broadcasting (terrestrial and satellite) will continue to be needed indefinitely and is funded by the programme distributors, it is not threatened by the ability to deliver programmes over the Internet and over DTN. In contrast the telcos are threatened significantly by the prospective loss to the Internet of telephony paid for by users according to their usage. This is why the main commercial competition will be between the different commercial models of the telcos with largely usage based charging and the Internet with largely subscription based charging.

Overall, the word "convergence" does not seem to fit particularly well with the period of intense competition that is starting.

One of the main conclusions of the analysis of the market situation below is that although the telco and Internet worlds are competing, they are likely to continue in parallel for the medium term future and it is not clear to what extent they will converge eventually to a single solution (the NGN). The effect of competition is likely to be that some traffic moves from the telco world to the Internet world and vice versa but both will continue for a period of time. The possibility of the two worlds converging to a single universal technical and commercial model is probably many years away. Thus in some respects the Internet and the telco networks are not converging at present but staying far apart.

Convergence is not a simple process. Technologically networks are converging on the use of IP technology but the methods of managing the networks and the provision of services differs significantly, and the telco and Internet business models are coming increasingly into competition with each other. From a market perspective, convergence means that organisations that previously worked in distinct areas are increasingly becoming able to provide a wider range of services and compete with each other.

6 CURRENT MARKET SITUATION AND DEVELOPMENTS

Overall the market currently lacks direction. After a period of diverse investments, many of which have not been profitable, the top priority for many operators is to manage their debt situations.

In terms of fundamental resources:

- Local physical infrastructure remains expensive
- Transmission costs has fallen and is falling very rapidly thanks to a combination of absolute costs (cost per bit) and coding that enables more use to be made of a bit (eg voice coding)
- Switching costs are falling but faster for IP-based switches than for circuit switches
- Billing costs are falling only slowly, and the overheads of running a telecommunications business are increasing as a result of increased regulatory compliance costs including areas such as data protection.

This situation leaves telcos re-focusing on core business but with some developing broadband access networks.

There is a great deal of discussion and confusion about how telecommunications networks will develop at a technical level in the next few years. Three years ago everyone was expecting the rapid and near universal adoption of IP technology but since then the whole investment climate has changed and the current situation is much less clear.

Communications services can be classified in many ways but there are two important distinctions:

- User – user services compared to user – host services
- Real-time services compared to store and forward services (real-time also means delay sensitive).

Figure 4 shows how services (grey ellipses) relate to these categories and which networks (coloured rectangles) are best suited to each category. In the past each network was designed for a particular service type, but now we are seeing the Internet becoming capable of providing real-time services such as speech and sound and video broadcasting, in other words it is spreading into these other service areas. In contrast, the DTN will be a new development starting from nothing capable of providing all services.

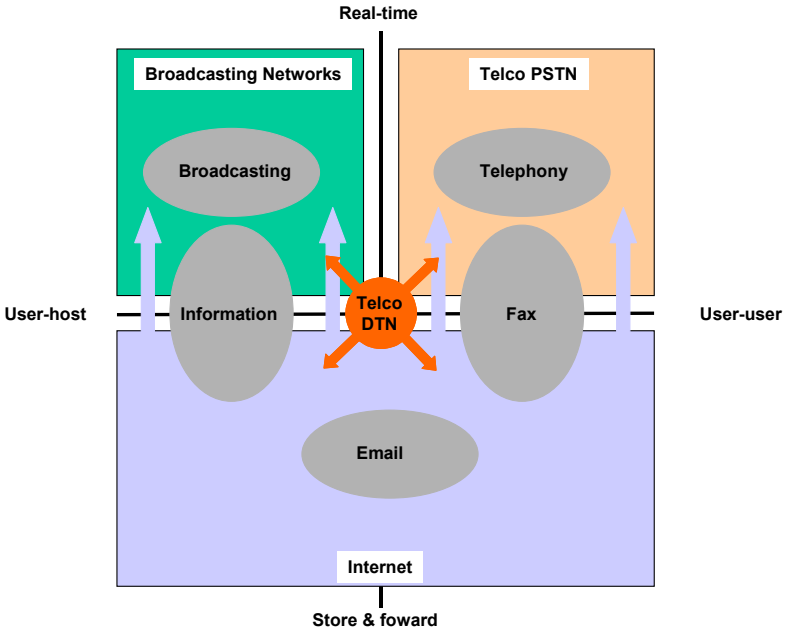


Figure 4: Network developments in relation to services

In terms of total traffic volumes, the volume of "data" on the Internet is continues to grow and is estimated to be several times the volume of telephony traffic, which is static and in some countries beginning to fall. The volume of broadcasting traffic is growing but it is difficult to make an appropriate comparison between broadcast and point-point traffic. Taking very approximate figures for the UK, 50 radio channels at 400 kbit/s and 30 TV channels at 10 Mbit/s gives a loading of

320 Mbit/s one way. In comparison the total telephony traffic is estimated to be around 320 Gbit/s in the busy hour[4] with 64 kbit/s per channel, some three orders of magnitude higher. The comparable figures for Switzerland are 514Mbit/s and 30Gbit/s.

Figure 5 shows a credible view of how networks will change. The diagram[5] is best viewed in colour as the colours are significant. The blue rectangle covering the whole diagram illustrates the dependence on a common IP based transmission platform, the exception being the lop left hand corner where circuit switching is still used. The diagram shows the terrestrial and satellite broadcasting arrangements continuing unchanged but losing traffic to the Internet. The main economic issue is whether new services will develop on the DTN or on the Internet.

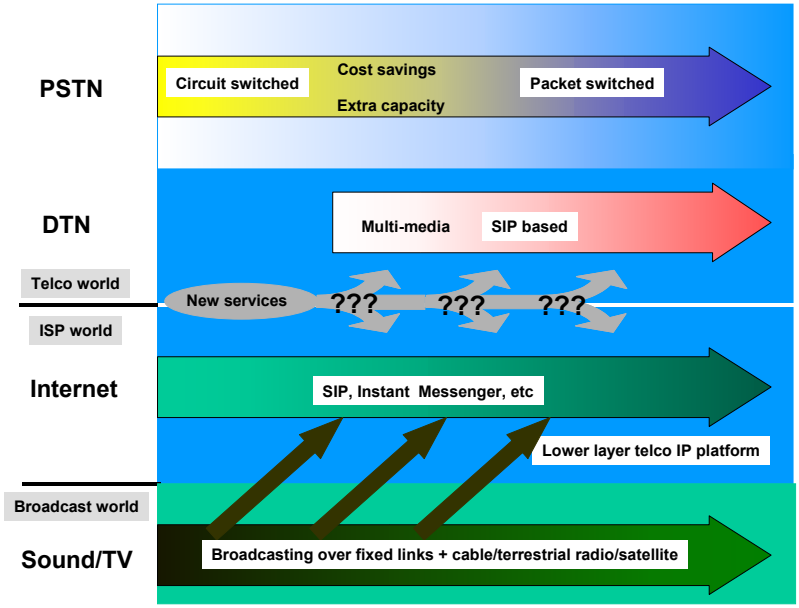


Figure 5: Short to medium term network developments

6.1 PSTN and mobile networks

The PSTN/ISDN and the mobile networks are largely circuit switched. Public services currently offered using E.164 numbering are likely to continue largely unchanged for the indefinite future because they work well and are universal.

Technologically it is now possible to provide at least basic public services on a packet based network infrastructure that uses either IP or a combination of IP and ATM. The range of supplementary services available may be less that with circuit switching. Although some operators are already using packet based infrastructures in some places, these technologies are working as islands and nearly all interconnections currently remain circuit switched. There is general acceptance that, if there is a widespread migration to packet technology, the approach to network planning and network management will have to change and that there will be some challenges in satisfying all the requirements met hitherto by the circuit switched PSTN/ISDN.

The main justification for replacing circuit switches with packet based switches is economies of scope with new services and cost savings primarily in operational expenditure since the capital expenditure has already been made. This justification will grow gradually if manufacturers fail to supply adequate spares and if the expertise for software modifications is dissipated, but relatively few modifications will be needed and the current circuit switches could remain in use for at least another 10 years, at least at the local level. There are differing reports on the current scope for justifying replacement based on savings.

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[4] This is based on 60 billion minutes of traffic from fixed telephones per quarter as given by Oftel for Q2 2000/1, using 50 working days per quarter and 4 hours of traffic per day at the busy hour level, giving 5 million simultaneous conversations.

[5] Adapted from a diagram produced by Mr Nozsek of Deutsche Telekom.

Where extra capacity is needed, it is less likely that operators will buy new circuit switches and some manufactures may no longer be able to supply them, so they will buy softswitches instead. Since PSTN/ISDN traffic is static or falling (except for Internet access and some calls to non-geographic numbers) there should not be too much need for additional capacity.

The solution to the growing Internet access traffic is to introduce xDSL eg as ADSL and so remove this growing traffic from the local switches and to handle it in a more appropriate manner. Some telcos are now pushing ADSL very actively.

Where circuit switches are replaced by softswitches, the aim will be to make the PSTN services appear not to be changed. Thus the simplest solution will be to implement the No7 Signalling Protocols over IP with minimum changes. Manufacturers already are doing this for transit level switches (Class 4) but few if any have yet developed soft switches with the full capability of local exchange circuit switches, but this will change.

At the international level, there are now several IP based networks that handle international traffic including traffic from incumbents and the entry into the market of these networks has helped to create an active market in international call minutes. Some of this traffic is handled on dedicated IP networks and some on the public Internet.

Mobile operators are currently grappling with the introduction of GPRS to provide Internet access and better data services. The always-on GPRS Internet access is analogous to ADSL but much slower although higher speeds should be achieved with 3G technology. The GPRS backbone is at an early stage of development but the operators are increasingly marketing it as a means of Internet access rather that as a bundle of operator-specific services. Mobile networks are increasingly substituting for fixed networks in terms of the provision of telephony, for example some households no longer have fixed telephones, but the cost of cellular mobile data access is likely to exceed that of fixed for the foreseeable future. The longer term goal of IP multimedia services (3GPP Release 5) is closely analogous to the telco DTN.

The future of cellular mobile networks will be affected quite significantly by the recent and rapid growth in WiFi as a means of providing high bit rate low cost Internet access. WiFi is especially useful for laptops which are normally used in places that can easily be served by WiFi such as waiting rooms, airports, hotels, cafes.

Future developments of WiFi may also compete with fixed access if they can provide a greater operating range.

Figure 6 shows the trends for network access, comparing mobile and fixed networks and the circuit based and packet based forms of access. It shows circuit based access traffic to the fixed networks reducing as the traffic, mainly telephony, migrates to mobile access for greater ease of use or to the Internet over xDSL. A migration of voice communications from circuit switching to packet switching within mobile networks is less likely because mobile packet access is much more expensive than fixed packet access. In any case, the mobile operators have some control over the migration of mobile telephony to the Internet through the combination of their pricing policies and the quality of Internet access that they provide. Thus it is the telephony revenue of the fixed telcos that is most at risk from competition from the Internet.

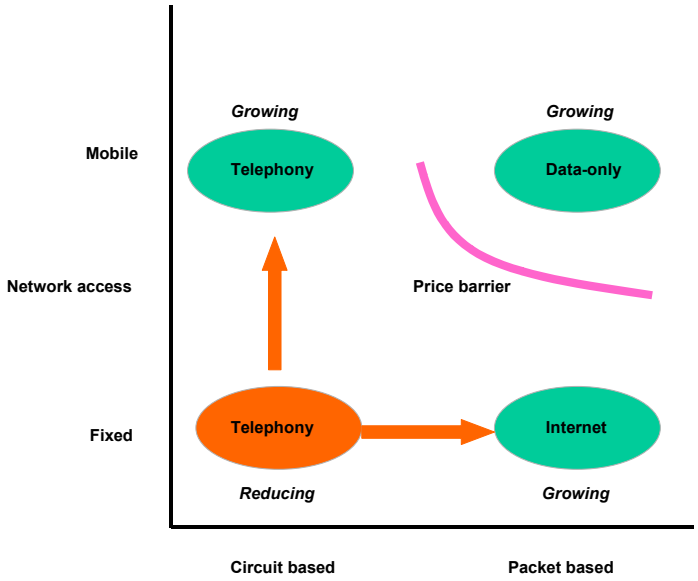

Figure 6: Traffic trends on different forms of network access

Information services are currently provided on both the Internet (web) and as telephone response services accessed from the PSTN and mobile networks. These services have seen significant growth in both forms. For many users, access by telephone has been the only option but with the growth in both mobile and fixed data services, telephone access will reduce and be used only where the user prefers the telephone medium to the data medium.

In summary:

- the fixed PSTN/ISDN is likely to stay largely unchanged with slowly declining traffic volumes as traffic is lost to mobiles and the Internet. Its technology will migrate slowly to soft switches, driven by cost savings.
- Mobile networks will see some further growth in telephone traffic. They may migrate to a packet architecture if it offers sufficient cost savings but this migration is some way off.
- Packet based access in fixed networks is the key to enabling new services to be provided at low cost and is also a principal enabler for the migration of telephone traffic from the PSTN to the Internet.
- Mobile data is likely to remain a specialist service on price grounds for the foreseeable future.

6.2 Broadcasting

Broadcasting networks use leased lines, satellite links and point-point microwave links with delivery to the customer via any of the following:

- Cable
- Terrestrial radio
- Satellite broadcasting.

Increasingly broadcasting channels are distributed to end users at lower bit rates over the Internet with reasonably long buffers to correct for the variable transmission delay.

Broadcasting technology is undergoing a major change from analogue to digital terrestrial and satellite broadcasting, and digital broadcast channels will be used for an increasingly wide range of data distribution eg group paging services, and not only for traditional programmes.

Another change is the development of interactive programmes where viewers or listeners respond to the programme or interact with it in other ways. A variety of return channels are used including telephone (voice and direct modem), SMS, web forms and email. The Internet will increasingly be used for the return channel, but the forward and return channels are likely to remain independent because of the diversity of forward channels needed.

Since broadcasting (terrestrial and satellite) will continue to be needed indefinitely and is funded by the programme distributors, it is not threatened by the ability to deliver programmes over the Internet and over DTNs.

6.3 NGN and DTN

The NGN description document produced by SG13 in ITU-T says that the NGN can be defined by the following fundamental characteristics:

1) Packet-based transfer,
2) Separation of control functions among bearer capabilities, call/session, and application/service,
3) Decoupling of service provision from network, and provision of open interfaces
4) Support for a wide range of services (including real time/ streaming/ non-real time services and multi-media)
5) Broadband capabilities with end to end transparency, including access network utilization considerations
6) Interworking with legacy networks
7) Generalized mobility
8) Unfettered access from users to competing service providers and/or services of their choice.

The term DTN is used for the telcos initial developments of IP-based networks as a step towards the NGN.

There is confusion over whether the term DTN should be used from the perspective of the technology used or the services provided. There is no right answer as the choice is a matter of definition. The use of the term in this report is primarily from the services perspective, ie the capability to provide new services not currently offered by the telcos. The reasons for this usage are:

- The main issue that is affecting the market is whether the telcos will be able to raise revenue form new services provided by the DTN in competition with the services and applications on the Internet. The view taken of these prospects will determine whether or not the telcos invest in DTN.
- Any investment that is made in DTN is likely to be targeted on the customers that are most likely to use the services and DTN would therefore be introduce as an overlay to the circuit switched PSTN, although the DTN infrastructure would also be used to provide public telephony to customers of DTN services.
- The "competition" between the DTN and the Internet is likely to be resolved before the there is a good case for replacing the circuit switched PSTN with a packet based network on grounds of cost savings, mainly operational expenditure.

SIP is currently the favourite protocol for these developments and work on SIP is being undertaken in 3GPP for its IP Multimedia Platform.

One of the problems with DTN is that few people have clear ideas of what services will be needed. This is one reason why the manufacturers are perusing an "open services environment", as no one is very sure about what to do. In general the telcos want to pursue technical competition in service creation, rather than standardisation and they are resisting suggestions of service standardisation in ETSI.

Figures 4 & 5 show the DTN arrow growing from nothing to indicate its gradual implementation.

6.4 Corporate VPNs

This is currently the area where telco IP-based services are growing most rapidly. The VPNs provide:

- Internal voice communications
- External PSTN access
- Services exclusive to the customer that relate to their operations
- Internet access

The needs for corporate and public telephony are similar technically to the provision of public telephony over IP, however the protocol is likely to be QSIG over IP since it will be necessary to provide a smooth transition for services from circuit switching to IP.

VPNs are used primarily for telephony, Internet access and functions that relate specifically to corporate operations; there is as yet little innovation in services.

Continued expansion of the VPN market is likely and it is also likely that there will be a demand for interconnection between the VPNs of different organisations. However this interconnection will only be of value where the "services" of both networks are similar at a technical level. This should be achievable for standardised services such as public telephony and its private counterpart. Where new DTN services have been developed such as video-telephony, interconnection between VPNs run by different telcos will be possible only if the "service" is similar at a technical level, which implies standardisation.

6.5 Internet

The public Internet is the third area of development. It is by definition an open services environment but the commercial arrangements are quite different from those of the managed telco networks because the Internet provides a global platform with access paid largely by subscription.

The range of services available on the Internet is increasing and users are able to obtain services, including voice communications, at low or zero marginal price on the Internet that previously they had to pay usage based charges to the telcos. There will however be differences in the quality of service but these differences may reduce to a level that is not a deterrent for users. Thus the fixed telcos are facing a steady migration of traffic away towards the Internet and also to mobile networks.

The Internet model represents a major threat to the traffic related revenue of the telcos because the marginal costs of using the Internet are low or zero for many users who have already obtained the necessary equipment such as a PC. In the longer term this may lead to a revision of the economic models.

6.6 Comparison of the telco and Internet models

Table 3 compares the "closed" telco networks with the "open" Internet. The most important difference is that the telco networks are aware of both the services that they are carrying and the users for whom they are carrying them, and is responding in different ways (eg charging) to this information, whereas the Internet is just transporting packets without this awareness.

Current telco networks	Current broadcast networks	Telco DTN networks - closed	Internet - open
• Circuit switched technology • User-user services centrally controlled by provider of transport service • Usage related charges and quality control • Access control for users and interconnection • Interconnection is service related and controlled • Few/no third party services • Intelligent network, dumb terminal[6]	• Circuit orientated technologies • Delivery by cable, terrestrial radio or satellite • Distribution charges are normally based on the quantity of programmes distributed and not the quantity viewed • Well developed third party service market • Increasing provision of interactive programmes but forward and return channels are independent • Terminals become more intelligent	• ATM/IP based technology • run via APIs • Usage related charges and quality control • Access control for users and interconnection • Interconnection may occur at various levels. Above the IP level it is likely to be service related and controlled • Intelligence focused in telco servers attached to the network	• IP based technology • No service creation - services and applications run from edge • User-user services run by users themselves • Client-host services run by independent hosts at edge • Access control for users but otherwise open • Interconnection is open and only at IP level • No usage-related charges and little quality control • Gateways to telco networks have control and charging • Dumb network, intelligent terminal

Table 3: Comparison of telco networks and the Internet

The distinctions are illustrated in Figure 7, which compares the telco concept of the DTN with the Internet. The Figure highlights the controlled and service related interconnections between the telco networks and the use of APIs by through which the "service-aware" telco networks obtain the information that they need about the services.

6 Mobile networks have more intelligent terminals than fixed networks, see section 6.7.

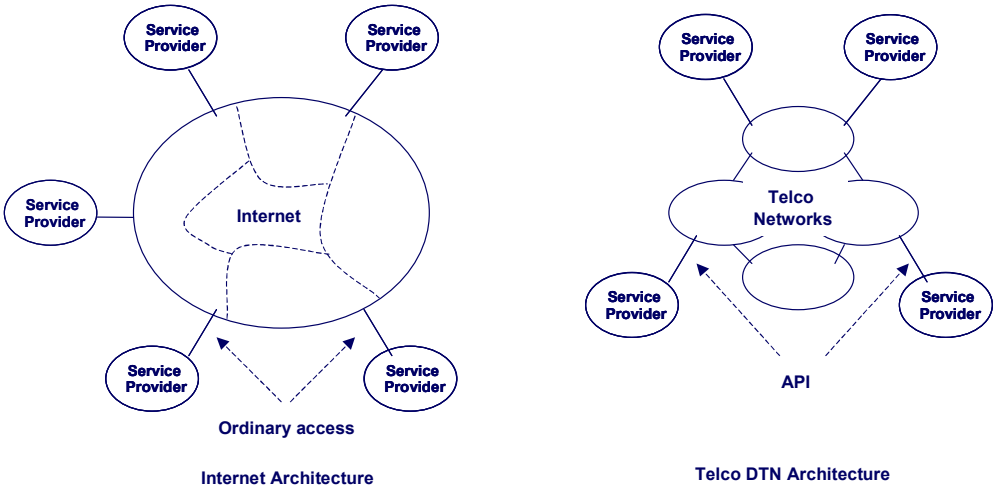

Figure 7: Comparison of telco DTN architecture and the Internet

6.7 Network architectures and intelligence

The traditional PSTN had a strong degree of vertical integration in that the same organisation provided the service, ran the network infrastructure and provided the access technology. The same was true to some extent for broadcasting since many broadcasters ran their own distribution networks.

In contrast the Internet was always split horizontally into:

- Service providers or application operators
- Backbone network operators
- Internet access providers (ISPs)
- Physical access providers (eg the telcos who provided dial-up access circuits or leased lines).

Liberalisation, with its focus on competition and opening unbundled access to dominant activities, coupled with the example of the Internet, have created a trend towards all networks becoming split horizontally (less vertically integrated). As the network and access technologies become more multi-purpose, there are increasing opportunities for service providers and content distributors to use many different networks. For example messages can be sent and received using many different technologies, and radio programmes are distributed on the Internet as well as by traditional terrestrial and satellite technologies.

Terminals are becoming more intelligent. The functionality in mobile terminals has grown extremely rapidly with pressure from the large scale consumer market. These terminals initially functioned with pre-loaded software but more recently they are becoming more like general purpose computers into which service providers can download software and upgrade the software when necessary with varying degrees of user visibility and control. The complexity of the software is likely to make this trend continue as new services may not be standardised and service providers will need the ability to add features and correct software bugs.

Intelligence will be handled differently in the DTN from the way in which it was handled in the PSTN. In the PSTN the intelligence was distributed and often duplicated on each switch. In the DTN the intelligence is expected to be centralised in a logically single server, with one server[7] for each network. The basic network infrastructure will be dumb and similar to the Internet, except that there will be call related access control at the network boundaries.

[7] For service control and call control in TIPHON terminology. There may be other facilities provided as well such as voice response systems.

6.8 Voice traffic

The telcos are heavily involved in the support of the Internet in that they supply the basic transmission facilities and dial-up access and in many cases also have large businesses as ISPs, and therefore the growth of the Internet is not wholly a commercial threat. Their main risk, however, is the loss of revenue from usage based telephone traffic, which is typically some three times that for access line rental.

Voice traffic can be subdivided into three categories:

- Repeat calls to same people (family, friends, colleagues). This is the largest category and the one best suited to Instant Messenger services
- Calls to Government, shops, services, schools. This will be a major application for web pages with click to talk services as call centres develop Internet access
- "Random other calls". These calls are likely to remain served by the PSTN.

Figure 7 shows where voice traffic that has hitherto been carried as telephony on the fixed PSTN is migrating. The migrations are:

- Slow but accelerating substitution by mobile networks. An increasing number of customers no longer bother to have fixed lines and rely wholly on mobiles.
- Substitution of some short non-urgent calls by text messaging using either email or SMS
- A slow substitutionary migration of traffic to the public Internet and corporate VPNs. This traffic is mainly frequent calls between the same small group of people (eg teams at work or distant family members).

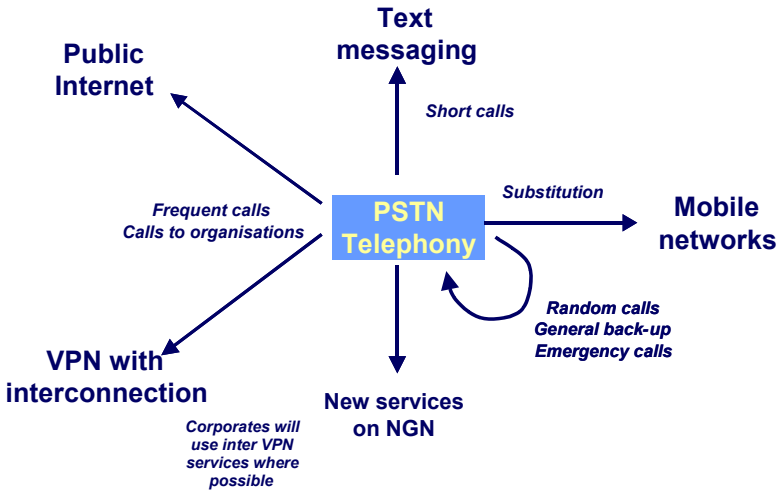

Figure 8: Migration of telephony from the PSTN

Some of the traffic that stays on the PSTN may be handled by IP if IP technology is introduced into the PSTN.

Figure 9 shows the differences in market pressure between the telcos and the Internet. The main pressure on the telcos is to reduce price, the main pressure on the Internet world is to increase quality (in the broad sense of the term).

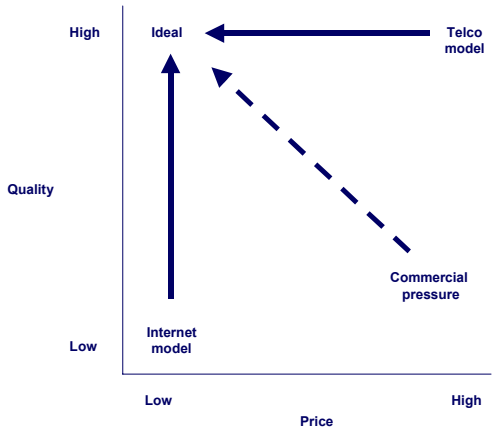

Figure 9: Market pressures

Three main issues are slowing the migration of voice traffic to the public Internet:

- Transmission quality
- Ease of use
- Blocking by NATs and firewalls.

At present most of the codecs used in VoIP were designed for circuit switched applications and are badly affected by the packet loss that occurs on congested IP-based networks, however new codecs designed to tolerate packet loss are becoming available and are expected to provide adequate quality even over the Internet.

Ease of use will then remain the critical factor. Voice communications over the Internet at present depend on services such as Instant Messenger to overcome the problem of dynamic assignment of IP addresses. This creates three problems:

- There are different proprietary solutions (eg Microsoft, AOL and Yahoo) which results in users having to register with multiple systems, which is not popular. (Interestingly this is the same problem that will be created by the competition in services that the telcos now seem to favour.)
- The call set-up arrangements of Instant messaging is not as quite simple as making an ordinary telephone call.
- Only some users subscribe to Instant Messaging and so the capability to reach other users is more limited that for the PSTN and also not easily predictable.

Dynamic assignment of IP addresses is likely to remain common for the next few years although it might reduce if there is rapid adoption of IPv6. The introduction of IPv6 is uncertain as there are a variety of issues that affect it. Whilst IPv6 will remove limitations in the availability of IP addresses, this may not lead to widespread use of permanently assigned addresses as dynamic assignment and the use of NATs offer some advantages in security that users will take into account..

The ease of use needs to be improved by better software but significant improvements are expected within the next two years.

In most cases, voice communications over the Internet are blocked by firewalls and Network Address Translators (NATs). Some of the causes of blocking are can be solved by changing the policy of the relevant IT Departments, but voice communications cannot currently traverse NATs because the NAT cannot be made to translate IP addresses and port numbers for the media streams as well as the signalling. There are various activities that aim to solve this problem and substantial progress is expected during 2003/4. Advocates of an early introduction of IPv6 see the possibility of removing NATs as a major driver for its introduction, but its effect will depend on how quickly solutions to the NAT problem are developed for IPv4.

Other developments that facilitate the migration of voice to the Internet are:

- The growing popularity of broadband Internet access with always-on capabilities. Ironically this means that if telcos accelerate the roll-out of broadband access they may facilitate the loss of some voice traffic revenue.
- The rapid growth of "WiFi" wireless Internet access and especially its provision in public places such as airports, railway stations, hotels and conference centres. "WiFi" is expected to have major implications for 3rd generation mobile services as it offers better performance at lower prices for the mobile laptop market, and there is the possibility of the development of a large market for WiFi-based SIP telephones.
- Growth in the use of LANs in the home, whether wireless LANs or hardwired ones. LANs are being sold in some do-it-yourself stores in some countries.

The main development that is likely to deter the migration of voice to the Internet is the introduction of flat rate tariffs by the telcos. Such tariffs are becoming more common, whether for the whole day or just for off-peak times, and they remove the cost saving incentive of using the Internet. Users seem to like flat rate tariffs because they are less vulnerable to unexpectedly high bills. Flat rate tariffs also help the telcos to reduce their costs in handling customer complaints.

The overall conclusion is that voice traffic, which has limited potential growth capability within Europe, will continue to migrate away from the fixed networks to mobile networks and to VPNs and the Internet. The migration to the Internet is likely to gather pace from late 2003 as the problems of traversing NATs are solved and new facilities make PC based voice communications more user friendly.

This migration of voice traffic is unlikely to reduce the demand for fixed access including access to the PSTN greatly as most smaller premises will require Internet access via ADSL or newer technologies and most users will wish to continue to have access to public telephony both for any-any connectivity and for use when other forms of communication fail.

6.9 Service multiplication and concentration

Service providers are multiplying and users are consequently facing:

- An increase in the number of different bills that they have to pay
- An increase in the number of subscriber identities and passwords that they have to use.

This is creating a new market for service and subscription aggregation. This market is not limited to telecommunications services but includes other utilities and the purchase of goods and services over telecommunications networks of all types.

Two of the various commercial identification schemes that are starting are:

- The Federated Network Identity being developed by the Liberty Alliance (www.projectliberty.org) supported by a wide range of commercial interests including credit card companies
- The Microsoft Passport introduced in 1999 with over 200 million registrations by April 2002.

ETSI is also studying a Universal Communications Identifier (UCI) that will probably be based on a subset of E.164 numbers with additional information.

These schemes are not only concerned with identification but also with authentication and the collection and exchange of personal information, and each has its own unique features - they are not equivalents. They are of significant interest to Governments who need to integrate their various dealing with citizens (eg tax, health, education, motoring, passports, law enforcement). Thus identification systems are being caught up in wider “multi-disciplinary” issues. The following statements illustrate some of the conflicting forces at work:

- Users want simpler account and subscription management and billing
- Users want privacy
- Users need protection against identity theft
- Advertisers want information about users so that they can target advertisements and operators of common identification schemes are in a prime position to collect this extremely valuable information
- Credit card companies want authenticated user identities that they can trust
- Banks and insurance companies want better information for credit ratings and risk assessment
- Governments want to integrate their dealings with citizens and this needs a common electronic identity
- Law enforcement authorities would benefit from any concentration of information about citizens as it would reduce the number of different bodies that they may have to interact with.

Because they are globally unique and understandable across a wide range of languages and cultures, E.164 numbers are potentially a very convenient identifier. For this reason, demand for E.164 numbers may be expected to increase. However, the particular types of numbers that will be sought, and the sources of demand, are likely to change. Requirements for global mobility (e.g. access to services from anywhere in the world) may increase interest in global numbers (i.e. numbers that are not country specific). Telcos will remain as a source of demand for numbers, but Internet application service providers will also seek E.164 numbers. Moreover, the attractiveness of E.164 numbers may result in interest in using them as identifiers for purposes unrelated to telecommunications.

In the telco and Internet worlds, the proposed ENUM scheme for mapping E.164 numbers to Internet names and URLs is receiving a great deal of attention but it is only a part of a bigger picture.

These developments are discussed further later in the report.

The "open" Internet commercial model is competing with the "closed" telco commercial model. Critical issues are how fast voice traffic will migrate onto the Internet and whether new services will use the Internet or the telcos' new networks.

7 COMPETITION BETWEEN DTN AND THE INTERNET

7.1 DTN developments

Whilst there is a clear case for migrating private and corporate networks to an IP platform to provide integrated voice and data, there is not a clear economic case for doing so for public networks. Several operators have undertaken studies of the economic benefits of replacing circuit switched networks with IP based networks but have found that the benefits do not outweigh the costs.

The fundamental problem for fixed circuit switched network operators is that traffic levels are flat or decreasing slightly for almost all traffic other than dial-up Internet traffic[8]. The strategy of removing Internet access traffic as early as possible onto a separate network platform and leaving the circuit switched network in place therefore seems increasingly attractive and is likely to remain attractive until the maintenance costs of the circuit switches and concentrators becomes too high. This problem may occur earlier than "necessary" since many manufacturers have ceased, perhaps prematurely, manufacturing spares for this technology. Notwithstanding this, it is unlikely that a clear case will emerge for replacing circuit switches within the next 4-5 years. IP based infrastructure will therefore be rolled-out in parallel as an overlay network to serve:

- New developments
- Areas where high population growth cannot be served by the existing switches
- Customers who specifically need DTNs.

Two of the hopes of the telcos are that:

- Users will want to continue to have "guaranteed quality"
- Service providers will pay to host services on the new telco DTN platforms.

It is not clear whether these hopes will come to fruition. Adequate quality for a high proportion of cases may prove sufficient for most customers, and innovators of new services may prefer to use the Internet and gain global reach to prospective customers at the price of basic access rather than enter special arrangements with telcos whose history of helping third party service development in the IN era was disappointing.

Within ETSI the support of TIPHON has reduced significantly and there are few signs that manufacturers are implementing the standards yet[9]

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[8] The growth of dial-up traffic is also distorting traditional network planning and changing the cost base of networks.

[9] Most examples of the use of TIPHON standards relate to the OSP protocol for billing and clearing house services, which was developed outside TIPHON and presented to ETSI for re-publication.

7.2 Internet developments

The critical question for the Internet is whether quality (all aspects including transmission) will continue to increase or whether it is currently at its peak, due to excessive "dot-com" investments, and will deteriorate in the future. The trend for increasing dependence on the Internet suggests that people will if necessary be willing to pay more overall for Internet access and so quality can be sustained or improved. In practice it seems that a large proportion of the costs are in the access arrangements and several countries are seeing quite high levels of demand for ADSL access which indicates willingness to pay more for better quality. The fact that most of the bottlenecks are in the access[10] means that it should be possible to achieve a fairly direct relationship between subscription levels and quality, giving the right economic signals to the market.

One of the main methods to improve Internet quality is to segregate traffic of different types (packet length and delay sensitivity) onto different virtual networks so that they queue separately for routers and some priority can be given to delay sensitive traffic. Techniques for such segregation have been developed (eg diffserv) and may be introduced in the future.

7.3 Hybrid developments

There is a great deal of activity in hybrid PSTN-Internet services mostly from smaller new entrant operators. The main businesses established so far are Internet based services for PSTN break-out that enable users with Internet access to make long distance and international phone calls are reduced rates, especially into countries with high termination rates.

A group of operators called VisionNG are establishing a service for users with laptops to have both incoming and outgoing calls from Internet connections. They will be assigned numbers from the global code +878 10. Some of the technology developed is a spin-off from TIPHON.

Other potential developments are linkages between ISPs and local exchanges so that Internet users on dial-up access can be warned on incoming telephone calls and either clear to receive then or receive them on their Internet access.

In general the hybrid developments are either specialist services or short term bypass services that will decline when better access to the Internet is available for more people.

7.4 Parallel operation

Possibly the most likely outcome is that both the Internet and telco DTN platforms develop in parallel but with the DTN platforms for the PSTN developing slowly. It is not at all clear how quickly the Internet will take traffic from the PSTN because it is not clear how rapidly the ease of use and NATs problems of voice over the Internet will be solved. It is also unclear how rapidly new DTN services will develop (see next section).

Computer based systems for voice over the Internet are unlikely to reach the levels of reliability of the PSTN for a long time and many customers may choose to retain their traditional PSTN connections for use when the PC or LAN crashes, even when they use the Internet for most of their voice traffic. This combination could be the "best of both worlds".

It is not clear how the competition between the Internet and the new telco networks will develop. Both are expected to continue their developments in parallel and hybrid services that use both networks will also develop. The circuit switched PSTN is likely to remain indefinitely but with gradually reducing traffic volumes.

8 DTN NETWORK SERVICES

The telcos and their suppliers, who are supporting DTN developments, whether fixed or mobile, are planning to promote technical competition in the development of new services rather than the standardisation of new services. Figure 10 shows the architecture planned. This approach applies to both mobile (eg 3GPP IP Multimedia) and fixed networks (eg TIPHON).

[10] Especially in the routers and contention systems used behind the access line.

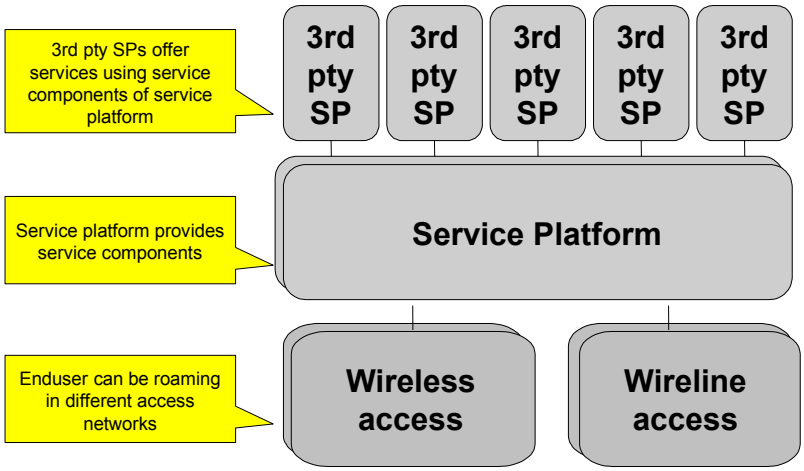


Figure 10: Architecture of DTNs

The intention is that the network operators will provide a general purpose service platform for the creation of innovative services by themselves and third parties, and that the service platforms and third party service providers will be able to charge customers on a usage basis.

The service providers will innovate in service creation and place contracts with service platforms for connectivity. This approach raises several issues:

- Network operators were unwilling to promote third party service creation in the ISDN-IN era and have not yet demonstrated in practice a willingness not to favour their own vertically integrated services.
- Service providers will have to negotiate connectivity agreements with the platforms of many different operators if they are to have wide coverage for their services and to have usage based billing.
- Where new client-client services are provided, communications may only be possible between the customers of the same service provider unless different service providers cooperate to offer the same technical service.

It is far from clear how these developments will work out. There is a huge advantage in having a standardised service with standardised UNI and NNI interfaces for public services and also for any "private services" that could be interconnected on VPNs. The standardised UNI interface creates a large independent terminal market, and the standardised NNI provides easy any-any interconnectivity between the customers of different service providers and facilitates the development of comparable Reference Interconnection Offers. Standardisation of these interfaces does not inhibit the development of new features that exist wholly within a terminal or wholly within a network. Yet, notwithstanding these advantages there is currently no support from fixed network operators for producing technical standards for new services, probably because there is no consensus on what services to standardise and a fear of discussing proposals when the focus is on competition between different types of services.

The success of competitive service innovation compared to the traditional standardisation route will depend on:

- The extent to which better technical characteristics in a particular service influence the choice of service provider when most customers take many or all services from the same provider.
- The extent to which customers find that the loss of an any-to-any capability is a disadvantage when communications are possible only between customers of the same service provider. In other words, how well do the informal groups whose communications account for probably the majority of each person's communications map to the choice of service provider?
- The effect of competition from similar services on the Internet which may not have the same constraints.
- The level of competition between service providers.

Figure 11 shows some of the possible developments and their dependence on the main key issues.

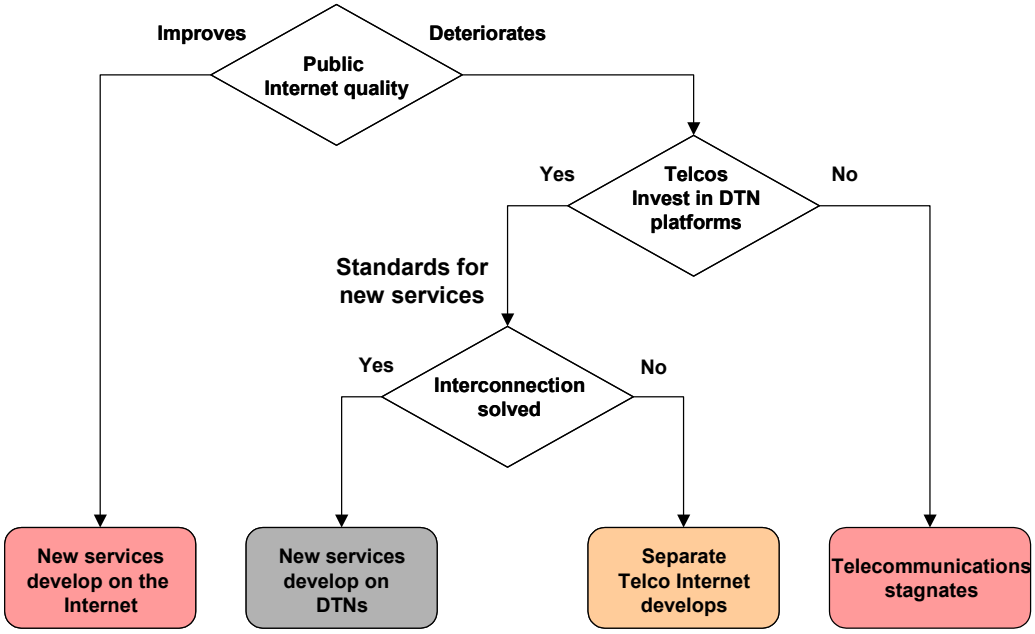


Figure 11: Possible short to medium term developments

If quality improves then service innovation is likely to take place on the Internet. If it deteriorates, then the telcos will have more incentive to invest in DTN platforms. If the new services start to develop on the DTN platforms then the main issues will be coverage and coverage and interconnectivity. If they are solved then the current telco model will prevail. If they are not solved then the telcos may have to offer an open platform of higher quality than the public Internet, ie an "Internet Mark 2" with higher access charges and higher charges for attaching service but without usage based charging to simplify interconnectivity.

The DTN architecture is quite similar to the Internet architecture in terms of the separation of functions and layers and so it creates the similar issues for the commercial and operational relationships between the players . Figure 12 compares the two architectures.

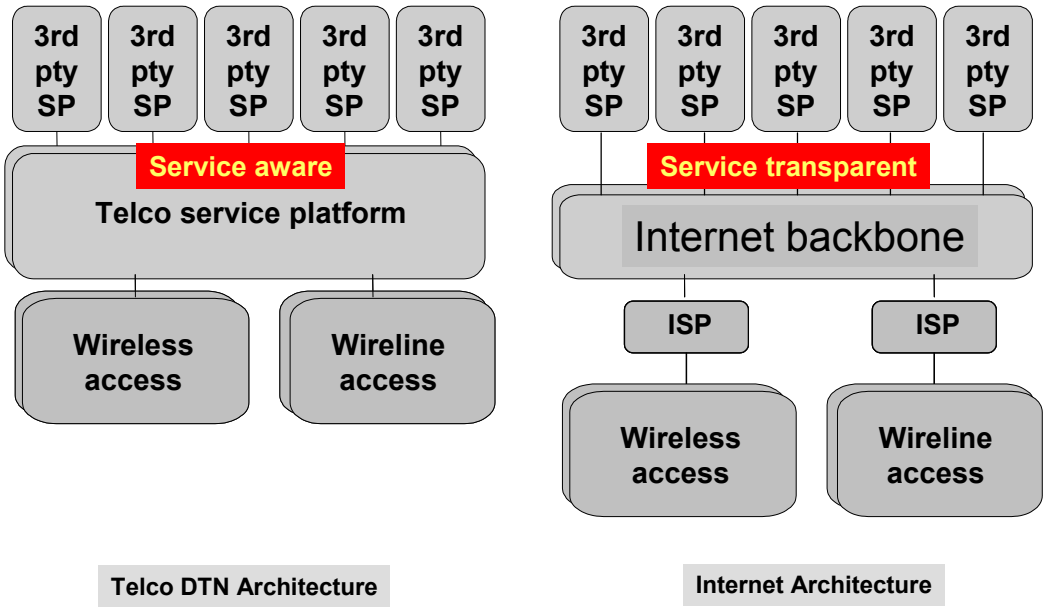


Figure 12: Comparison of the telco and Internet architectures

The differences lie primarily in the commercial and organisational arrangements. In the Internet model users pay for Internet access that is general purpose and has no knowledge of the services being used. They may then use any service anywhere and pay the service provider directly as necessary. Thus Internet access is totally decoupled from service usage and so:

- Interconnection between parts of the backbone and between ISPs and the backbone is simple
- Users have access to all service providers.

In contrast, with the DTN model:

- Interconnections between service platforms and possibly between access systems and service platforms are service specific
- Users have access only to those services that are supported by their access provider and service platform through specific agreements.

Given the unavoidable multiplicity of service providers, the DTN commercial and operational model seems to be impracticably complex and restrictive. This line of analysis points towards the conclusion that the Internet commercial model of an "open" network platform may be the only viable commercial and operational model.

If the telco DTN does not develop because it is impracticable, then it is questionable whether the telcos will develop a "telco Internet" separately from the public Internet. If the quality of the Internet is poor then the telcos could run part of the Internet themselves with better quality and higher access charges. This could be preferable to developing a separate "telco Internet" because it would preserve global connectivity.

Politically the possibility or prospect of the DTN failing and all new services running over the Internet means a continuation and possible enhancement of the dependence of entities in Europe on essential facilities in the US. This is not limited to DNS servers such as the root servers and .arpa but covers other facilities such as Instant Messenger servers and the servers used for Microsoft Passport. With increasing concerns about national security, this means that US law enforcement could have better access to information on European citizens than is available to European law enforcement. Furthermore trade-offs could be made to relax "anti-trust" concerns in return for better access to information for law enforcement.

The structure of the developing telco networks and the Internet both provide separation of service provision from network operation but the commercial arrangements of the closed telco network backbone will make connectivity on the telco networks difficult to achieve. These problems coupled with a lack of innovation in new services by the telcos makes the future of the new telco networks uncertain. The telcos may need to move to more of an Internet model and one possibility is the development of a "telco Internet" with higher charges and higher quality than the public Internet.

9 CONCLUSIONS AND IMPLICATIONS OF THE MARKET DEVELOPMENTS

The preceding sections have described the current developments in the market. . The second half of the report examines the current initiatives with respect to numbering, naming and addressing and the implications of the market developments for numbering, naming and addressing. Therefore at this point, it is necessary to summarise the main conclusions and indicate the implications that are to be considered in the second half.

The main conclusions are:

1 The public Internet will become increasingly important for communications including real-time communications such as voice.

> **Implication**: Adequate management of the naming and addressing resources on the Internet is needed to satisfy the various commercial and governmental requirements

2 The different economic models of the telcos (intelligent network with controlled usage and time based charging) and the Internet (dumb network with open usage and subscription based charging) will increasingly compete with each other, and there is a possibility that basic communications will become a subscription charged utility in the future. This means that the future development of the DTN based on the current telco commercial model is not assured, creating an unprecedented degree of uncertainty in the market place. Consequently the development of future services will become increasingly diverse and unpredictable.

Implication: Adequate address space is needed to allow a variety of approaches to networks to be tried in the market place even though some may fail. The future service environment will become increasingly unstable.

3 E.164 numbers will be used in three ways for services that are provided over IP:

- Migration of telco services with E.164 numbers to IP
- New telco services on IP that will require E.164 numbers
- New services on the Internet that will require E.164 numbers

Implication: These developments will lead to increased demand for E.164 numbers and increased diversity in the services that they are used for.

4 Whereas in the past new services were developed cooperatively by the telcos through standardisation bodies such as ITU-T and ETSI, service development through these bodies for fixed networks has largely ceased, although it is continuing to some extent in the mobile area for third generation systems. Innovation in services is now focused on the Internet where services are created at the edge of the network and "terminal functionality" is provided through downloadable software. Service innovation is also fragmented with various companies developing similar but incompatible services such as Instant Messenger. The main area of growth at present is distributed customised applications.

Implication: Naming and numbering in the future will have to be able to support a much less stable service environment because they can no longer be related to well-defined services. This will in turn lead to a loss of the information that can be deduced from numbers such as service type, tariff level and location. Consequently there will be a need for more comprehensive directories and other sources of service-related information.

5 The availability of the Internet as a "dumb network", and the scope for creating and running services from outside the network is stimulating the development of intelligent software based terminals that use general purpose hardware such as PCs and PDAs.

Implication: This will lead to reduced control over how numbers and names are used and increased threats to the integrity of the E.164 numbering scheme (ie use of numbers for services for which they have not been assigned, and the adoption of numbers without regard to the formal assignment processes).

6 There is growing user demand to make services more user friendly especially as sophisticated telecommunications becomes a pervasive part of society and not just a tool for people who are better educated or interested in computing. These objectives are driving new initiatives to simplify identification and to reduce the number of identifiers that users have to handle. More information on the current concepts that are being developed is given in a later section.

Implication: There may be a need for better centralised directories and other support functions especially for information relating to new services in order to support greater user friendliness.

7 There is a strong trend towards the separation of networks operation and service provision. This separation is already an integral part of the structure of the Internet but it is being adopted also by the telcos in their plans for DTNs. This separation of service provision is likely to result in services being provided from outside the country where they are used.

Implication: As above. There will also be problems in the loss of reliable geographic information, the control of services and the support of law enforcement, which relies heavily on numbers.

8 As networks become capable of supporting multiple different services there will be increasing pressure to use numbers for multiple services. This development will break the relationship between numbers and network operation and lead to requirements for a new approach to number assignment and personal numbering.

Implication: Numbers will become multi-service in the same way that Internet names are multi-service. This will create increased pressure for individual/personal assignment of numbers and the need for adequate methods of validating people's rights to use a given number. It will also result in loss of information from numbers because the information normally relates to specific services.

9 Numbers are a very useful form of identifier especially for services that are potentially global and are used in a wide range of different cultures. Therefore there is likely to be increasing demand for E.164 numbers not only from both the telco and Internet based communities, but also for purposes that go beyond communications.

Implication: The increased and diverse demands will lead put pressure on the structure of the E.164 scheme and it will become increasingly difficult to decide what range of numbers to use for new services. The demand for global numbers, ie numbers that are not country specific, will increase. Demand will develop to use E.164 numbers for purposes that are beyond telecommunications.

The implications of some of these conclusions overlap. The following is the list of implications that are considered further in the second half of the report. These implications are grouped in terms of their subject.

Management of the Internet names and addresses

1 Adequate management of the naming and addressing resources on the Internet is needed

Availability of Internet addresses

2 Adequate address space is needed to allow a variety of approaches to networks

Organisation of the E.164 scheme and number assignment

3 Naming and numbering in the future will have to be able to support a much less stable service environment because it can no longer be related to well-defined services

4 There will be increased demand for E.164 numbers and increased diversity in the services that they are used for

5 The increased and diverse demands will lead put pressure on the structure of the E.164 scheme and it will become increasingly difficult to decide what range of numbers to use for new services.

6 Numbers will become multi-service. This will create increased pressure for individual/personal assignment of numbers.

7 There will be a loss of the information that can be deduced from numbers such as service type, tariff level and location

8 The demand for global numbers, ie numbers that are not country specific, will increase.

9 Demand will develop to use E.164 numbers for purposes that are beyond telecommunications.

Control of numbers and names and their use

10 There will be reduced control over how numbers and names are used and increased threats to the integrity of the E.164 numbering scheme (ie use of numbers for services for which they have not been assigned, and adoption of numbers without regard to the formal assignment processes).

11 There is a need for adequate methods of validating people's rights to use a given number.

12 There will be problems in the support of law enforcement, which relies heavily on numbers.

Databases

13 There may be a growing need for databases, other support functions and improved directory functions.

10 NAMING SCHEMES AND THEIR CHARACTERISTICS

From the perspective of numbering and naming, there are different systems that have been developed in the Internet and telco worlds so far and so exists on opposite sides of the main axis of competition. The Internet world uses Internet names of the form "user@domain" supported by the Domain Name System (DNS) under the guidance of ICANN. The telco world uses E.164 numbers whose assignment is controlled under the ITU-T. Both schemes can be supported on IP based networks and the telcos may start to use Internet names more as they develop packet-based DTNs.

Table 4 summarises the main features of each naming scheme and adds the capabilities of an ideal scheme.

Feature	E.164	Internet name	Ideal scheme
Management	International: ITU-T National: Administrations	International: ICANN National: Mostly various not-for –profit organisations	Open, stable, accountable, and responsive
World wide suitability	Well established worldwide	Popular in countries that use non accented Roman alphabet but difficult for countries with other alphabets	Suitable for all cultures and character sets
Sharing	Geographic numbers are commonly shared by users who share an exchange line	Rare	None
Relationship to addresses	Confused, some E.164 numbers are names only others are both names and addresses	Totally separate	Totally separate
Memorability and user friendliness	Low, expect for golden numbers	Can be better than numbers as can include natural names but diminishing due to increasing number of TLDs, and non-uniqueness of many natural names (See ETSI EG 201 940)	Good
Tariff information	Can be inferred approximately in many cases	Not relevant with the current model	Best treated separately
Support from directory services	Good for geographic numbers	Poor	Good
Relationship to services	Number space is subdivided into ranges for different services and so many users have multiple numbers, one for each type of service	Names are intrinsically multi-service because the application is specified separately, but some users subscribe to services from more than one provider and so may have multiple names	Multi-serve to be simple for the users
Portability between locations	Not normally available between countries but normally available locally in fixed networks	Normally available wherever access to the ISP is possible	Probably both portable and not portable systems are needed as different users have different requirements
Portability between service providers	Supported within some services and some countries, but generally becoming more widely available	Supported if the user has their own domain name, but many users have Internet names of the form "user@service-provider" and so cannot port their name.	Supported
Authentication	Good	Poor	Good
Use by law enforcement	High	Low	High
Data protection (directory CLIP / CLIR)	middle / high	low	High

Table 4: Main features of each naming scheme and capabilities of an ideal scheme

Ideally users want as few telecommunications identities as possible with each name being capable of being used for multiple services, with a separate mechanism for identifying the services available. This makes it easier for users to remember their telecommunications identities and give their identities to other users.

Figure 13 shows the current situation for a user of services in both worlds.

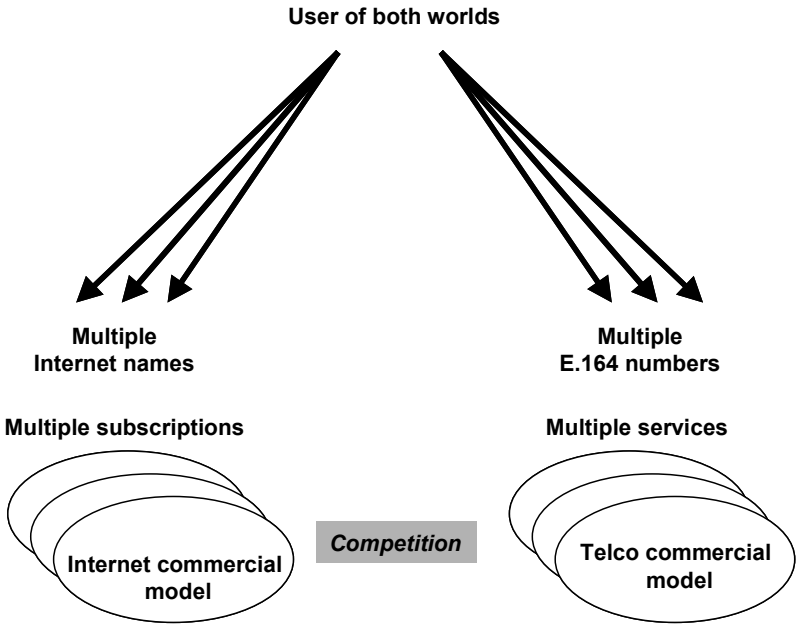


Figure 13: Current situation for numbering and naming

The ETSI TIPHON project has studied the possibilities for non-numeric naming and has concluded that it is not possible to create a scheme that is significantly better than the Internet naming scheme since all the main problems associated with that scheme are:

- Intrinsic in the use of non-numeric names that are language and alphabet dependent and involve varying degrees of natural replication and intellectual property value
- the consequence of the scheme running on the basis of loose cooperation where anything that does not cause a major problem is tolerated rather than a more rigid system backed by regulation.

11 CURRENT DEVELOPMENTS FOR IDENTIFIERS

The main problem being worked on at present is the multiplication of different identifiers for the same users. This is true both for communications services and for services and transactions over communications services, eg purchases over the web. Solutions are needed that:

- Reduce the number of identifiers that need to be used and stored by users
- Simplify and increase the reliability end effectiveness of authentication
- Improve the ease with which users can find out how they can communicate with other users and what identifier to use
- Are adequately proof against fraud and impersonation.

We now review the different schemes that are being developed. There is, however, one fundamental problem that underlies all these developments, because the number of service providers has multiplied, only the users know their own list of identities and services used. Service providers have only a subset of this information and some of the information that they hold, eg a fixed telco's record of a user's email address, may be out of date. Thus all improvements are dependent on persuading users to input their information and keep it up-to-date.

11.1 Customisable address books in terminals

Telecommunications terminals are becoming more intelligent and many mobile terminals and personal computers include customisable address books where users can store numbers and Internet names, including ones collected form incoming communications and associate then with correspondents who can be known by short or nick-names. The availability of these features has gone a long way to make up for the absence of email directories.

11.2 ENUM

ENUM is a proposal to populate the Internet Domain Name System under .e164.arpa[11]s with information of telephone subscribers using the E.164 number in reverse, thus information about the subscriber for:

+44 71 215 5000

would be held under:

0.0.0.5.5.1.2.7.1.4.4.e164.TLD

This information would use the standard DNS pointers and syntax and would enable a software agent to query DNS using an E.164 number and be pointed to, for example, the subscriber's:

- Email address
- SIP address
- Mobile telephone number
- Web site
- Entry in a more extensive database

Thus ENUM provides a one-way translation from E.164 numbers to Internet names and other identifiers. Figure 14 illustrates this.

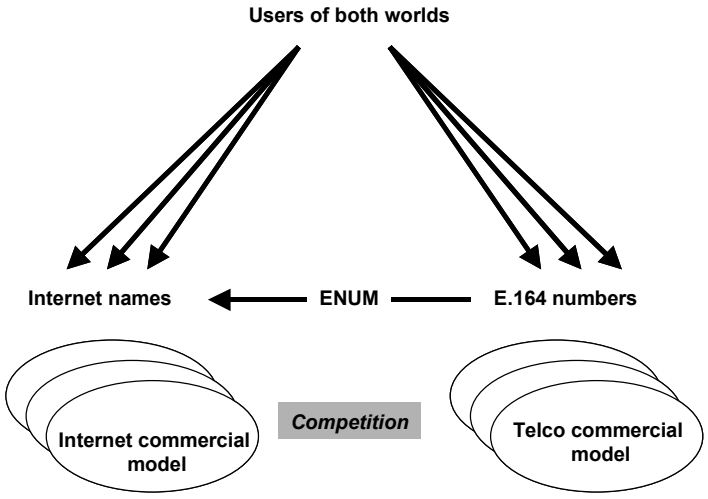


Figure 14: Role of ENUM (RFC 2916)

In addition, ENUM allows the E.164 number holder to input and update information about how they wish to be communicated with, eg a preference for email.

Several countries including Austria, France, Germany, The Netherlands, Sweden, UK are running or planning trials of ENUM and ETSI has prepared an ETSI TS 102 172 on how information should be stored in the NAPTR records within DNS.

[11] The IETF has decided to use .arpa for ENUM but a number of administrations in ITU-T want a new TLD to be used, so the situation is not fully stable.

RIPE NCC in the Netherlands, which is also the Regional Internet Registry for Internet Addressees in Europe has been selected by the Internet Architecture Board as the registry for .e164.arpa and so registers the registries that are appointed for aE.164 country code or regional code.

ITU-T SG2 has approved "Interim Procedures" to request ENUM delegations from RIPE NCC. According to this procedure the ITU-T TSB is consulted by RIPE NCC and given an opportunity to object to any appointment. The ITU-T TSB consults the relevant national Administration and objects to any appointment that is not confirmed as satisfactory by the Administration. This arrangement is designed to prevent an unauthorised organisation becoming the ENUM registry for a country code. The "Interim Procedures will be replaced by an ITU-T Recommendation currently under development.

The following are some fundamental practical issues that will affect the success of ENUM:

1. Correspondents need to know the E.164 number first so ENUM is not as good as directories
2. ENUM is designed only to translate one way and so does not provide a translation from say an email address to an E.164 number. (It would take additional conventions and an expansion of DNS to introduce a reverse translation from Internet name to E.164 number since DNS does not hold Internet names of the form “user@domain”, it holds only the “domain” part)
3. Many E.164 numbers are shared because they refer to exchange lines that are shared and ENUM does not handle sharing
4. Many potential users of ENUM do not have stable relationship with E.164 numbers, eg students who move frequently between home, college and temporary accommodation for vacation jobs
5. Only users know all the information that needs to be entered into ENUM and so there will be a need to create incentives for users to populate ENUM, and at the same time a need to cover the costs of running ENUM
6. It will be difficult to ensure the continuing accuracy of information in ENUM.

In parallel with the official development of ENUM, various commercial organisations are offering or planning to offer similar mechanisms in other parts of DNS, ie not under .e164.arpa.

Within ITU-T there are a wide range of views about ENUM. Whilst a number of administrations support ENUM, or at least support enabling the creation of ENUM subject to normal market forces, other administrations have two major concerns:

- That most of the .arpa servers are located in the US.
- That ENUM could facilitate the migration of telephony traffic from the PSTN to IP based networks and cause special economic problems for developing countries who collect substantial national revenue from incoming international calls that have high tariffs.

It is not certain how these concerns will be resolved.

11.3 Universal communications identifier (UCI)

UCI is a new identification system proposed by ETSI and supported by the European Commission that consists of:

A unique numerical identifier + A natural name (eg John Smith) + Additional information

The unique numerical identifier is the main part of the proposed UCI and is the part that would be used by networks to identify the calling and called parties. The natural name is added to provide more meaning for the human user, for example when they see a CLI they could also see the name of the caller. The additional information would be designed to help directories or user agents and could include information about the preferences of the person identified. The unique numerical identifier is highly likely to be a new range of E.164 numbers. Different values of the unique numerical identifier could be used for personal and business life. This would make UCI an extension of E.164.

Figure 15 shows the function of the UCI in relation to other identification schemes and ENUM.

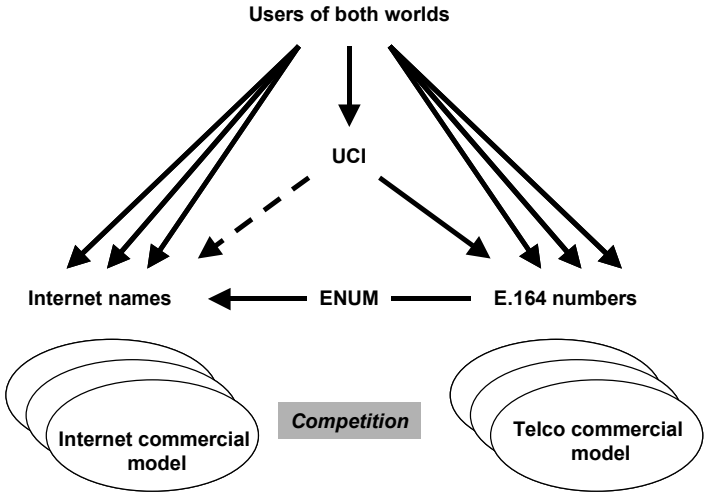


Figure 15: Role of UCI

Two ETSI Guides have been produced so far:

- EG 201 795: Human Factors (HF); Issues concerning user identification in future telecommunications systems
- EG 201 940: User identification solutions in converging networks.

Current work is covering the following issues:

- Downstreaming results of ETSI STF 180 on UCI Services
- Maximising the usability of UCI based systems
- Guidelines on the usability of UCI based systems
- Placing UCI in context; Review and analysis of existing identification schemes
- Results of a detailed study into the technical areas for identification harmonisation
- A web-based UCI Demonstrator
- Using UCI based systems to improve communications for disabled, young and elderly people
- Human Factors guidelines for real-time person-person communication services.

The work in ETSI is also examining how to authenticate the user's natural user identity and to prevent impersonation and identity theft.

The prospects for UCI are difficult to assess. ITU-T is likely to assign a number range for its use and the current work in ETSI is examining the possibility of using the Internet to carry messages between user agents. It is however unlikely that the PSTN will be upgraded to carry the full UCI. It is not easy to predict to what extent users agents will develop. Systems such as Instant Messaging already implement a form of user agent based on an Internet name and they may be reluctant to change to UCI. It is not yet clear exactly how the UCI will be used with Internet names. This is why the line to Internet names in the above figure is shown as dashes.

11.4 Microsoft Passport

The Microsoft Passport is an identification system based on an existing email address supported by a password and run on Microsoft servers. When a user is on-line, software downloaded into the PC reports into the Microsoft servers which record that the user is on-line record the current value of the user's IP address. The user is then invited to sign-in and does so with their passport (email address and password). While signed in, if the user accesses any web site that uses Passport, the access is redirected first to the Passport site where it is validated and returned to the site being accessed. Thus the site can use a different secret and validated identity from Microsoft and so does not need to apply its own separate user name and password system to identify and validate users.

These interactions give Microsoft an unprecedented opportunity to collect statistics on the web use of users. Passport raises concerns similar to those raised by ENUM but far greater in magnitude.

Note: This description of the operation of Microsoft Passport has been deduced from information obtained form articles on the web and not from authoritative source materials.

11.5 Liberty Alliance

The Liberty Alliance is an open cooperative initiative supported by a wide range of organisations including:

- American Express
- Cisco
- Ericssons
- France Telecom
- Mastercard
- Neustar
- Sun
- Verisign
- Visa
- Vodafone.

It operates quite differently from Microsoft Passport as it has a distributed architecture and does not have a master identity for users.

The objectives are to:

- Enable consumers to protect the privacy and security of their network identity information
- Enable businesses to maintain and manage their customer relationships without third-party participation
- Provide an open single sign-on standard that includes decentralized authentication and authorization from multiple providers
- Create a network identity infrastructure that supports all current and emerging network access devices.

The protocols and software enable organisations to establish their own circles of trust within which users may federate (join up and share) their identities. Users can then sign-on once with any member of the circle and then use the other web sites in the circle without signing on separately. Existing local sign-on user names and passwords are preserved and can continue to be used for the initial sign-on. The system works by assigning temporary hidden aliases for use with the other sites in the circle of trust.

11.6 Conclusion

All the developments described here are rather different from each other and only Microsoft Passport and customisable address books have been implemented widely so far. Whilst customisable address books will improve and become more widespread as more terminals contain processors, it is not easy to predict whether the other concepts will take off and become well established or will fail. Thus the future developments are unclear.

12 MANAGEMENT OF THE INTERNET NAMES AND ADDRESSES

As the Internet grows in importance, it becomes increasingly important that the management of domain names and IP addresses is stable, effective and efficient, and takes adequate account of issues of public interest.

The following sections treat the political and regulatory issues separately. This is a loose distinction and the issues could be grouped differently.

12.1 Status of ICANN

ICANN is currently responsible for the management of the Internet addressing and naming scheme (IP addresses and Domain name system DNS). The status of ICANN reflects the historical development of the Internet within the private sector as a network of networks based on voluntary cooperation. ICANN is a private not-for-profit organisation based on the Californian law but it receives significant inputs from governments on public policy issues through its Government Advisory Committee whose influence has grown over the last four years. The Government Advisory Committee is open to all countries but in practice only some 40 are represented

A wide spectrum of views are held by various Governments on the constitution of ICANN and the scope for Governmental participation, and the following summarises the different ends of the spectrum.

The interventionist view
This view is concerned that a private organisation is managing an increasingly important global resource. It considers that the current arrangements on which ICANN is based are unacceptable and too much under US influence. They think that an entity as important as the Internet needs to be adequately under the control of Governments and that Governments need to ensure that they retain full national sovereignty over their communications including in particular the use of their ccTLDs. Proponents of this view would like the views of Governments to have more formal international authority and their decisions to be binding on ICANN and each other especially in relation to ccTLDs. They would like the arrangements for the Internet to be aligned much more closely with those of the ITU.

The non-interventionist view
This view is that the Internet has flourished under self-regulation and has developed faster and better than traditional telecommunications have under the Government controlled ITU based structures. It believes that the changes now being made in ICANN will provide adequate Government oversight through cooperation, and sees no pressing need for stronger Government involvement. It considers that national sovereignty is adequately protected by national laws, and that greater involvement would introduce risks of slowing developments and reducing market led flexibility.

Recommendation - 1
CEPT as an independent organisation should not become involved in the on-going debate about Government involvement in Internet naming and addressing. The issues are discussed in the Government Advisory Committee of ICANN and the ITU with the European position being prepared in the Internet Informal Group (IIG) convened by the Commission, and there is little point in attempting to duplicate the discussions within CEPT. However these arrangements do not provide scope for participation by all CEPT members who are not members of the EU and CEPT administrations could ask the Commission to expand the membership of the IIG[12].

12.2 Coordination between E.164 and Domain name management

The development of the traditional telecommunication networks/services and the Internet have a totally different historical background. While the traditional telecommunication networks developed in a strongly regulated environment, the Internet developed mostly in the little regulated environment of one country. The same distinction applies to the numbering and naming schemes used by these networks/services. This is also a reason why most NRAs have legal responsibility only to manage the traditional "E.164 numbering plan". Only a few also have formal responsibilities in the field of Internet naming and addressing.

With the convergence of traditional networks and the Internet and/or the next generation networks, NRAs are or will be confronted more and more with problems that need expertise in both numbering and naming schemes. This means that in the countries where the formal responsibilities for E.164 and IP/DNS matters are split between different authorities, a good dialogue and co-operation between these different authorities is essential to ensure that the public interest is protected in the management of the involved numbering and naming schemes. ENUM is a good example where both E.164 and DNS expertise is important.

Whatever view is taken on the role of Government in the management of domain names, the convergence of E.164 and Internet naming requires coordination at the national level between the people who are managing the schemes if incompatibilities and problems are to be avoided.

Recommendation - 2
Each national government should take steps to ensure adequate coordination between the people responsible for managing E.164 numbers and those responsible for managing domain names, irrespective of the legal and organisational arrangements.

[12] Norway and Switzerland are allowed to participate as observers.

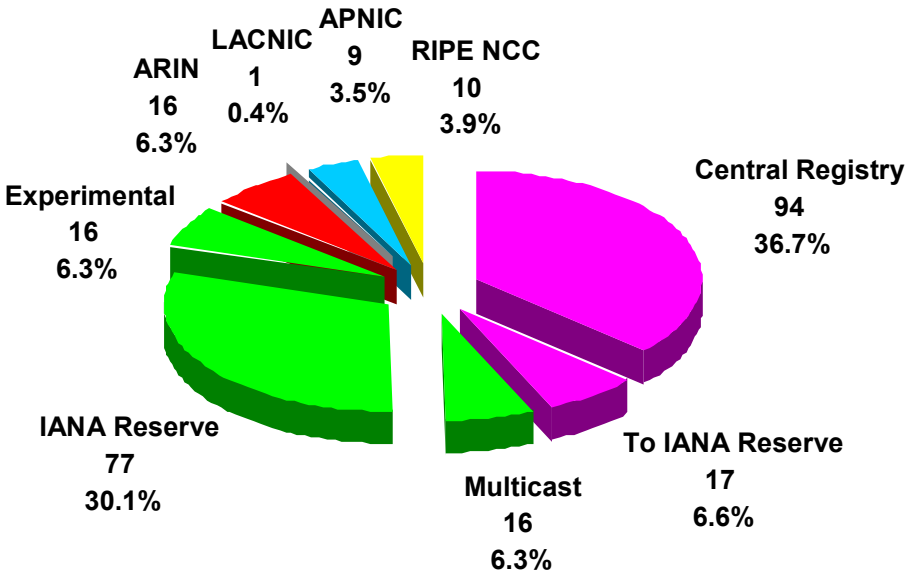
13 AVAILABILITY OF INTERNET ADDRESSES

There is much discussion about the prospect of shortages on IPv4 addresses and the need for IPv6 to replace IPv4. Concern is raised not only because of the growth of the Internet but the prospect of large scale demand for IP addresses from mobile systems, despite the slow start to third generation systems.

Within Europe, the Commission is funding several pilot programme based on IPv6. There is strong interest in the Far East, especially Japan. Overall the Far East seems to be the most advanced in terms of IPv6, Europe next and North America last.

IPv6 has a 128 bit address field, which is very much larger than the 32 bit field in IPv4, and therefore there should be no shortages in the availability of IPv6 addresses for "ever".

Figure 16 shows the usage of IPv4 addresses in terms of the assignment of prefixes by the Regional Internet Registries (RIRs) as of early 2003.



Courtesy of RIPE NCC as presented to ITU-T SG2 in May 2003

Figure 16: IPv4 Assignments by 2003

Assignments are dominated by the profligate pre-RIR assignments to many entities (mostly US) who do not need such large assignments (shown as "central registry"). This was done in good faith before the Internet reached the phase of rapid growth. All the main growth has been accommodated by the 14% assigned via the RIRs, which is not yet fully used up. 36% remains unassigned will be assigned according to need by the RIRs who have adopted very strict criteria for assignment. A simplistic calculation would suggest that there could be capacity for 10-20 years growth left, with more if steps were taken to recover some space form the pre-RIR assignments. The pessimists for IPv4 foresee rapid growth in areas such as China that will lead to much earlier exhaustion and the IPv6 Forum suggests that problems will start at some time within the next 5 years.

The other concern is that the growth of third generation mobile with many new data applications will lead to earlier exhaustion. This is a problem that many mobile operators would perhaps welcome in the current climate, and it many be a factor in the longer run.

The other drivers for a migration from IPv4 to IPv6 are improved functionality. Unfortunately the advantages are not yet adequately developed to become real commercial drivers to start the migration.

The migration from IPv4 to IPv6 will be complex and organisations will need to retain public IPv4 addresses to maintain IPv4 connectivity for a long time after starting to use an overlay of IPv6. Thus careful and adequate preparation will eventually be necessary. At this stage Governments will need to ensure that users are fully aware of the issues.

Recommendation - 3
WG NNA should keep an active watch on the development of IPv6 and the usage of IPv4 addresses.

Recommendation - 4
WG NNA should study the issues that will be involved in migrating from IPv4 to IPv6, preferably through a case study.

14 ORGANISATION OF THE E.164 SCHEME AND NUMBER ASSIGNMENT

14.1 The unstable service environment and growth in demand

Names and numbers are an essential part of the description of a telecommunications service because the type of identifier used delineates the set of parties that can be communicated with. In the past there were relatively few services and each service was well standardised through ITU-T or ETSI. Innovation is services is growing, but it is growing to a large extent outside the traditional standardisation bodies, so a common and coherent approach is being replaced by a more fragmented and rapidly changing one. Thus the whole services environment is becoming less stable.

14.2 The structure of the E.164 scheme

The E.164 scheme is structured in terms of:

- Service (fixed, mobile, paging)
- Geographical location (country codes and regions within countries)
- Tariff (separate number ranges for different tariff types such as freephone, premium rate).

If users have a requirement to use E.164 numbers in connection with more than one type of service, then the assignment of number ranges to specific services will begin to lose its meaning and the structure will need to be re-organised to be more open and less service specific.

The use of different ranges of numbers for services with different tariffs is quite important to users. With the falling costs of basic communications and the prospective growth in flat rate tariffs on the one hand, and the growth of sophisticated premium rate services on the other hand, the polarisation between low cost calls and high cost calls will grow and has to be taken adequately into account in the future development of E.164.

Providers of services on the Internet are starting to ask for assignments of E.164 numbers. For example providers of Internet telephony gateways would like E.164 numbers to assign to their subscribers so that incoming calls from the PSTN can be directed to subscribers through their gateways, and so that their subscribers can present a usable CLI when making outgoing calls to the PSTN. Guidance needs to be prepared for the NRAs over the assignment of number ranges for these applications.

Recommendation - 5
WG NNA should develop guidelines to help National Regulatory Authorities handle the wide variety of applications for the use of E.164 numbers for voice communications over IP technology including the Internet.

14.3 Multi-service use for numbers

The multiplication of services could lead to a multiplication of different identifiers for users. This is not user-friendly and users would prefer to have fewer identifiers with each identifier being used for multiple services. The use of numbers for multiple services will break the uniqueness of the linkage between a number and a service provider. This will not matter if numbers such as personal numbers are used since these numbers are designed to be mapped to various different services and have no linkage to a specific service, but it is likely to cause problems if numbers that are linked to one service begin to be used in addition for another service.

Existing arrangements to facilitate the portability of E.164 numbers may need to be reviewed or re-shaped in order to encompass the following developments:

- the supply of services in connection with a single E.164 number by more than one service provider; and
- the supply of voice over IP applications by providers who are not based in the country in which the service is supplied, and who may benefit from the ability to access number portability databases in order to route call sufficiently.

Recommendation - 6
WG NNA should study in more depth the use of numbers for multiple different services and produce guidance on the problems that can arise and how they can be avoided.

14.4 Loss on information from numbers

If E.164 numbers will be used in connection with Internet-based applications, it is likely that these applications could be supplied from and to anywhere in world (e.g. voice applications where an end user can log in from any location).

Such developments are likely to eliminate the association that exists in many countries between a particular series of numbers and a particular geographic area. The association between a given number series and a particular geographic area is, today, important:

- because it may enable callers to predict the cost of a call where this cost is distance-dependent;
- because it enables networks to accurately bill for calls; and
- in respect of porting of numbers, in that geographic numbers may be capable of being ported only within a specified geographic area with which a number series is associated.

Consequently, alternative methods of predicting call cost and billing for calls may be necessary, however with tariffs dropping and becoming less distance dependent this may not be a major problem . Similarly, technical considerations that impose geographic restrictions on porting of numbers may need to be overcome or the regulations will need to be altered.

If E.164 numbers are used in connection with Internet-based applications that can be accessed anywhere in world, the use of the calling line identification associated with an end-user's service for providing location information to public service answering points of emergency services (in the event of an emergency call) or to support location-based services (such as services that rely on origin-dependent routing) will no longer be workable. In practice it may be necessary to advise users to continue to use the traditional PSTN or mobile networks and not Internet based services for accessing the emergency services because these networks have established mechanisms for location information. In the longer term it may become necessary to consider introducing means to contact the emergency services over the Internet if traditional services become less universally available than they are now.

14.5 Increased demand for global numbers

The separation of service provision from network operation is enabling services providers to offer services from one location to users in many different countries. Where these service providers need numbers to assign to their subscribers, assignment would be simpler if they could be assigned numbers from a global range without explicit country identification.

Users are also becoming more mobile and demand for non-country specific numbers could grow especially if the downward trend in tariffs continues and "international" numbers are less commonly regarded as expensive.

14.6 Demand for uses beyond telecommunications

The E.164 numbering scheme has high value as a global system of numerical identifiers that transcends cultural and language differences.

Names are used not only for identifying the source and destination of communications but also for identifying user profiles and preferences. For example, E.164 numbers are used extensively in the customer support systems of the telcos and can acts as the entry point to other information and systems, some of which will contain information that is subject to various privacy laws. This means that E.164 numbers are being used outside the narrow role of identifying communications endpoints and so the management and planning of E.164 needs to take account of this wider role. Developments such as ENUM, Microsoft Passport and Liberty Alliance are starting to consider these issues.

It is possible that new demands will arise for using E.164 numbers as keys in databases for applications outside telecommunications.

14.7 Direct assignment

Direct assignment of E.164 numbers to end-users is likely to become increasingly desirable, including direct assignment of geographic and mobile numbers, as a way of:

- giving end users greater control over E.164 numbers they are assigned that they wish to use for more than one type of service, or in connection with which they wish services to be supplied by more than one service provider; and
- making it easier for end users to demonstrate their rights to use the E.164 numbers that they are assigned (e.g. when arranging to create, modify or delete ENUM records for their numbers).

Other means of giving users greater control may also be possible.

15 CONTROL OF NUMBERS AND NAMES AND THEIR USE

15.1 Loss of integrity

There may be reduced control over how numbers and names are used and increased threats to the integrity of the E.164 numbering scheme. Examples of loss of integrity are:

- use of numbers for services for which they have not been assigned;
- adoption of numbers by users or operators who have not been assigned them formally.

One of the main potential problems is that "pseudo-E.164 numbers" will start to be used widely with people becoming dependent on them before compatibility problems with properly assigned E.164 numbers start to be noticed. At that point some numbers will need to be changed and this will cause disruption to operators and users. This situation is similar in many ways to the unauthorised use of radio frequencies.

There is concern amongst some telcos and regulators that, without proper controls, ENUM may provide scope for the creation of "pseudo E.164" numbers in the domain name space, eg use of the domain name 1.0.0.5.5.1.2.7.0.2.4.4.e164.arpa when the number +44 207 215 5001 is not assigned.

15.2 Rights of use of numbers & names

Where the same E.164 number is used in connection with more than one type of service (such as a voice over IP application or applications that are initiated via ENUM), then one service provider will need to be able to verify that end-user's has the right to use of an E.164 number that may have been assigned by another service provider. This is to ensure that additional services are supplied in connection with an E.164 number only with the express authorisation of the end user to which the number is assigned and to ensure the integrity of a (national) numbering scheme. Such verification will require a robust means of proving that a particular E.164 number is assigned to an end user.

There are comparable issues when services are ceased since mechanisms may be needed to release numbers when users cease to have any service running on them.

The introduction of internationalised Internet domain names will need to be managed in such a way that conflicts are not created between holders of internationalised Internet domain names and holders of closely-related domain names that already exist (e.g. genève.com and geneve.com).

15.3 Support of law enforcement

For law enforcement purposes, it is sometimes necessary to be able to trace a particular end user or a service used by that end user. Methods for achieving this in telco networks, which usually rely on the end-user's E.164 numbers as a key, are well-established. This is not the case for Internet-based applications, for which a particular end user may be identifiable by a given Internet name or address but for which there may be no simple or inexpensive means of relating the name or address to the end-user or finding what Internet-based applications are used by that end user.

It may be necessary to establish requirements and methods for tracing end users by means of an Internet name or address and tracing an Internet-based application used by a particular end user.

16 USER IDENTITIES, DIRECTORIES AND DATABASES

16.1 User identities

With the deployment of the Internet and the liberalisation of the telecommunication market, the number of telecommunication identities identifying a single user is increasing. It is quite common for a subscriber to have more than one telephone number, E-mail address or other communication identifiers.

Ideally users want as few telecommunications identities as possible. Users want also be able to keep their telecommunications identities as long as possible (number portability in a general sense) because of the cost of changing identities.

Various initiatives are underway both in the government funded sector such as UCI and in the private sector such as Microsoft Passport and the Liberty Alliance. These initiatives could develop rapidly and lead to market power issues, especially in the case of Microsoft.

Recommendation - 7
WG NA should keep a close watching brief on the public and private sector developments for simplifying user identification.

16.2 Directory enquiry services

The Universal Service Directive Article 5 requires the provision of directory enquiry services:

1. Member States shall ensure that:

(a) at least one comprehensive directory is available to end-users in a form approved by the relevant authority, whether printed or electronic, or both, and is updated on a regular basis, and at least once a year;

(b) at least one comprehensive telephone directory enquiry service is available to all end-users, including users of public pay telephones.

2. The directories in paragraph 1 shall comprise, subject to the provisions of Article 11 of Directive 97/66/EC, all subscribers of publicly available telephone services.

3. Member States shall ensure that the undertaking(s) providing the services referred to in paragraph 1 apply the principle of non-discrimination to the treatment of information that has been provided to them by other undertakings.

This requirement, however, is intended to cover only the E.164 numbers for publicly available telephone services, ie PSTN/ISDN and mobile. The various addressing or naming schemes used today are not subject to the same legal obligations.

E.164:	legal obligations apply on service providers which assign E.164 numbers to subscribers (obligations to hold a directory and to give third party access to directory data).
E-mail addresses:	no legal obligations apply and also no initiative from the E-Mail service providers.
IM-id:	no legal obligations apply but IM service providers are encouraging users to publish their data in a proprietary directory (like “Search for Friends” pages on ICQ, Yahoo! Messenger, MSN Messenger, etc…).

Directory service providers are also trying to enhance their services by incorporating other telecommunication identifiers besides E.164 numbers, such as E-mail addresses, web site addresses and more rarely IM-id. However, because of privacy issues (eg. SMS or E-mail spamming, etc.), the subscribers are more and more reluctant to publish such data in publicly available directories. For example, in most European countries the number of mobile telephony subscribers who have published their mobile phone number in the public directory today is insignificant. This is unlikely to change if the subscribers have no means to protect themselves against unsolicited communications (eg. emails or SMS).

As E.164 numbers are going to become more and more “multi-service”, a better design of directory services would be needed. In particular, it will be necessary to specify which services can be used for a particular E.164 number (for example voice telephony, fax, sms, etc…) instead of having separate directories for each services. Directory service providers could benefit from ENUM to enhance their services and products in such a way.

Advanced customised directory services in combination with ENUM and various time manager applications could also help customers to set dynamically the means by which they want to be reached.

It has also to be noted that currently the lack of competition in the market of directory services is preventing innovative services from being developed. One of the problems here is that users are highly familiar with a single number for calling directory enquiries and the introduction of competition would mean separate numbers would need to be assigned to different directory enquiry providers and a proportion of users would object to these changes.

There may also be a problem of the availability of information that relates to newer services. Some service providers may not be willing to reveal the relevant information about their customers and increasing tension is likely between privacy regulation and the need for directories.

The Internet has good search facilities for finding information on web pages and the registries for top level domains provide some information about the owners of domain names, but there is no comprehensive directory for Internet names such as email or SIP addresses.

Increased functionality in terminals such as address books that automatically store information on callers will go some way to making up for the lack of directories.

Recommendation - 8
WG NA should keep a watching brief on the development of directories and if necessary study in greater depth the scope for competition in basic telephony related directories and the possibility of developing more comprehensive directories for new services.

16.3 Databases

The directories considered above are directories for users. There may be requirements for databases for routing that necessarily include all numbers but are not accessible by the public; an example is a central database for number portability. Such requirements are likely to grow as the structure of telecommunications becomes more international and more networks cross international borders. The ENUM concept could be used for the design of such databases.

There is also a need to use databases to support wider functions such as the provision of emergency services and these services may become more sophisticated in future for example by using location information or by providing links to medical information.

Recommendation - 9
WG NNA should keep a watching brief on the development of databases for use by network operators and public support functions.

16.4 Multi-channel issues

Both the DTN and the Internet separate the role of service provider from that of network operator. This creates the possibility for a given service to be accessed or used from various different types of network. Two examples of this possibility are:

- Messaging systems that may be accessible from:
  - voice response systems
  - Internet web pages
  - Email
  - SMS
  - Fax
- Sound and video programme distribution via:
  - Terrestrial radio broadcasting
  - Satellite broadcasting
  - Cable

and may use various means such as the Internet and dial-up for responses to interactive programmes.

The mobile operators are currently introducing a multi-media messaging service (MMS) that is also multi-channel.

The use of multiple network types is known as “multi-channel”. Strictly speaking, a service that integrates content and adds value is using multiple communications services with the possibility of using multiple identifiers that need to be mapped together. The growth of multi-channel services will lead to increasing issues of relating different names and addresses together and the possibility of introducing overall “meta” identifiers to which existing identifiers may be linked.

This is an area for further study and is closely related to ENUM, UCI and the other commercial initiatives such as Microsoft Passport and Liberty Alliance.

Recommendation - 10
WG NNA should study the development of multi-channel access to services.

17 CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER STUDY

17.1 Main conclusions and their implications

1 The public Internet will become increasingly important for communications including real-time communications such as voice.

> **Implication**: Adequate management of the naming and addressing resources on the Internet is needed to satisfy the various commercial and governmental requirements

2 The different economic models of the telcos (intelligent network with controlled usage and time based charging) and the Internet (dumb network with open usage and subscription based charging) will increasingly compete with each other, and there is a possibility that basic communications will become a subscription charged utility in the future. This means that the future development of the DTN (Developing Telecommunications Network) based on the current telco commercial model is not assured, creating an unprecedented degree of uncertainty in the market place. Consequently the development of future services will become increasingly diverse and unpredictable.

> **Implication**: Adequate address space is needed to allow a variety of approaches to networks to be tried in the market place even though some may fail.

3 E.164 numbers will be used in three ways for services that are provided over IP:

- Migration of telco services with E.164 numbers to IP
- New telco services on IP that will require E.164 numbers
- New services on the Internet that will require E.164 numbers

> **Implication**: These developments will lead to increased demand for E.164 numbers and increased diversity in the services that they are used for.

4 Whereas in the past new services were developed cooperatively by the telcos through standardisation bodies such as ITU-T and ETSI, service development through these bodies for fixed networks has largely ceased, although it is continuing to some extent in the mobile area for third generation systems. Innovation in services is now focused on the Internet where services are created at the edge of the network and "terminal functionality" is provided through downloadable software. Service innovation is also fragmented with various companies developing similar but incompatible services such as Instant Messenger. The main area of growth at present is distributed customised applications.

> **Implication:** Naming and numbering in the future will have to be able to support a much less stable service environment because they can no longer be related to well-defined services. This will in turn lead to a loss of the information that can be deduced from numbers such as service type, tariff level and location. Consequently there will be a need for more comprehensive directories and other sources of service-related information.

5 The availability of the Internet as a "dumb network", and the scope for creating and running services from outside the network is stimulating the development of intelligent software based terminals that use general purpose hardware such as PCs and PDAs.

> **Implication**: This will lead to reduced control over how numbers and names are used and increased threats to the integrity of the E.164 numbering scheme (ie use of numbers for services for which they have not been assigned, and the adoption of numbers without regard to the formal assignment processes).

6 There is growing user demand to make services more user friendly especially as sophisticated telecommunications becomes a pervasive part of society and not just a tool for people who are better educated or interested in computing. These objectives are driving new initiatives to simplify identification and to reduce the number of identifiers that users have to handle. More information on the current concepts that are being developed is given in a later section.

> **Implication**: There may be a need for better centralised directories and other support functions especially for information relating to new services in order to support greater user friendliness.

7 There is a strong trend towards the separation of network operation and service provision. This separation is already an integral part of the structure of the Internet but it is being adopted also by the telcos in their plans for DTNs. This

separation of service provision is likely to result in services being provided from outside the country where they are used.

> **Implication**: As above. There will also be problems in the loss of reliable geographic information, the control of services and the support of law enforcement, which relies heavily on numbers.

8 As networks become capable of supporting multiple different services there will be increasing pressure to use numbers for multiple services. This development will break the relationship between numbers and network operation and lead to requirements for a new approach to number assignment and personal numbering.

> **Implication**: Numbers will become multi-service in the same way that Internet names are multi-service. This will create increased pressure for individual/personal assignment of numbers and the need for adequate methods of validating people's rights to use a given number. It will also result in loss of information from numbers because the information normally relates to specific services.

9 Numbers are a very useful form of identifier especially for services that are potentially global and are used in a wide range of different cultures. Therefore there is likely to be increasing demand for E.164 numbers not only from both the telco and Internet based communities, but also for purposes that go beyond communications.

> **Implication**: The increased and diverse demands will put pressure on the structure of the E.164 scheme and it will become increasingly difficult to decide what range of numbers to use for new services. The demand for global numbers, ie numbers that are not country specific, will increase. Demand will develop to use E.164 numbers for purposes that are beyond telecommunications.

17.2 Recommendations

Recommendation - 1
CEPT as an independent organisation should not become involved in the on-going debate about Government involvement in Internet naming and addressing. The issues are discussed in the Government Advisory Committee of ICANN and the ITU with the European position being prepared in the Internet Informal Group (IIG) convened by the Commission, and there is little point in attempting to duplicate the discussions within CEPT. However these arrangements do not provide scope for participation by all CEPT members who are not members of the EU and CEPT administrations could ask the Commission to expand the membership of the IIG[13].

Recommendation - 2
Each national government should take steps to ensure adequate coordination between the people responsible for managing E.164 numbers and those responsible for managing domain names, irrespective of the legal and organisational arrangements.

Recommendation - 3
WG NNA should keep an active watch on the development of IPv6 and the usage of IPv4 addresses.

Recommendation - 4
WG NNA should study the issues that will be involved in the introduction of IPv6, preferably through a case study.

Recommendation - 5
WG NNA should develop guidelines to help National Regulatory Authorities handle the wide variety of applications for the use of E.164 numbers for voice communications over IP technology including the Internet.

Recommendation - 6
WG NNA should study in more depth the use of numbers for multiple different services and produce guidance on the problems that can arise and how they can be avoided.

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13 Norway and Switzerland are allowed to participate as observers.

Recommendation - 7
WG NNA should keep a close watching brief on the public and private sector developments for simplifying user identification.

Recommendation - 8
WG NNA should keep a watching brief on the development of directories and if necessary study in greater depth the scope for competition in basic telephony related directories and the possibility of developing more comprehensive directories for new services.

Recommendation - 9
WG NNA should keep a watching brief on the development of number databases for use by network operators and public support functions.

Recommendation - 10
WG NNA should study the numbering and naming aspects of multi-channel access to services.

ANNEX A: ITU-T Resolution 102

INTERNATIONAL TELECOMMUNICATION UNION	STUDY GROUP 13
TELECOMMUNICATION STANDARDIZATION SECTOR	TD 15 (PLEN)
STUDY PERIOD 2001-2004	English only

Question(s):	All/13	Geneva, 29 October - 8 November 2002

TEMPORARY DOCUMENT

Source:	TSB
Title:	RESOLUTION 102 (Rev. Marrakesh, 2002)
	Management of Internet domain names and addresses

The Plenipotentiary Conference of the International Telecommunication Union (Marrakesh, 2002),

aware

that the purposes of the Union are, *inter alia,* to promote, at the international level, the adoption of a broad approach to the issues of telecommunications in the global information economy and society, to promote the extension of the benefits of new telecommunication technologies to all the world's inhabitants and to harmonize the efforts of Member States and Sector Members in the attainment of those ends,

considering

a) that advances in the global information infrastructure, including the development of Internet Protocol (IP)-based networks and especially the Internet, are of crucial importance as an important engine for growth in the world economy in the twenty-first century;

b) that the private sector is playing a very important role in the expansion and development of the Internet, for example through investments in infrastructures and services;

c) that the development of the Internet is essentially market-led and driven by private and government initiatives;

d) that the management of the registration and assignment of Internet domain names and addresses must fully reflect the geographical and functional nature of the Internet, taking into account an equitable balance of interests of all stakeholders;

e) that Internet domain names and addresses, and more generally the Internet and global information networks, must be widely accessible to all citizens without regard to gender, race, religion or country of residence;

f) that the methods of assignment of Internet domain names and addresses should not privilege any country or region of the world to the detriment of others;

g) that the management of the Internet is a subject of valid international interest and must flow from full international cooperation;

h) that the expanding use of the Internet is expected to lead to the need for an increased capacity of IP addresses;

i) that Member States represent the interests of the population of the country or territory for which a country code top-level domain (ccTLD) has been delegated;

j) that Member States should play an active role in coordinating the resolution of management and administrative constraints arising with respect to their ccTLDs,

recognizing

a) that ITU is dealing with issues related to IP-based networks in general and the Internet in particular;

b) that ITU performs worldwide coordination of a number of name and address assignment systems and acts as a forum for policy discussion in this area;

c) that ITU can play a positive role by offering a platform for encouraging discussions, and for the dissemination of information, particularly to developing country governments, on the management of Internet domain names and addresses;

d) that through international cooperation, ITU should contribute to policy development related to the management of Internet domain names and addresses,

emphasizing

a) that the management of Internet domain names and addresses includes:

– technical and coordination tasks, for which technical private bodies can be responsible, and;

– public interest matters (for example, stability, security, freedom of use, protection of individual rights, sovereignty, competition rules and equal access for all), for which governments or intergovernmental organizations are responsible and to which qualified international organizations contribute;

b) that the methods of assignment of global and essential resources such as Internet domain names and addresses are of interest to both governments and the private sector;

c) that the role of governments is to provide a clear, consistent and predictable legal framework, to promote a favourable environment in which global information networks are interoperable and widely accessible to all citizens, and to ensure adequate protection of public interests in the management of Internet domain names and addresses;

d) that it is in the public interest that the system that manages Internet domain names and addresses has transparent rules and procedures, including dispute resolution procedures to facilitate the protection of intellectual property rights;

e) that governments are expected to promote, as appropriate, a fair competitive environment among companies or organizations responsible for Internet resource assigneion,

resolves to instruct the Secretary-General

1 to take a significant role in international discussions and initiatives on the management of Internet domain names and addresses, taking into account associated developments and the purposes of the Union;

2 to encourage all Member States to participate in the discussions on international management of Internet domain names and addresses, so that worldwide representation in the debates can be ensured;

3 to liaise and to cooperate, in conjunction with the Bureaux, with the regional telecommunication organizations pursuant to this resolution;

4 to provide assistance, in conjunction with the Bureaux, to Member States, if so requested, in order to achieve their stated policy objectives with respect to the management of Internet domain names and addresses;

5 to report annually to the Council on the activities undertaken on this subject,

instructs the Director of the Telecommunication Standardization Bureau

1 to continue to liaise and to cooperate with appropriate entities on relevant Internet domain name and address management issues, such as the transition to IP Version 6 (IPv6), ENUM, and internationalized domain names (IDN);

2 to work with Member States and Sector Members, recognizing the activities of other appropriate entities, to review Member States' ccTLD and other related experiences;

3 to work with Member States and Sector Members, recognizing the activities of other appropriate entities, to develop a recommendation to clarify the management of the domain ".int";

4 to report annually to the Council on the activities undertaken on this subject,

instructs the Director of the Telecommunication Development Bureau

1 to organize international and regional forums, in conjunction with appropriate entities, for the period 2002-2006, to discuss policy, operational and technical issues on the Internet in general and the management of Internet domain names and addresses in particular for the benefit of Member States, especially for least developed countries;

2 to report annually to the Council on the activities undertaken on this subject,

instructs the Council

to take appropriate measures in order to contribute actively to international discussions and initiatives related to the management of Internet domain names and addresses,

invites Member States

1 to participate actively in the discussions on the management of Internet domain names and addresses and notably on progress being made in pursuit of their policy objectives;

2 to participate in and follow the policy, operational and technical developments of the management of Internet domain names and addresses;

3 to increase awareness at national level among all appropriate entities, and to encourage their participation in the management of Internet domain names and addresses.

ANNEX B: PRINCIPLES FOR THE DELEGATION AND ADMINISTRATION OF COUNTRY CODE TOP LEVEL DOMAINS

This is a formal text agreed in the ICANN Government Advisory Committee (GAC)

1. PREAMBLE

In the five years since the issuance of RFC 1591, the Internet has evolved from a tool reserved for computer and networking research, to a global medium for commerce, education, and communication. The new realities of the Internet, including its increased importance as a vehicle for national economic growth, and the expanding and more diverse nature of the Internet community necessitated evolution in the traditional means of managing and administering Internet technical functions.

As a result, DNS functions, including the administration of the DNS root server system, the development of policies for the registration and assigneion of domain names, the coordination of Internet Protocols, and the delegation of Internet Protocol numbers are becoming more clearly delineated and formalised through the ICANN process. Similarly, the procedures and framework of accountability for delegation and administration of ccTLDs need to evolve into a more robust, certain, and reliable system as well.

While evolution is needed, the principle of RFC 1591 remains sound: the manager of a ccTLD performs a public service on behalf of the relevant local community and as such the designated manager has a duty to serve this community. The designated manager also has a responsibility to the global Internet community. By 'global Internet community' we do not mean any specific legal or international entity, but rather we interpret the term to refer to all of those who are affected by, now or in the future, the operation of the relevant TLD, because such operation may impinge on more than one jurisdiction and affect the interests of individuals and entities from both within the relevant country or territory and elsewhere. This is our interpretation of the meaning of 'global Internet community' as it is used in RFC 1591.

2. OBJECTIVE OF THIS DOCUMENT

The objective of this document is to suggest principles that will assist in the development of best practice for the delegation and administration of ccTLDs. These principles are intended to contribute to the development of models of:

- a communication between the relevant government or public authority and ICANN;
- a communication between ICANN and the delegee; and
- a communication between the relevant government or public authority and the delegee.

3. DEFINITIONS

For the purposes of this document, the following definitions apply:

3.1 'Alternative Dispute Resolution' (or 'ADR') means any system of resolving a dispute other than by court litigation, and includes arbitration, mediation, conciliation and processes of administrative dispute resolution.

3.2 'Communication' should include a law, regulation, agreement, document, contract, memorandum of understanding, or any other written instrument, as appropriate.

3.3 'Country code top level domain' or 'ccTLD' means a domain in the top level of the global domain name system assigned according to the two-letter codes in the ISO 3166-1 standard, 'Codes for the Representation of Names of Countries and Their Subdivisions.'

3.4 'Delegation' means delegation by ICANN/IANA of responsibility for administration of a TLD in the DNS root.

3.5 'Delegee' means the organisation, enterprise or individual designated by the relevant government or public authority to exercise the public trust function of a ccTLD and consequently recognised through a communication between ICANN and the designated entity for that purpose. The delegee for a ccTLD may be the relevant government or public authority itself or an oversight body designated by the relevant government or public authority, inasmuch as the administrative and management functions for a ccTLD may be contracted out by the delegee to another party and hence not performed by the delegee itself.

3.6 'Designation' means designation by the relevant government or public authority of the delegee.

3.7 'DNS' means domain name system.

3.8 'ICANN' means the Internet Corporation for Assigned Names and Numbers.

3.9 'Relevant government or public authority' means relevant national government or public authority of a distinct economy as recognised in international fora as those terms are used in the ICANN Bylaws and GAC Operating Principles.

3.10 'Relevant local community' means the local community in the context of the ISO 3166-1 code. This definition is specific to the purposes identified in this document and not broader.

3.11 'Top Level Domain' or 'TLD' means a domain in the top level of the global domain name system.

4. ROLE OF DELEGEE

4.1 The delegee of a ccTLD is a trustee for the delegated domain, and has a duty to serve the residents of the relevant country or territory in the context of ISO 3166-1, as well as the global Internet community (as that term is interpreted in the Preamble to this document). Its policy role should be distinguished from the management, administration and marketing of the ccTLD. These functions may be performed by the same or different entities. However the delegation itself cannot be sub-contracted, sub-licensed or otherwise traded without the agreement of the relevant government or public authority and ICANN.

4.2 No private intellectual or other property rights should inhere in the ccTLD itself, nor accrue to the delegee as the result of delegation or to any entity as a result of the management, administration or marketing of the ccTLD.

4.3 Tradable goods and services may arise in the performance of other management and administrative functions attached to the ccTLD.

4.4 The delegee should recognise that ultimate public policy authority over the relevant ccTLD rests with the relevant government or public authority.

4.5 The delegee should work cooperatively with the relevant government or public authority of the country or territory for which the ccTLD has been established, within the framework and public policy objectives of such relevant government or public authority.

4.6 The delegee, and the delegee's administrative contact, should be resident or incorporated in the territory and/or jurisdiction of the relevant government or public authority. Where the delegee, administrative contact or technical contact are not resident or incorporated in the territory and/or jurisdiction of the relevant government or public authority, it should nevertheless operate in a way that is consistent with the laws and public policy of that relevant government or public authority.

5. ROLE OF GOVERNMENT OR PUBLIC AUTHORITY

5.1 The relevant government or public authority ultimately represents the interests of the people of the country or territory for which the ccTLD has been delegated. Accordingly, the role of the relevant government or public authority is to ensure that the ccTLD is being administered in the public interest, whilst taking into consideration issues of public policy and relevant law and regulation.

5.2 Governments or public authorities have responsibility for public policy objectives such as: transparency and non-discriminatory practices; greater choice, lower prices and better services for all categories of users; respect for personal privacy; and consumer protection issues. Considering their responsibility to protect these interests, governments or public authorities maintain ultimate policy authority over their respective ccTLDs and should ensure that they are operated in conformity with domestic public policy objectives, laws and regulations, and international law and applicable international conventions.

5.3 It is recalled that the Governmental Advisory Committee (GAC) to ICANN has previously adopted the general principle that the Internet naming system is a public resource in the sense that its functions must be administered in the public or common interest.

5.4 The relevant government or public authority should ensure that DNS registration in the ccTLD benefits from effective and fair condition of competition, at appropriate levels and scale of activity.

5.5 To give effect to governments' or public authorities' public policy interests, governments or public authorities should ensure that the terms outlined in Clause 9 are included in their communications with delegees.

5.6 In making a designation for a delegee, the government or public authority should take into consideration the importance of long term stability in the administration and management of the ccTLD and in the DNS. In most cases, such stability may be best served through the designation of an organisation or an enterprise rather than a specific individual.

6. ROLE OF ICANN

6.1 A primary function of ICANN is to establish, disseminate, and oversee implementation of the technical standards and practices that relate to the operation of the global DNS. In this capacity, ICANN administers a range of technical Internet management functions, including:

- establishment of policy for IP number block assigneion;
- administration of the authoritative root server system;
- creation of policy for determining the circumstances under which new TLDs would be added to the root system;
- coordination of the assignment of other Internet technical parameters as needed to maintain universal connectivity on the Internet; and
    - other activities necessary to coordinate specified DNS administration functions.

6.2 Specifically in relation to the administration and operation of ccTLDs, ICANN's role is to develop and implement policies that fulfil the provisions of Clause 10 below.

7. PRINCIPLES RELATING TO DELEGATIONS

7.1 Where a communication between the relevant government or public authority and the delegee is in place, when ICANN is notified by the relevant government or public authority that the delegee has contravened the terms of the communication, or the term of the designation has expired, ICANN should act with the utmost promptness to reassign the delegation in coordination with the relevant government or public authority.

7.2 Notwithstanding the urgent need for a communication-based regime for ccTLD designation, delegation and administration, in the absence of such communication between the relevant government or public authority and the administrator of the ccTLD, ICANN should, upon the tendering of evidence by such government or public authority that the administrator does not have the support of the relevant local community and of the relevant government or public authority, or has breached and failed to remedy other material provisions of RFC 1591, act with the utmost promptness to reassign the delegation in coordination with the relevant government or public authority.

7.3 When ICANN notifies the relevant government or public authority that the ccTLD is being operated in a manner that threatens the stability of the DNS or of the Internet, or has otherwise breached and failed to remedy other material provisions of the communication between ICANN and the delegee, as outlined in Clause 10, the relevant government or public authority should cooperate with ICANN to remedy this situation or effect the reassignment of the delegation for the ccTLD.

7.4 With respect to future delegations or reassignment of delegations, ICANN should delegate the administration of a ccTLD only to an organisation, enterprise or individual that has been designated by the relevant government or public authority.

7.5 Delegees should enjoy, in the execution of their responsibilities, the appropriate rights under applicable law, and should not be subject to discriminatory or arbitrary practices, policies or procedures from ICANN or the relevant government or public authority. In the event of a reassignment of delegation, registrants in the ccTLD should be afforded continued name resolution, or a reasonable period in which to transfer to another TLD.

8. PRINCIPLES CONCERNING THE COMMUNICATION BETWEEN THE RELEVANT GOVERNMENT OR PUBLIC AUTHORITY AND ICANN

8.1 The communication between the relevant government or public authority and ICANN, as outlined in Clause 2, should include a designated point of contact within the relevant government or public authority, as well as the name and contact details of the recognised delegee and duration of this recognition. Either as part of this communication, or through a subsequent communication, the relevant government or public authority should copy to ICANN any communication established between it and the delegee, setting forth the terms and conditions of the designation and/or concerning the execution of the delegee's role and the management of the delegation.

8.2 The relevant government or public authority should communicate to ICANN how it will require the delegee to abide by the terms and conditions outlined in Clause 9 below.

8.3 Recognising ICANN's responsibilities to achieve consensus in the creation of any new generic TLDs, ICANN should avoid, in the creation of new generic TLDs, well known and famous country, territory or place names; well known and famous country, territory or regional language or people descriptions; or ISO 639 Codes for representation of languages unless in agreement with the relevant governments or public authorities.

9. PRINCIPLES CONCERNING THE COMMUNICATION BETWEEN THE RELEVANT GOVERNMENT OR PUBLIC AUTHORITY AND THE DELEGEE

9.1 The communication between the relevant government or public authority and the delegee should include the following provisions, a copy or summary of which should be forwarded to ICANN:

9.1.1 Term, performance clauses, opportunity for review and process for revocation.

9.1.2 A commitment by the delegee to operate the ccTLD in the interest of the relevant local community and the global Internet community.

9.1.3 A recognition by the delegee that the management and administration of the ccTLD are subject to the ultimate authority of the relevant government or public authority, and must conform with relevant domestic laws and regulations, and international law and international conventions.

9.1.4 Confirmation that the ccTLD is operated in trust in the public interest and that the delegee does not acquire property rights to the ccTLD itself.

9.1.5 Conditions to ensure the transfer of all relevant DNS data to a nominated replacement, if, for any reason, a reassignment to a new delegee is necessary.

9.1.6 Conditions for the efficient and effective resolution of disputes arising from domain name registration. In so far as ccTLD registration policies allow or encourage registrations from entities or individuals resident outside the relevant territory, then the delegee concerned should implement dispute resolution policies that ensure that the interests of all registrants, and of third parties, including those outside their territory and in other jurisdictions, are taken into account. Dispute resolution policies should, to the greatest extent possible, follow common principles, including due regard for internationally recognised intellectual property, consumer protection and other relevant law, and be implemented by all delegees. The delegee should, so far as possible, implement alternative dispute resolution procedures conducted online, without precluding access to court litigation.

9.1.7 The delegee's commitment to abide by ICANN developed policies as set forth in Clause 10.

9.1.8 Where ccTLD registration policies allow or encourage registrations from entities or individuals resident outside the relevant territory, the delegee commits to observe all ICANN policies applicable to such ccTLDs, not otherwise provided for in Clause 10, except where the delegee is prohibited by law from, or instructed in writing by the relevant government or public authority to refrain from, implementing such other ICANN policies.

9.1.9 The above terms and conditions shall apply to delegees, including delegees who are resident and/or incorporated outside the territory of the relevant local community.

9.2 A delegee should not sub-contract part or all of the technical operations of the ccTLD registry without ensuring that the sub-contractor has the technical qualifications required by ICANN, and informing ICANN.

9.3 In any sub-contracting of the technical operations of the ccTLD registry or administrative and management functions of the ccTLD, the sub-contract must state that the delegation itself is an exercise of a public right, not an item of property, and cannot be reassigned to a new delegee except in accordance with the provisions of Clause 7.

10. PRINCIPLES CONCERNING THE COMMUNICATION BETWEEN ICANN AND THE DELEGEE

10.1 The communication between ICANN and the delegee should contain ICANN's commitment to:

10.1.1 maintain, or cause to be maintained, a stable, secure, authoritative and publicly available database of relevant information for each ccTLD (see below);

10.1.2 ensure that authoritative and accurate root zone information is generated from such database and ensure that the root servers are operated in stable and secure manner;

10.1.3 maintain, or cause to be maintained, authoritative records and an audit trail regarding ccTLD delegations and records related to these delegations; and

10.1.4 inform the delegee in a timely manner of any changes to ICANN's contact information.

10.2 The communication between ICANN and the delegee should contain the delegee's commitment to:

10.2.1 cause to be operated and maintained in a stable and secure manner the authoritative primary and secondary nameservers for the ccTLD, adequate to resolve names within the ccTLD for users throughout the Internet, and any sub-domains over which they retain administrative authority, and ensure that the zone file and accurate and up-to-date registration data is continuously available to ICANN for purposes of verifying and ensuring the operational stability of the ccTLD only;

10.2.2 inform ICANN in a timely manner of any changes to the ccTLD's contact information held by ICANN;

10.2.3 ensure the safety and integrity of the registry database, including the establishment of a data escrow or mirror site policy for the registry data managed by the delegate. The escrow agent or mirror site should be mutually approved by the relevant government or public authority and the delegee and should not be under the control of the delegee;

10.2.4 ensure the transfer of all relevant DNS data to a nominated replacement, if, for any reason, a reassignment to a new delegee is necessary;

10.2.5 abide by ICANN developed policies concerning: interoperability of the ccTLD with other parts of the DNS and Internet; operational capabilities and performance of the ccTLD operator; and the obtaining and maintenance of, and public access to, accurate and up-to-date contact information for domain name registrants; and

10.2.6 ensure the payment of its contribution to ICANN's cost of operation in accordance with an equitable scale, based on ICANN's total funding requirements (including reserves), developed by ICANN on the basis of consensus.