REVISED FINAL REPORT

ON

The Numbering Requirements of
Corporate Telecommunication Networks (CNs)
And their impact on Public Network Numbering

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7 January 2000

ETO, on behalf of ECTRA, has prepared this study for the Commission of the
European Communities.

Work order: *48 377*

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Authors: *Marco Bernardi*
                 Jack Nuijten
                 Steve Roberts

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Content

Marco Bernardi, Jack Nuijten, and Steve Roberts from ETO have prepared this report. They have received the kind assistance of the other experts from ETO, ECCO, ECMA, ECTA, ECTEL, ECTRA/PT N, EIIA, ENF, ETNO, ETSI, INTUG Europe, GSM MoU EIG and individual NRAs. You should note, however, that the report does not necessarily reflect the official opinions of the said organisations.

EXECUTIVE SUMMARY

The purpose of this work order is to study numbering requirements of CNs (Corporate Networks), including the requirements of Virtual Private Networks (VPNs).

CNs may be national, regional, or global (in this report a region is understood to be a group of countries). CNs may cover a multiplicity of different operator's domains. They need not respect any public network or geographic boundaries. Multinational companies usually operate on a global rather than a regional basis. For this reason, Europe should study the numbering requirements of CNs taking into account this global perspective.

To be clear VPN is the generic term to designate the emulation of CN components by hardware and software of public network equipment. Although owned and (at least to a certain degree) operated by a public network provider, the VPN can form an architectural part of a CN.

Concerning accessibility from the public network, the access numbers of these terminals need to conform to the ITU-T[1] Recommendation E.164 numbering plan. However, this necessity is normal, as the general CN requirements on the public numbering plan already cover it.

The term CN embraces broadband networks as well as narrow-band networks. Broadband public and private networks can provide broadband services as well as emulating narrow-band services. Numbering plan E.164 is common to broadband networks and narrow-band networks, and, in the case of broadband networks, operators use it in the provision of broadband services as well as emulated narrow-band services.

At present, Administrations number CNs from national numbering resources. No numbering resources exist for numbering of CNs on a global level. The establishment of the ETNS (European Telephony Numbering Space) could extend European CN numbering from the national to the regional level. However, regional numbering might be an intermediate step for numbering of CNs because of their global nature.

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[1] ITU-T – International Telecommunication Union Standardisation Sector

We present the conclusions from this work in Chapter 6. We have analysed the CN requirements in the regional and global contexts and concluded that the critical issues are non-discriminatory access, capacity constraints, number assignment, tariff setting, number length and CLI[2].

The use of national numbering resources to harmonise access to CN services and capabilities is not advisable. The use of E.164 global resource to create harmonised mechanisms to access CN extensions would be impossible in the near term. In terms of harmonisation of access to CNs, the use of the ETNS numbering resource is a sound solution for European-based corporations mainly aiming at the European market with their businesses.

The ETNS is today the most promising solution for the provision of number resources for harmonised access to CN services.

ETO[3] urges ECTRA[4] to act to follow up the conclusions and proposals from this study. The ECTRA/PT N[5] should prepare ECTRA Decisions or Recommendations based on the outcome of this report. ECTRA should pay particular regard to the potential for harmonisation of access to CNs using the ETNS.

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[2] CLI – Calling Line Identification

[3] ETO – European Telecommunication Office

[4] ECTRA – European Committee of Telecommunication Regulatory Authorities

[5] ECTRA/PT N – ECTRA Project Team on Numbering

1.   PRESENTATION OF THE STUDY

ETO, on behalf of ECTRA, has prepared this study on issues related to numbering of CNs for the CEC[6].

The work order addressed to ETO was as follows:

1. To review current access mechanisms used for VPNs

2. To define the requirements of CN numbering, the necessary dialling arrangements, including the maximum number of dialled digits

3. Based on the outcome of this study and other studies related to this issue (such as that on carrier selection[7]), to propose harmonised procedures for access to CNs in Europe, taking into account the requirements of global VPNs

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[6] CEC – Commission of the European Communities

[7] Final Report on Carrier Selection, Work Order 48 341, ETO, 30 May 1997

The study does not address the implications of naming and addressing in the context of IP[8] based CNs and VPNs (such as "intranets", "extranets" and the issues surrounding VoIP[9]) as this was outside its scope. Similarly, although mobile numbers are becoming more and more part of the corporate environment, the consideration of CN number space for mobile extensions was also outside the scope of this study. However, ETO recognises that these areas need urgent consideration and encourages ECTRA and the CEC to consider how they should tackle these issues.

ETO has undertaken this study in close co-operation with the CEC, the ECTRA/PT N, and the ENF (European Numbering Forum). ETO has also consulted broadly on the issues in the study with NRAs[10] and organisations such as ECCO[11], ECMA[12], ETNO,[13] and ETSI[14].

ETO has delivered two interim reports and one final report. It delivered the first interim report during the course of the work in June 1997. It distributed the second interim report in May 1998. Due to the extensive nature of the comments received, particularly from the CEC, ETO presented a draft final report for further comment in July 1999.

This final report contains the findings and proposals from the study.

In this section, we provide a presentation of the study with a summary of the work order addressed to ETO and the way in which we have tackled the work. The work requirement itself is included in the report as annex A. Section 4 provides a review of current access mechanisms used in Europe for CNs including mechanisms for Centrex, ISPBXs (Integrated Services PBXs[15]) and VPNs. The section contains a tabular overview of arrangements and proposals for access in all of the EU[16] countries and in eight non-EU countries.

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[8] IP – Internet Protocol

[9] VoIP – Voice over IP

[10] NRA – National Regulatory Authority

[11] ECCO – European Competitive Carriers Organisation

[12] ECMA - Industry Association for Standardising Information and Communication Systems (formerly known as European Computer Manufacturer's Association)

[13] ETNO – European Public Telecommunication Network Operators Association

[14] ETSI – European Telecommunication Standardisation Institute

[15] PBX – Private Branch Exchange

[16] EU – European Union

In section 3 we provide a review of the requirements of CNs concerning access mechanisms and numbering and relate these to national, regional and global facilities. Section 5 provides an assessment of the potential for harmonisation of CN access mechanisms and section 6 contains a list of the main conclusions from the study.

This report includes comments which individual ECTRA members have given on these issues concerning their respective national regimes and comments from ENF members.

2. INTRODUCTION

One of the main difficulties that ETO has had during this study has been to find an acceptable set of definitions relating to CNs. Annex D provides some commonly accepted definitions for terms used in the report. However, we give definitions below for some of the more contentious terminology for use within the context of this study. They cover CNs and concepts which are considered to be specific examples of CNs or closely related to CNs, such as PBX network, VPN, Closed User Group (CUG) and Centrex.

2.1 Corporate Network

In the context of this study, we broadly define a CN as being a private telecommunication network used by a single corporation. The hardware and software of the CN equipment may be private, public, or a combination of both. A CN may span several different geographic locations served by one or more public network operators within a single country or spread over several countries.

2.2 PBX Network

A conventional type of CN is a PBX network in which one or more PBXs of the corporation concerned perform the routing and switching. In the case of a PBX network spread over different locations, leased lines or public switched connections may interconnect the different parts of the network. In general, callers can usually reach PBX extensions from a public network by using Direct Dialling In (DDI). For internal calls, often the dialling of the DDI part of the destination number is sufficient. In the case of overlapping numbering domains, callers dial an additional location identifier first, such as the prefix 0 for leaving the private domain when accessing a public network.

2.3 Virtual Private Network

In the context of this study, VPN is the generic term to designate the emulation of CN components by hardware and software of public network equipment. Although the property of and, at least to a certain degree, operated by, a public service provider, a VPN can form a logical part of a CN architecture.

A VPN can emulate three functions, either independently or in combination:

1. the interconnection of private nodes (that is PBXs on dispersed corporation premises or Centrex nodes)

2. the Intervening Network (IVN) function; that is, the transparent, point-to-point interconnection of different private nodes (such as PBXs)

3. the attachment and servicing of terminals on a corporation's premises by public switching equipment; that is, a Centrex function (see below)

Functions 1 and 3 may also provide a gateway function to co-operate with the general public network, that is, to provide incoming and outgoing call capabilities to a CN as a traditional PBX offers today

2.4 Centrex

Centrex is a service whereby extensions of one or multiple corporation(s) connect to a single public service provider's switch that may offer services that are normally available only in PBXs. The extensions can be in one or more locations. Centrex facilitates the support of a Private Numbering Plan (PNP).

2.5 Closed User Group

A CUG is a public network feature that CNs can use to limit outgoing or incoming calls as a whole to a predefined group of users or terminals. These may span several different locations, if the whole access number (excluding the DDI part of the number) for a particular corporation is marked as belonging to a particular CUG. As the CUG function is a public network feature, neither the gateway of a CN nor the terminal nodes (such as PBXs) can check for validity of interconnections.

2.6 Private Number Plan (PNP)

A PNP is a number plan explicitly relating to a particular private number domain, defined by the CN manager of that domain. A PNP usually comprises the least significant digits of the E.164 resource, often used for DDI.

2.7 Access Code

An access code is a short code that consists of the first part of a prefix or a telephone number. The access code provides information to the network on the type of network or service required. This might be a non-geographic telephony service,

a public telephony network, a CN, a type of information or assistance service, or a carrier selection service.

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3.   CN REQUIREMENTS

In this section, we analyse the requirements that CNs place on the mechanisms and numbering schemes used to access them. We examine requirements specific to CNs. These are then examined from regional (particularly the ETNS) and global perspectives. We base this analysis largely on the work carried out within ETNO and ECMA.

3.1   Requirements of Corporate Networks

In general, ETO believes that CNs will require a flexible and publicly accessible PNP that allows different number length and allocation of numbers to support varying needs from different users.

There is a view that, at a national level, numbering for CNs should not be restricted to certain parts of the national numbering plan.

The public (national, regional or global) number plan should not restrict or limit the development of new functions within CNs.

The access mechanism should support both CNs accessible from a number of different operators and "operator specific" CNs.

Although in previous work NRAs, including OFTEL[17] in the UK[18], have seen CN numbering as a substitute for geographic numbers, it seems more likely to ETO that the demand will be additional to the existing numbering resources. For example, a corporate user would be loath to give up a London number as it has prestige implications. Corporate users will probably want to simply overlay corporate numbers on their existing site code and extension numbering schemes, which will inevitably lead to a requirement for extended and variable number lengths. Operators will tend to resist this as it leads to technical complexity and cost for them.

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[17] OFTEL – Office of Telecommunications (UK NRA)

[18] UK – United Kingdom (of Great Britain and Northern Ireland)

Ultimately, large corporate users might want numbering which is neutral to national and European borders, which is non-geographic and which allows them unlimited expansion in the same number space. They will want to be able to occupy an entire decade of national numbers in case they ever expand or merge. They will probably want to be able to move the numbers anywhere in the EU (or worldwide) easily and without reference to particular SPs or public network operators (they may even desire to take control of some network routing functions).

It is possible that in order to appear globally integrated yet locally responsive, corporate users will require the same physical handset to be accessible via different types of number. A geographic number would give a sense of location. A national number would identify the user as a national player, and a European or global number would establish them as an international player. The corporate user would give each number to the appropriate callers.

There is a potential conflict between what corporate users may desire and what is in operators' commercial interests to offer, or what is safe to offer in the context of network integrity. It may be that some requirements are more important for certain types of CNs than for others. It may also be that some requirements are hard to realise.

Looking at the general requirements listed above in the context of CNs:

3.1.1   Consistency of Dialling Procedures and Numbers

In general, the PNP number of a CN extension corresponds with the last part of the number dialled from a public network to reach the same CN extension whether geographic or non-geographic numbers are applied.

Corporate users should have their own number plan tailored to the requirements of their CN, and, preferably, the PNP numbers should be non-geographic.

3.1.2   Number Length

When a corporation connects a CN to the public telephone network, the public telephone number (without DDI) or the first digits of the telephone number (followed by DDI digits when DDI is used) identify the CN. A number in the CN's number plan can be part of the public E.164 number plan (in the case of DDI). In

this case, the structure of the PNP number has an impact on public network numbering or vice versa.

The PNP number has to be sufficiently long to satisfy current and future demand in terms of numbers. In case of non-geographic access codes it may be a variable length (dependent on the length of the allocated CIC[19] value) to allow different business needs and possible future evolution to be taken into account.

For IVPN (International VPN) up to four digits for a CIC and up to ten digits for the PNP number may be required.

3.1.3   Ease of Recognition of Geographic Place of Termination

At present, NRAs number CNs from national numbering resources. No numbering resources exist for numbering of CNs on a global or a regional level.

Managers of CNs spanning different locations generally prefer a location-independent access code.

The perception of a calling party connected to a public network either inside or outside Europe dialling a European national number is that he is accessing a European CN, and that the call is likely to be terminated in Europe. The consequence of this perception is that operators will provide each public network user with access to the European CN as if it was located entirely in Europe. However, in some cases the terminating point of the call can be outside Europe.

CNs comprise the private networks of corporations, which have usually connected them to a single (or multiple) public network(s). In multinational CNs, telephone numbers for these CNs are country specific. Consequently, a single multinational CN has several different types of telephone numbers. Multinational CNs could benefit from a single number range that callers can dial all over the world. In addition, the DSN (Domain Specific Number), when using DDI, could come from a single range and be consistent across borders and across operators' domains.

Multinational companies operate usually on a global rather than a regional basis. For this reason, Europe should address the numbering requirements of CNs taking into account the global perspective.

3.1.4 Relation Between Call Charges and Numbering

If a tariff indication in the CN access code is included, a low (local or national) tariff is preferred. Probably, a less precise tariff indication is required rather than a split of the CN access code according to different tariff levels. The latter would require a CN to change numbers when the tariff was changed.

Operators could charge each public network user in Europe as if they had attached the European CN directly to their public network. However, this is not always the case, as operators must determine charges using cost based pricing in a freely competitive market environment.

Operators could charge the calling party for off-to-on net calls at local or national rates.

3.1.5 Number Portability

In line with emerging European legislation, numbers for CN access should be portable, between SPs, public network operators and between locations whenever possible.

3.1.6 Carrier Selection

CN users and managers should have the ability to select the long distance and international carriers. In line with emerging European legislation, carrier selection should be available by pre-selection according to time of day, destination and so on with the option to override the pre-selection on a call by call or case by case basis. This might influence the length of the dialled digit string. When the system provides CLI, no reference to a particular selected carrier must appear at the destination user's terminal.

Carrier selection is a facility in addition to any "least cost routing" arrangements implemented by the CN manager in the CN equipment itself.

3.1.7 Corporate Network Identity

The access mechanism should provide an easily recognisable identity of the CN (using a CIC, DI, or other suitable means).

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[19] CIC – Corporate Identification Code

3.1.8 Ease of Network Management

The access mechanism should facilitate effective and comprehensive management of the CN to ensure an adequate Quality of Service (QoS) for the CN users at an optimum cost.

3.1.9 Accessibility to Service Numbers

CN extensions should be accessible from a public network, at the discretion of the CN network manager.

A CN must be, in principle, open to access from calling parties connected to public networks inside and outside Europe.

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4. REVIEW OF CURRENT ACCESS MECHANISMS USED FOR CNs INCLUDING CENTREXs, ISPBXs AND VPNs

Current access mechanisms provide access to CNs in a number of different ways. Frequently, at both the national and international level, administrations assign individual numbering resources to specific locations (that is, they are location dependent).

The consequences for the CN are:

- Fragments of the E.164 numbering plan which alone do not constitute a harmonised CN numbering plan.

- Overlay numbering to achieve at least within the CN some harmonisation of numbering for the internal communication among the CN users (and thus the requirement for establishing PNPs).

- Non-unique "telecommunication appearance" to the public reflecting the local dispersion of the corporation rather than any logical infrastructure.

The consequences for the public networks are:

- Non-harmonised national or operator specific solutions where CNs adopt a variety of different solutions according to technical possibilities within a particular country or operator's domain.

- Non-harmonised national solutions arising in Europe.

- Multiple waste of national numbering resources due to their disparate allocation to the various locations of the same corporation.

4.1 CN Access Mechanisms in Europe

4.1.1 Introduction

Here, we define access mechanisms as; the dialling procedures, including numbering, required to terminate a call at a CN user's terminal. We consider four different types of calls:

- calls which originate and terminate on the CN (on-to-on net calls)

- calls which originate on the CN and terminate on a public network (on-to-off net calls)

- calls which originate on a public network and terminate on the CN (off-to-on net calls)

- calls which originate and terminate on a public network (off-to-off net calls)

The main area of concern for this report is off-to-on net calls, where calls originate on a public network and terminate on the CN.
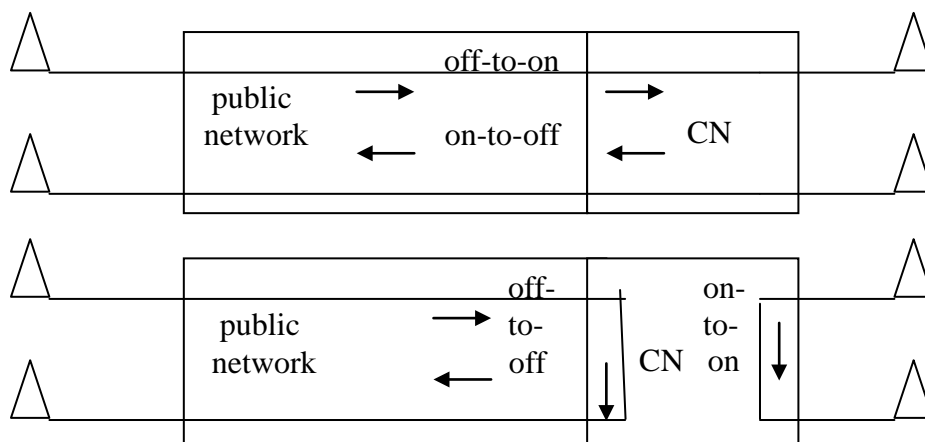
Figure 1.   Four different types of calls to access a CN

CNs may be associated with either geographic or non-geographic public network numbers. In the geographic case, the public network number identifies a CN extension by the last digits (through DDI or translation). Thus, the last digits may, or may not, form the PNP number.

In the non-geographic case, the public network number could contain a CN access code, followed by a CIC and a PNP number.

The access mechanisms in a country may differ for different types of CNs. Local geographic public network numbers may adequately serve a PBX network in one geographic location. However, a PBX network, which spans several different locations, is probably better served with public network numbers of which the initial digits comprise a national non-geographic access code. One block of non-geographic numbers, compared with a set of smaller geographic blocks, provides better possibilities for creating a number plan fulfilling a CN's needs by using the last digits of the public network numbers.

VPNs usually require a national non-geographic access code to enable routing of calls to a national VPN platform. Non-geographic national access codes have some additional advantages:

- they can be followed by a CIC providing a clear indication of the corporation concerned within a country

- they enable number portability between locations throughout that country provided that the remaining number length would be acceptable according to a particular corporation's needs

For the future, there might be further operator specific (such as satellite based) VPN access codes specified but this arrangement must always take account of the overriding requirements for portability of numbers in the national and international number plans.

In all cases, a choice can be made, in principle, between one-stage, two-stage and three-stage dialing. Multi-stage dialing is required when using an authorization code, account code or security code or when using an escape code to deviate from the normal service and to select extra features.

We focus mainly on single stage dialling and describe the access mechanisms without the use of such codes below.

4.1.1.1 On-to-On Net Calls

Users must at least dial the PNP number. The PNP number is automatically translated by the CN node into the corresponding public network number for calls from users connected to a PBX that have to be routed via the public switched network. In VPNs where users do not connect to a PBX, the users may have to dial the VPN access code before the PNP number. CN users connected to a PBX do not need to dial the VPN access code as the PBX can generate this code. The CLI can then include the CIC. The calling terminal's serving node (such as a PBX or VPN node) typically inserts the CIC into the called party number.

4.1.1.2 On-to-Off Net Calls

Users must at least dial the off-net destination indication ("outside line" code, for example 0) followed by the public network number for the destination they want to reach. In VPNs where the users do not connect to a PBX, they may have to dial the VPN access code before the off-net destination indication. CN users connected to a PBX may not need to dial the VPN access code as the PBX can generate this code. The calling terminal's serving node (such as a PBX or VPN node) typically provides the CLI.

4.1.1.3 Off-to-On Net Calls

Usually, either callers can reach CN extensions from a public network by one-stage dialling using a public network number only, or by two-stage dialling using a public network number, identifying the CN, followed by a PNP number.

4.1.1.4 Off-to-Off Net Calls

To limit fraud, usually, multi-stage dialling is required using an authorisation code and possibly a security code. Corporation employees use this type of facility to call on the account of their corporation.

4.1.2   Review of CN access mechanisms

Table 1 provides a detailed overview of public network numbering and dialling arrangements in European countries.

| Countries | CN access mechanisms in Europe | |
	Public network numbering (AB… represents the CIC)	Dialing in from public network
European Union		
Austria	CN (0)5 ABCD (E)	
Belgium	VPN: (0)88 and (0)98	
Denmark	VPN: 17A(B) plus no further digits	No one-stage dialling
Finland	CN: numbers within operator-specific ranges (0)10, (0)20, (0)30, (0)75XY with variable length	Only one-stage dialling
France	VPN: (0)85XY plus numbers with variable length (where XY is an SP identification code)	Not regulated
Germany	IVPN: 181plus up to eleven digits, CIC three or four digits VPN: 182-189 plus up to eight digits, CIC two to seven digits	Not regulated
Greece	No CN access codes	
Ireland	VPN: (0)18081 and (0)18082 plus numbers with variable length; numbers within network-specific ranges 172 and 173 with variable length	Not regulated
Italy	VPN: 1482, 149X (X=4-9) 149XY (X=0-3, Y=2-9) 149XYZ (X=0-3, Y=0-1, Z=0-9) 1482 and 149X (YZ) identify SP handling the VPN	One or two-stage dialling, authentication possible
Luxembourg	CN: 3 foreseen only in cases where present numbering without access code can not be used	
Netherlands	VPN: (0)82 XYZ (SP identifier) plus numbers with variable length CN: access code in consideration	Not regulated
Portugal	CN: 705AB plus seven digits; one digit reduction foreseen; 700 will stop	One or two-stage dialling, security code possible
Spain	No CN access codes	
Sweden	CN: numbers within the operator-specific services range (0)78 with variable length; national access code in consideration	Only one-stage dialling
United Kingdom	CN: (0)5ABC(D) reserved, to be reviewed in 2000	One or two-stage dialling

| Countries | CN access mechanisms in Europe | |
	Public network numbering (AB… represents the CIC)	Dialing in from public network
Non European Union		
Czech Republic	No CN access codes	
Hungary	CN: (0)71AB plus five digits	
Moldova	No CN access codes	
Norway	No CN access codes	
Poland	No CN access codes	
Russian Federation	No CN access codes	
Slovak Republic	No CN access codes	
Switzerland	PBX: (0)58ABC plus four digits for PBXs with at least 10,000 numbers; (0)50 will stop by end 1999; VPN: (0)869AB plus numbers with variable length	Not regulated

Table 1.   CN access mechanisms in European countries[20]

In summary, eleven EU countries had some provision for national CN access codes or were considering it, and outside the EU, at least Hungary and Switzerland had CN access codes. Most existing access codes were in use with VPNs but the use of access codes for PBX networks seemed to be on the increase.

The lengths of the access codes, the subsequent CICs and the remaining parts of the public network numbers belonging to these ranges varied between countries:

- the access codes comprised between one and five digits, in most cases two digits

- the CICs comprised between one and seven digits, often two digits, and were variable in length in most cases

- the remaining parts had between zero and seven digits, and, in most cases, were variable in length; a length of zero digits implies that no one-stage dialling is possible

In general, no regulations applied to the procedures for how to dial into a CN from a public network.

A few CN cases supported only one-stage dialling and in one VPN case, no one-stage dialling was possible.

4.1.3   Specific Regulation Related to CN Access Mechanisms

Number assignment for CNs should be made by the national Number Plan Manager (NPM), usually the NRA, stressing the rights of use of CN users and supporting number portability. In this report, we define access mechanisms as; the dialling procedures, including numbering, required to terminate a call at a CN user's terminal. However, when we talk about number portability we mean portability of the E.164 digits only and not of other digits in the dialled sequence (such as prefixes).

In general and in the specific case of the ETNS, rules for the assignment of resources to CNs must satisfy criteria of fairness, transparency, and non-discrimination at a reasonable price (thereby also considering the call charge for the calling side).

Apart from that identified in table 1, no specific regulation related to CN access mechanisms exists in European countries. There are, however, several issues regarding CN access mechanisms that may require regulatory scrutiny; non-discriminatory access, capacity constraints, number assignment, tariff setting, number length, and appropriate CLI provision. We address each of these issues briefly below.

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[20] Where the table mentions numbers with variable lengths, it may also be possible for there to be no additional digits behind the access code and the CIC. In that case, instead of using the last digits of a public network number, a second stage in the dialling procedure is required to dial a PNP number.

4.1.3.1 Non-Discriminatory Access

Where the incumbent has large blocks of numbers in reserve, only numbers scattered over several smaller blocks may be available to new entrants. These may be insufficient to serve large customers. In addition, if the PBX network is spread over different locations in different geographic numbering areas, the new entrant may have fewer possibilities to offer the same number ranges in the different areas. Having the same number ranges would facilitate the creation of a consistent PNP by the corporation concerned. This could also ease the support of number portability if a corporation would decide to change the network operator or service provider.

Thus, NRAs should safeguard non-discriminatory access to CN numbering resources for public network operators, by assuring sufficient free capacity available for new entrants on the telecommunications market. This is easier to realise with non-geographic access codes. However, geographic numbering could still put new entrants at a disadvantage if there were capacity constraints in certain numbering areas. Capacity constraints are most tangible where large ranges of subsequent numbers are required, for example for DDI access to a PBX network.

4.1.3.2 Capacity Constraints

Problems regarding number capacity are less serious when using non-geographic access codes instead of geographic numbers scattered over different number areas. The usually high proportions of CN numbers will have less affect on the estimated need for numbers in a geographic numbering area. This would also prevent a possible 'hidden' disadvantage for new entrants as explained in the previous paragraph. Capacity constraints and of 'hidden' disadvantages are best solved by doing number assignments directly to the corporations as explained in the next paragraph.

4.1.3.3 Number Assignment

At present, number assignment usually comprises two stages; primary assignment by the national NPM to the network operator or service provider, which then makes secondary assignment to the corporation. Intermediate stages of assignment have the result that unused capacity is lost in the reserves of the assigned blocks.

Number assignment by the NPM directly to the corporation without an intermediate step may be considered when the public network numbers are portable between service providers and network operators, in particular when using non-geographic access codes.

With direct assignment to corporations, there would be efficient use of assigned number blocks. It would provide more independence of the corporation from public service providers and network operators. Direct assignment would guarantee non-discriminatory access. Corporations could easily select the most attractive blocks of numbers out of all unused capacity. It would also provide better control by the NPM over the use of capacity for CN access numbers.

4.1.3.4 Tariff Setting

Setting tariffs is an issue, as corporations with unrestricted access from the public network to their CN usually prefer to keep the tariff low, often at the level of the local rate. Networks (and users) usually derive tariffs from geographic access numbers. However, we must solve the problem of tariffs for calls to non-geographic access numbers separately, as there is no indication to characterise the local, national or international nature of the call.

If non-geographic access codes are used, a local tariff leaves little flexibility for interconnection agreements between public network operators and public service providers. The corporations may want to share the costs of calls from public networks to their CNs. In the UK, OFTEL has reserved (0) 5 for CN access with two tariff bands, one between local tariff and national tariff and the other close to local tariff. The disadvantage of different tariff bands, however, is that a change of tariff by a corporation here also implies a change of numbers. Also routing related services like roaming for supporting user mobility and other supplementary ser-

vices such as call forwarding and call transfer might further affect a particular call charge.

4.1.3.5 Number Length

When the last digits of the public network numbers form the PNP numbers, the PNP number length should allow ample space for corporations to choose a structure for the PNP numbers that fits their purposes. PNP numbers of up to seven or even eight digits may be required. For international CNs, the required length may even be up to ten digits. The length of the called party number is an important issue in the context of carrier selection in public networks.

4.1.3.6 Calling Line Identification (CLI)

When CLI is provided to a called CN user, the respective number has to be offered in such a way that would allow the calling party to be identified and called back.

In the case of emergency calls, it is important that the emergency centre always gets immediate knowledge about the geographic location of the calling party, or at least about the location of the corporation's premises. For fixed network accesses, the centre can normally derive the location from the provided CLI. This may be a problem when using a non-geographic CN access code, where the called party can derive only the corporate identity.

In the case of an emergency call from a CN, the CLI should not contain the non-geographic number but an appropriate geographic number. A CLI must not show the real route of a call. Instead, the network should send the normal E.164 number for calling back the calling party to the called terminal.

4.1.3.7 Number Portability

A change of network operator or SP must not cause a change of number for the corporation; that is, number portability will have to exist.

5.   HARMONISATION OF CN ACCESS MECHANISMS

In this context, "harmonisation of CN access mechanisms" means the use of common E.164 numbering resources to access CN capabilities and services throughout Europe.

The availability of harmonised access mechanisms would allow the calling party, irrespective of his physical location, to identify and access in an easy and user friendly way the CN extensions and services offered. The presence of harmonised CN access mechanisms would also be an advantage for the CN, expediting access to its services and network capabilities. This is particularly true when the CN spans several different countries or operators' domains.

CN access mechanisms may use any of three types of numbering resource, which can coexist:

- national

- global

- regional

In the following we will discuss how the use of each of these three types of resources might allow the establishment of harmonised CN access mechanisms.

5.1   Use of National Resource to Harmonise Access to CNs

European countries are currently using different codes to access CNs and the services offered by these networks.

As an example, the mechanisms currently in use to access CNs vary considerably from country to country. Some countries, such as France and Germany, have reserved codes to specifically identify access to VPN. Usually these codes are two to three digits long and they belong to different ranges; for example, in Germany, the codes start with digit 1, whereas in France the codes start with digit 8. After these codes there is a CIC which is used to identify a specific CN. The length and the structure of the CIC vary from country to country. In Germany, the CIC is between two and seven digits long whereas in France the CIC is just two digits.

Other countries, such as Spain and Norway, have allocated no specific codes to access CNs or VPNs. Currently the UK uses E.164 geographic numbers to access CN extensions.

The reservation of specific digits to identify access to CN services is still under consideration by European NRAs. More details on the current use of national resources to access CN services are in section 3.1.

Therefore, considering the current situation in Europe, the harmonisation of access mechanisms using national numbering resources has drawbacks. These relate to the changes that would be required in national numbering schemes in order to harmonise the codes to access CNs, the CICs and the number length. These changes are the consequence of the different national solutions currently available. In all countries, the same service codes should be open and dedicated to the access of CNs. ETO expects that new codes will be in the digit 1 range. In addition, there must be agreement on uniform CICs and number length.

Previous experiences, such as the harmonisation of the codes for emergency and directory services, have proven how difficult and time consuming the process is to change national codes already in use. In addition, following the ETO study, "Harmonisation of Short Codes in Europe", there is reason to doubt whether a sufficiently strong demand for harmonisation exists to outweigh the costs and the disadvantages of number changes in the national plans.

A minor positive point in using national resources compared to international resources is that the dialling sequence is shorter and the tariff perception of the calling party is favourable. However, the tariff perception may only be a temporary advantage as ETO expects that users will become acquainted with international dialling combined with tariffs that do not differ substantially from national tariffs. In addition, numbers are likely to lose their tariff significance in the future.

Due to international nature of their businesses, some corporations might not wish to identify with one particular country.

ETO concludes that:

- the use of national numbering resources to harmonise access to CN services and capabilities is not advisable

- the main difficulties reside in the costs and drawbacks arising from the number changes required in the national numbering plans

- previous experience indicates that the harmonisation of national codes requires a very considerable length of time

- corporations might wish to advertise or demonstrate a more international presence for their businesses

5.2   CN Requirements in an International Context

In this section, ETO assesses the numbering requirements of CNs from both the regional (European) and global point of view.

The establishment of schemes, such as the ETNS, can extend CN numbering from the national to the regional level. However, regional numbering is likely to be an intermediate step for numbering of CNs because of their global nature.

The ETNS is likely to be the first regional numbering resource that can offer numbering capacity for CNs. It would use Country Code (CC) 388.

ECMA has evaluated the CN demands on the ETNS. ETSI considered these requirements in defining the number structure for ETNS, including the length of the ESI (European Service Identifier) at the beginning of the EN (European Number). ETSI annexed the ECMA results to the European Technical Report (ETR) NA-021408, Management of the ETNS, October 1997[21]. In the following sections, we assume the establishment of a service within the ETNS called "harmonised access to CNs".

The European Technical Standard (ETS) 300 710[22] provides a description of the service aspects of how a CN or its users can be reached by users attached to the public network.

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[21] ETR NA-021408, ETSI, October 1997

[22] ETS 300 710 "Integrated Services Digital Network (ISDN); Public Switched Telephone Network (PSTN); Universal Access Number (UAN) service; Service description", ETSI

ETO has derived the following requirements for CN access in a regional or global context. They relate mostly to number length, geographic significance, and number portability.

The length of the ESC (European Service Code) used to identify the pan-European service "harmonised access to CNs" should be as short as possible. The identification of the specific CN (using the CIC) should be contained in the ESN (European Subscriber Number) in the digits immediately following the ESC. The CIC should be of variable length. The length should be appropriate to provide sufficient remaining digit capacity for serving a particular corporation's needs, including its evolution, whilst also providing enough capacity for addressing all foreseeable CNs.

ETO can foresee a requirement to allow a corporation to embed its current DSNs in any future European CN numbering scheme. In this regard, the requirements of number length are paramount.

Use of a one-digit ESC occupies ten percent of the total capacity of the ETNS. A two-digit ESC reserves only one per cent of the total capacity for CNs. If we define the ESC for CNs as two digits, a maximum of ten digits then remains for DIs (Domain Identities, which form the CIC in the case of the ESC for CNs) and DSNs. The DI may be variable from two digits upward, and we can define it taking into account the DSN number capacity needed for each corporation.

ETSI ETR NA-021408 gives a fictitious example of capacity division and number of available DIs (Figure 2).

Length of DI	Digit sequence (example)	Number of DIs	Maximum length of DSN	
			If ESC = 1 digit	If ESC = 2 digits
2	11………………..59	50	9 digits	8 digits
3	600……………..799	200	8 digits	7 digits
4	800……………8699	700	7 digits	6 digits
5	8700………….89799	2800	6 digits	5 digits
6	898000………909999	12000	5 digits	4 digits
7	9100000…..9199999	100.000	4 digits	3 digits
8	92000000.. 92999999	1000.000	3 digits	2 digits

Figure 2.   A Fictitious Example of Capacity Division and Number of Available DIs

In the international telephone network, operators carry out number analysis on up to seven digits.

5.3   Use of Global Resources to Harmonise Access to CNs

The second type of numbering resource that could be used to harmonise access to CNs is global E.164 resource. This means that the ITU would assign an E.164 CC or a shared E.164 CC to access CNs.

At present, according to E.164, ITU can only assign global resources to three applications:

– geographic areas

– global services

– networks

In the following, we discuss the suitability of these three categories to provide global resources for harmonised access to CNs.

In the first case, ITU assigns E.164 CCs to a region, a country, or a group of countries. This kind of global resource is not available for access to CNs.

In the second case, ITU assigns E.164 CCs to global services. The idea is to provide subscribers with unique numbers which are recognisable worldwide and which callers can dial in all the countries and networks where the service is available.

The availability of this kind of E.164 global resource seems to provide a perfect match to the requirements for establishing world-wide harmonised mechanisms to access CNs. However, in practice, the ITU regulates the allocation of E.164 CC to global services using strict rules. One of the first rules is that the service must be a global service, defined as such in an ITU-T Recommendation, and provided on the public switched network. In the context of the ITU terminology, the "served user" would be the corporation or the CN rather than the public network user calling the CN. However, the current definition of global service excludes access to CNs.

In the third case, ITU would assign E.164 global resources to networks. In E.164, qualifying "networks" (interconnected physical nodes and operational systems operated by members of ITU or ROAs[23]) must be implemented between two or more countries which provide public correspondence services. However, although ECMA proposed this as being the best solution for CNs, ITU has explicitly excluded CNs. This makes the third category unusable for provision of global resource to access CNs.

ETO concludes that, according to the existing ITU rules on the allocation of E.164 CCs, the use of E.164 global resource to create harmonised mechanisms to access CN extensions would be impossible in the near term.

5.4   Use of Regional Resources to Harmonise Access to CNs

A third alternative to achieve harmonisation is the use of regional numbering resources.

ITU has reserved CC 388 for Europe to create the ETNS, a numbering space overlaid on the existing European national numbering schemes. The objective of the ETNS is to allow service providers who plan to offer their services in the European market area to obtain a single number with a unique dialling procedure. They

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[23] ROA – Recognised Operating Agency

can use this number throughout Europe or even worldwide for accessing their pan-European services or network termination points.

It is worth noting that at present ITU has reserved CC 388 only for the conduct of technical field trials. ITU will take a decision about the definitive allocation of CC 388 to Europe at the ITU-T SG2 (Study Group 2) meeting in March 2000. Only after the definitive allocation of 388 can Europe launch commercial services based on the ETNS.

In terms of harmonisation of access to CNs, the use of the ETNS numbering resource is a sound solution for European-based corporations mainly aiming at the European market with their businesses.

The ETNS is a newly created numbering scheme with ample capacity to accommodate the demand of CNs. In particular the use of ETNS would overcome the drawbacks (number changes in the national schemes and structured numbering plan) which, as mentioned in section 5.1, make it difficult to use national resources.

Since the ETNS is a numbering space parallel to existing European national numbering schemes, if Europe uses a portion of the ETNS space to provide access to CNs, no number change is required at the national level.

Europe has conceived the ETNS with the idea of structuring the numbering scheme on a service basis. Figure 3 shows the structure of a generic EN.
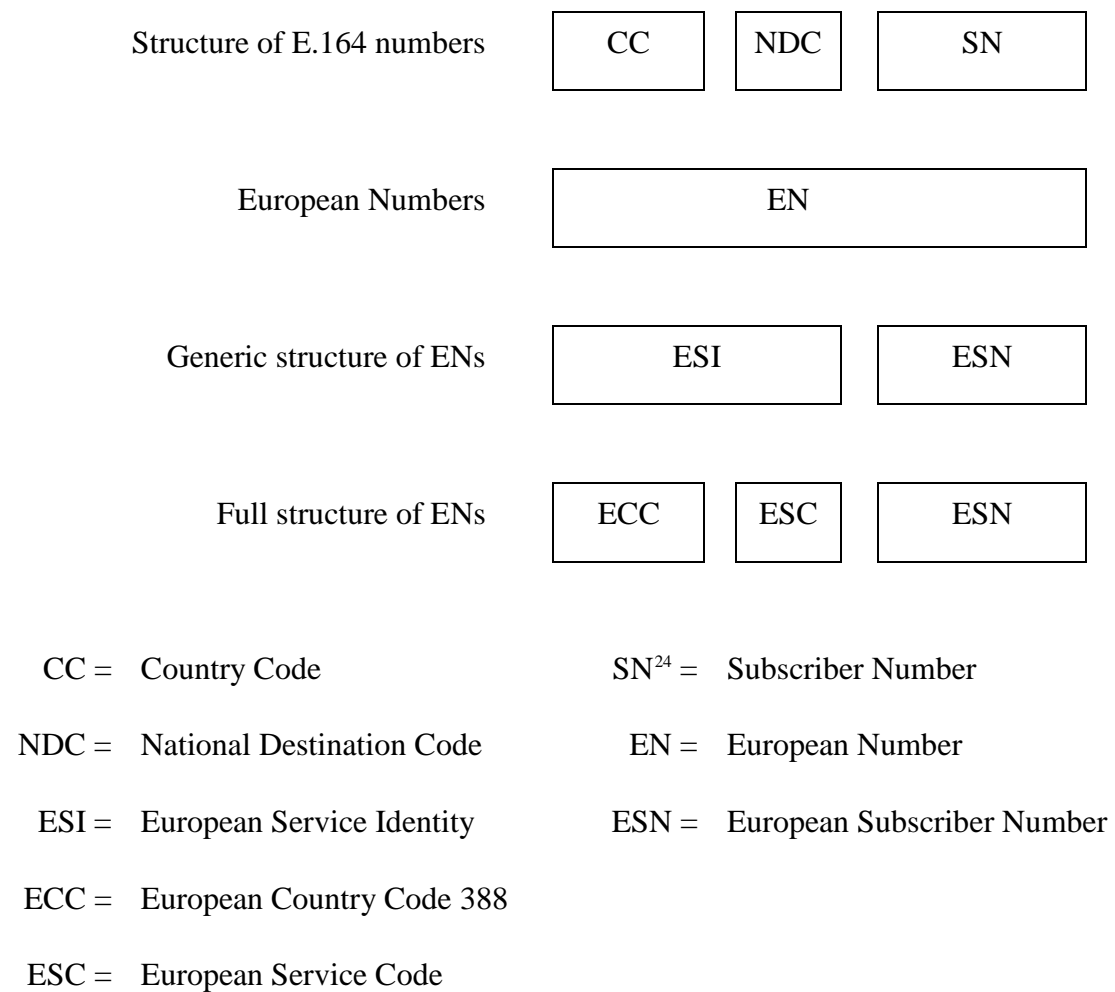
Structure of E.164 numbers	CC	NDC	SN

European Numbers	EN

Generic structure of ENs	ESI	ESN

Full structure of ENs	ECC	ESC	ESN

CC = Country Code

NDC = National Destination Code

ESI = European Service Identity

ECC = European Country Code 388

ESC = European Service Code

SN[24] = Subscriber Number

EN = European Number

ESN = European Subscriber Number

Figure 3: Structure of European Numbers

The maximum number of digits in the EN is fifteen. The initial part of the EN consists of the European Country Code (ECC) 388, followed by the ESC. The ECC and the ESC together constitute the ESI that consists of four to seven digits. The ESI denotes an access code for a specific type of ETNS service.

The ESN (the DI plus the DSN in the case of the ESC for CNs) consists of the remaining digits of the EN. In the specific case of CNs, therefore, the ETNS Administrator has to allocate an ESI value to the pan-European service "harmonised access to CNs". The ESI for "harmonised access to CNs" should be at least five digits. Thus, it allows for a remaining maximum number of digits for flexible al-

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[24] Note that in this report we use the abbreviation SN always to mean Subscriber Number and not Service Network, which we never abbreviated.

location to CNs (that is, a maximum of ten digits for the ESN, or DI plus DSN in the case of the ESC for CNs).

It is worth noting that CNs could use ETNS resources in addition to national resources. ETNS would be interesting for CN managers who see a benefit in having a European identity in their access numbers. However, we can regard this European identity as a limitation in the case of CNs aiming at having a global identity. The fact that the ESI consumes four or five digits, at least, is another disadvantage.

We discuss technical, regulatory and numbering aspects of the use of ETNS to provide a harmonised access mechanism to CNs in section 5.4.

ETO concludes that:

- the use of ETNS has the advantage of not requiring any changes to national numbering schemes and of being quickly and cheaply available once the definitive allocation of CC 388 to Europe has been made

- the use of the ETNS has the potential disadvantage of offering a European identity only, instead of a global identity to the CN and it imposes a limitation on the number length available to the CN

ETO further concludes that the use of national numbering resources to harmonise access to CN services and capabilities is not advisable. The use of E.164 global resource to create harmonised mechanisms to access CN extensions would be impossible in the near term. In terms of harmonisation of access to CNs, the use of the ETNS numbering resource is a sound solution for European-based corporations mainly aiming at the European market with their businesses. The ETNS is today the most promising solution for the provision of number resources for harmonised access to CN services.

5.5   Use of ETNS Resource for CNs

From the previous sections, we can see that, in terms of numbering resource, ETNS represents, today, the most promising solution for harmonisation of access to CNs.

ETSI has developed and defined the technical solutions for the ETNS whereas ETO, in collaboration with ECTRA, has set up the principles and the rules for the administration and the management of the ETNS numbering resource.

5.5.1 CN Requirements in the Context of ETNS

In the use of the ETNS to provide access mechanisms to CNs, we have to take account of several of the CN requirements.

In section 5.2, we analysed the CN requirements in the regional and global contexts. The critical issues are number length, geographic significance of numbers and number portability.

5.5.2 The ETNS Model

Before discussing the types of ETNS numbering resources available to access CN services, it is worth summarising some of the technical solutions and the regulatory principles on which the ETNS rests.

As mentioned before, ETSI has studied the ETNS technical specifications whereas ETO, in conjunction with ECTRA, has developed the regulatory principles.

5.5.2.1 Routing

In order to route an ETNS call to its final destination, the Serving Network (SgN) has to translate the EN dialled by the calling party into routing information. ETSI has studied different mechanisms to route an ETNS call. In particular, ETSI has identified the mechanism called "double translation using speech path" as the preferred one in the short term (Figure 4).
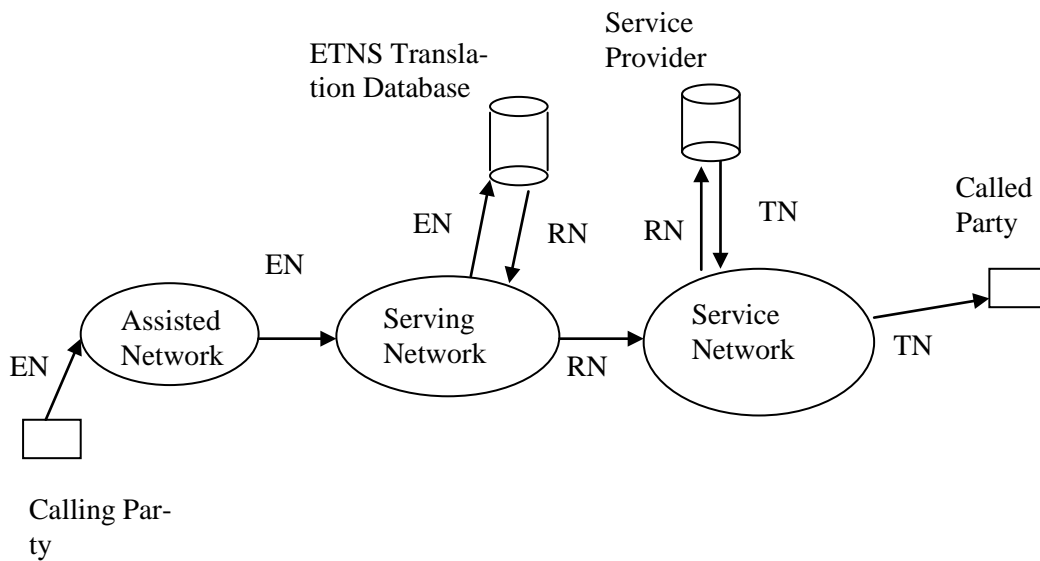
Figure 4: Double Translation Using Speech Path

As depicted in figure 4 the calling party dials the EN in its international format. Using the ESI, the ETNS routes the call to the SgN[25]. According to the ETSI terminology, a SgN is a network that is able to analyse and translate the EN by means of an ETNS translation database.

It is important to note that throughout this report we use terminology (particularly the terms SP, Service Network and SgN) in the context of the ETSI standards regarding network architecture (ETSI EN 301 160).

In some cases, the calling party does not directly connect to a SgN and then the ETNS call routes via an Assisted Network. The Assisted Network has only to analyse the ESI to route the call to the appropriate SgN. On receiving an ETNS call, the SgN triggers the ETNS translation database to translate the incoming EN into an outgoing RN (Routing Number). The RN points to the Service Network, which is the network to which the SP is connected. In most cases, the SP performs a second translation to obtain a TN (Terminating Number) to address the called party.

In future, we can envisage the use of standardised signalling interfaces between the ETNS translation database and the SP database. This would allow the mapping of the EN to the RN, and then the RN to the TN without using speech paths between the SgN and Service Networks. This solution, allowing an optimisation

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[25] SgN – Serving Network

of the network resources, requires capabilities of INs (Intelligent Networks) that are not yet generally available.

ETO concludes that, in line with the ETSI Standards, the routing mechanisms based on "double translation using speech path" represent a valid solution for the routing of ETNS calls including the provision of access to CNs.

5.5.2.2 Regulatory Framework

No European or national body can oblige network operators to act as SgNs offering ETNS translation database services to other networks. In particular, if a network operator decides to be a SgN no body should impose an artificial determination on the location of the translation database. The location and number of the ETNS databases should be the subject of commercial arrangements between network operators and SPs.

Likewise, no European or national body can oblige a network operator to act as an Assisted Network. This would drastically limit the potential use of this service.

Most of the considerations regarding the SgN also apply to the Service Network. In particular, in the perspective of aiming to promote competition, it does not seem appropriate to use regulation to determine who will be a Service Network. Each operator should be free to decide whether to act as a Service Network based on considerations of market opportunities only.

It is worth mentioning that ENs are required to be portable between ETNS SPs.

ETO concludes that:

- administrations should not regulate the relationship between the SgN and the Assisted Networks but leave this to commercial agreements between operators

- once a network operator has decided to be a Service Network for a specific ETNS SP, the two entities (Service Network and SP) should establish a relationship using normal commercial agreements within existing regulation

5.5.3   Application of the ETNS Model to CNs

Applying the ETNS technical model to the specific case of CN, we have to consider two alternatives:

- CN acting as SP

- CN acting as called party

The two alternatives have different implications for service provision, routing and numbering.

5.5.3.1 CN Acting as SP

In this case, the CN is the SP responsible for the provision of the service. The service consists of using ETNS numbering resources to access CNs.

From the routing point of view, when a CN acts as an ETNS SP, it is the responsibility of the CN to establish the appropriate commercial agreements with the other parties involved. That implies that the CN has to identify one or more Service Networks and a number of SgNs and define the necessary agreements. Such agreements should make sure that the ETNS calls correctly route to the point where the service exists.

A CN may be the SP and at the same time a subscriber of a service.

From the numbering point of view, we allocate ETNS resources to the CN. In this case, the EN has a structured ESN that consists of the DI field used to identify the specific corporation. The DSN field that identifies the route to the destination or to the termination of an incoming call follows the DI field.

5.5.3.2 CN Acting as Called Party

It is possible that another network is the SP for the subscribing CN. In this case, the CN is only the called party of an ETNS call. The SP is a third entity, which is in charge of translating the RN that the Service Network receives into a TN. The Service Network uses the TN to reach the final destination within that CN domain, where the usual signalling to CNs applies. In terms of service provision, the SP only performs a number translation operation and it is not involved in the pro-

vision of any CN service. We should note that a specific SP could provide this service to more than one CN. The SP must ensure the provision of the appropriate CLI.

From the routing point of view, when the CN acts as called party, it is not involved in the identification of the Service Network or the SgN. The setting up of the appropriate commercial agreements between the involved parties is the direct responsibility of the SP. However, this assumes that the calling party pays all call-related charges. If this were not the case then the CN manager would also need to be a party to those commercial agreements.

From a numbering point of view, the Registrar would allocate ETNS resources to the CN as a subscriber of the ETNS service. The SP would act as a qualified intermediary applying on behalf of the CN to obtain ETNS numbering resources.

5.5.4 Number Structure of an EN for CNs

We show the generic structure of an EN in figure 5. The EN consists of two parts: ESI and ESN.

The ESI is a code assigned to a pan-European service or a family of services. In the case of CNs, the code identifies the pan-European service "harmonised access to CNs". The designation of the ESI is one of the Administrator's functions. The other functions include the setting up of the rules for management of the ETNS. As indicated in the ETO report, "Management, Routing and Portability Aspects of the ETNS", ETO could fulfil the administration functions.

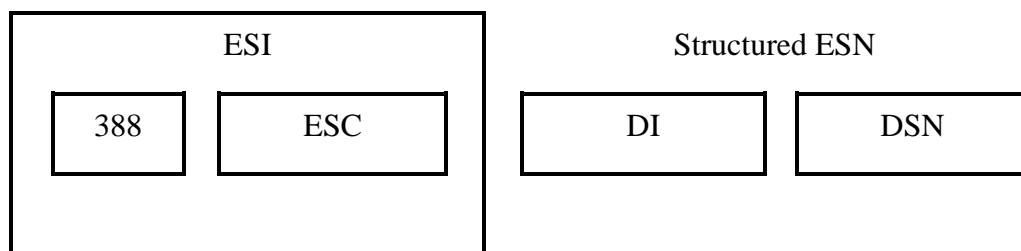| ESI		Structured ESN	
388	ESC	DI	DSN

Figure 5: Structure of EN

In the case of CNs, the structured ESN would be as shown in figure 5. The ESN has a variable length and consists of a DI and a DSN. The DI, which is of variable length, identifies the subscriber. The management of the DI is the responsibility of the Registrar. The subscriber, denoted by the DI, is responsible for the administration of the DSN.

In the case of the ESC for CNs, the DI forms the CIC.

In the case of CNs, the DI can identify a specific CN that will be responsible for the remaining DSN. The DSN, which is only relevant to the CN concerned, identifies an addressable entity within the CN.

From an ETNS numbering point of view, we can envisage the use of both a structured and an unstructured. Taking into account the requirement to have an indication of the CN identity in the EN, the structured ESN (DI plus DSN) is the only appropriate solution. The length of the DI can vary between two and eight digits taking into account the DSN capacity needed for each CN. This range should capture the different needs of big, medium and small CNs.

In terms of the structure of the EN another important requirement is the length of the ESC which is the code identifying a specific pan-European service. For the CN case, the use of a one-digit ESC would occupy ten percent of the total capacity of the ETNS. Such a large portion of the ETNS capacity may not appear acceptable for just one ETNS service. However, one should consider that up to 80% of all telecommunications traffic has its source and sink in CNs.

A good compromise between the conflicting requirements to have a short ESC and to use ETNS resources economically, could be a two-digit ESC. Such a code would reserve only one per cent of the total ETNS capacity for use by CNs. If we define the ESC for CNs as two digits, a maximum of ten digits then remains for the ESNs, that is, the DIs together with the DSNs.

ETO concludes that:

- the format of the EN defined in the ETSI standards is applicable to the case of CN

- the length of the ESC for CNs should be at least two digits

- the structured ESN (DI plus DSN) is the preferred solution

- the length of the DI will vary accordingly

5.5.5 Number Portability

ENs should be portable between different SPs offering pan-European access to CNs, and, in addition, they should be portable between public network operators and locations, even across national borders.

5.5.6 Migration of Current CN Numbers to the ETNS

We must take into account the impact of the provision of a migration path for CN numbers.

Existing company networks have established internal numbering schemes and experience has shown that when companies move to alternative solutions (such as the use of Centrex) a prime requirement is the maintenance of integrity of their internal number plan. Therefore, the degree of acceptance of, and hence demand for Therefore, the degree of acceptance of, and hence demand for corporate numbering will depend upon the commercial arrangements for its provision and support.

If there is a significant demand for corporate numbers under the ETNS, then this may eventually occupy a considerable proportion of the numbering capacity. Given that much of the allocation could be required for migration purposes, large amounts of redundant but inaccessible resource could exist in the scheme. On the other hand, if there is only a small demand for corporate numbers, then a large amount of unused resource could remain behind the ESC for CNs.

Again, we should remember that up to 80% of all telecommunication traffic has its source and sink in CNs.

6. CONCLUSIONS AND PROPOSALS

6.1 Numbering for CNs

1. The appropriate NPM (usually the NRA) should make number assignment for CNs, stressing the rights of use of CN users and supporting number portability. NRAs should safeguard non-discriminatory access to CN numbering resources for public network operators, by assuring sufficient free capacity available for new entrants on the telecommunications market, for example.

2. When the last digits of the public network numbers form the PNP numbers, the PNP number length should allow ample space for corporations to choose a structure for the PNP numbers that fits their purposes.

3. Corporate users can have their own PNP tailored to the requirements of their CN, and, preferably, the PNP numbers should be non-geographic in order to save number space.

4. The PNP number has to be sufficiently long to satisfy a CN's current and future demand in terms of numbers. In the case of non-geographic access codes it may have a variable length (dependent on the length of the allocated CIC) to allow different business needs and future evolution to be taken into account.

5. CN extensions should be accessible from a public network, at the discretion of the CN manager.

6. In principle, a CN accessible by international number resources must be open for access by calling parties connected to all public networks.

7. In case of emergency calls, it is important that the emergency centre knows the geographic location of the calling party. The CLI should provide the geographic location of the caller if he makes an emergency call from a CN to a public network.

8. E.164 numbers for CN access should be portable between public network operators, SPs and locations whenever possible.

9. CN users and managers should have the ability to select the long distance and international carriers for on-to-off calls. Carrier selection should be available by pre-selection according to the time of day, destination and so on with the option to override the pre-selection on a call by call or case by case basis.

10. The access mechanism should provide an easily recognisable identity of the CN.

11. The access mechanism should facilitate effective and comprehensive management of the CN to ensure an adequate QoS at optimum cost for the CN users.

6.2 Harmonisation

12. The use of national numbering resources to harmonise access to CN services and capabilities is not advisable. The use of E.164 global resource to create harmonised mechanisms to access CN extensions would be impossible in the near term. In terms of harmonisation of access to CNs, the use of the ETNS numbering resource is a sound solution for European-based corporations mainly aiming at the European market with their businesses.

13. The ETNS is today the most promising solution for the provision of number resources for harmonised access to CN services.

14. The format of the EN defined in the ETSI standards, and described in the ETO report on Management, Routing, and Portability Aspects of the ETNS, is applicable to the case of CNs. Taking into account the requirement of having an indication of the CN identity in the EN, the structured ESN (DI plus DSN) is the only appropriate solution.

15. The length of the ESC used to identify the pan-European service "harmonised access to CNs" should be as short as possible, but at least two digits. The identification of the specific CN (using the CIC) should be contained in the ESN (DI plus DSN in the case of the ESC for CNs) in the digits immediately following the ESC. The CIC should be of variable length. This length should provide sufficient capacity for a particular corporation's evolution, but still provide enough space for addressing foreseeable CNs.

16. ENs for CNs should be portable between different public network operators and SPs offering pan-European access to CNs, and, in addition, they should be portable between different locations, even across national borders.

17. The routing mechanisms based on "double translation using speech path" represent a valid solution for the routing of ETNS calls including the provision of access to CNs.

18. From the routing point of view, when a CN acts as an ETNS SP, it is the responsibility of the CN to establish the appropriate commercial agreements with the other parties involved (such as Service Networks and SgNs). Such agreements should make sure that the ETNS calls correctly route to the point where the service exists.

19. When the CN acts as the called party, it is not involved in the identification of the Service Network and the SgN, which is the direct responsibility of the SP.

ETO urges ECTRA to act to follow up these conclusions and proposals. The ECTRA/PT N should prepare ECTRA Decisions or Recommendations based on the outcome of this report. ECTRA should pay particular regard to the potential for harmonisation of access to CNs using the ETNS.

7.   ANNEXES

The Numbering Requirements of Corporate Telecommunications
Networks (CNs) and their impact on Public Network Numbering
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Annex A WORK REQUIREMENTS

Subject: The Numbering Requirements of Corporate Telecommunications Networks (CN) and their impact on Public Network numbering

Purpose

The work requirement covers the work that the European Telecommunications Office (ETO) will conduct on behalf of ECTRA for the European Commission in the area of numbering of telecommunication services. This Annex defines the terms of reference for a study to define the numbering requirements of CNs for securing the accessibility of CN components such as Virtual Private Networks in Europe.

Justification

A substantial part of present and future international traffic will remain within CNs or Closed User Groups. Today carriers and service providers already offer Virtual Private Network (VPN) and Closed User Group (CUG) solutions for their customers for national and international telecommunications traffic.

The handling of VPN-CUG traffic can be facilitated by special service codes to indicate to the network that the call is a VPN-CUG call, which requires special treatment and routing. Ideally, traffic needs to deviate at some point in the lower (local) network layer into the (long-distance) network of another carrier or service provider. Calls can be earmarked as VPN-CUG calls by generating special access codes or prefixes that identify the calls.

The identification of VPN-CUG calls (through special number sequences) strongly resembles the identifying of calls destined for specific long-distance carriers or service providers (through carrier selection by special number sequences). Codes for identifying calls in either category could be used to route traffic, depending on a preference for service or operator branding.

In this context, a study on the numbering requirements of CNs is urgently needed.

Work requirement

To review current access mechanisms used for Virtual Private Networks (VPNs);

To define the requirements of CN (CN) numbering, the necessary dialling arrangements, including the maximum number of dialled digits;

Based on the outcome of this study and other studies related to this issue (that is carrier selection), to propose harmonised procedures for access to CNs in Europe, taking into account the requirements of global VPNs.

Execution

The work will be carried out in close co-operation with the CEU, the ECTRA PT on Numbering and the European Numbering Forum. Part of the work, mainly the technical aspects, will be carried out by ETSI under a separate Commission work requirement. This work requirement therefore has to be seen in conjunction with the ETSI work requirement.

The final report of the study shall be delivered to the CEU by 30 June 1997 and the delivery date may be postponed if the corresponding ETSI work is delayed.

Deliverables

Two interim reports and one final report shall be delivered.

The first interim report shall be delivered during the course of the work, by December 1996.

The second interim report shall contain the draft findings and proposals as they will be submitted to CEPT/ECTRA for approval.

The final report shall contain the findings and proposals, as approved by CEPT/ECTRA and will include any comments individual CEPT/ECTRA members have on implementation in their respective national regimes.

All reports shall be made available in draft form one month before a liaison meeting at which results will be discussed and approval must be given for their release.

The Commission shall receive three copies of the interim reports, while the approved final report shall be made available in 15 bound copies, one unbound copy and one copy on floppy disk in Word for Windows V2.0 format. Graphics shall be made available on separate hard copies.

Manpower

It is expected that this task can be accomplished in 6 man-months at expert level, including possible subcontracting.

Subcontracting

Subcontracts - totalling 1 man-month - may be given to external experts for the execution of parts of this contract.

The Numbering Requirements of Corporate Telecommunications
Networks (CNs) and their impact on Public Network Numbering
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Annex B BIBLIOGRAPHY

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4. Final Report on Carrier Selection, Work Order 48 341, ETO, 30 May 1997

5. Standard 155, 2nd edition, ECMA, June 1997 (also ETSI 300 189 and ISO/IEC 11571)

6. ETR NA-021408, ETSI, October 1997

7. ETS 300 710 "Integrated Services Digital Network (ISDN); Public Switched Telephone Network (PSTN); Universal Access Number (UAN) service; Service description", ETSI

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Annex C DEFINITIONS

Please also refer to ETSI ETS 300 415 on CN terms and definitions

Access Code: a short code that consists of the first part of a prefix or a telephone number. The access code provides information to the network on the type of network or service required. This might be a non-geographic telephony service, a public telephony network, a CN, a type of information or assistance service, or a carrier selection service.

Administration of the ETNS: establishment of the ETNS conventions (and changes to them).

Assisted Network: a public or corporate network that routes all the calls to ENs towards a SgN it has agreement with in order to complete the call.

Called party: a party that terminates a call to an EN. The Called party may be the ETNS subscriber to the EN, an entity delegated by the ETNS subscriber or terminating equipment of the SP (such as recorded announcement equipment).

Calling party: a party that dials an EN.

ESI designations: the ESIs, the specific structure of the associated ENs and the specific conditions attached to each of the ESIs.

ETNS conventions: set of rules needed for management of the ETNS. They are composed of three elements: the ETNS definition, the ESI designations, and the rules for management of the ETNS.

ETNS country: a CEPT country participating in the ETNS.

ETNS registrar database: the database managed by the Registrar where all data, both administrative and operational, for each European number are registered.

ETNS translation database: a database, which, in the call process, translates the EN into a RN.

European Number (EN): a number from the ETNS.

Management of the ETNS: the whole of the administration, registration, and advisory function for the ETNS.

Originating network: a network, either assisted or serving, to which the calling party is connected.

Private Number Plan (PNP): a number plan explicitly relating to a particular private number domain, defined by the CN manager of that domain. A PNP usually comprises the least significant digits of the ITU-T Recommendation E.164 resource, often used for DDI.

Registration: the assignment of the ENs from designated ESIs, surveillance of the usage conditions and withdrawal of assigned ENs

Routing Number (RN): an E.164 number used to route to the service exchange. It can also identify the called party or the ETNS SP for routing purposes.

Service exchange: an exchange of the Service Network that triggers the provision of the service on reception of the RN, and then forwards the call.

Service network: a network that operates one or more service exchange(s).

ETNS Service Provider (SP): an entity that provides one or more ETNS service(s) to its ETNS subscribers on a contractual basis. In addition, during the process of an ETNS call to a CN, it provides translation of the RN into the TN.

Serving exchange: an exchange, in the SgN, that can interrogate directly or indirectly an ETNS translation database to get a RN related to the EN, and then forward the call.

Serving Network (SgN): a network with one or several serving exchange(s). A SgN, contrary to an Assisted Network, can analyse the whole EN through database dip.

Annex D LIST OF ABBREVIATIONS

CC	Country Code
CEC	Commission of the European Communities
CIC	Corporate Identification Code
CLI	Calling Line Identification
CN	Corporate Network
CUG	Closed User Group
DDI	Direct Dialling In
DI	Domain Identity
DSN	Domain Specific Number
ECC	European Country Code
ECCO	European Competitive Carriers Organisation
ECMA	Industry Association for Standardising Information and Communication Systems (formerly known as European Computer Manufacturer's Association)
ECTEL	The European Telecommunications and Professional Electronic Industry
ECTRA	European Committee for Telecommunications Regulatory Affairs
ECTRA/PT N	ECTRA Project Team on Numbering
EIG	European Interest Group
EIIA	European Information Industry Association
EN	European Number
ENF	European Numbering Forum
ESC	European Service Code
ESI	European Service Identity
ESN	European Subscriber Number

ETNO	European Public Telecommunications Network Operators' Association
ETNS	European Telephony Numbering Space
ETO	European Telecommunications Office
ETR	European Technical Report
ETS	European Telecommunication Standard
ETSI	European Telecommunications Standards Institute
ETSI STC NA2	ETSI Sub Technical Committee Network Aspects 2
EU	European Union
GSM	Groupe Speciale Mobile
IN	Intelligent Network
INTUG	International Telecommunications Users Group
IP	Internet Protocol
ISPBX	Integrated Services PBX
ITU	International Telecommunication Union
ITU-T	ITU Telecommunication Standardisation Sector
IVN	Intervening Network
IVPN	International Virtual Private Network
MoU	Memorandum of Understanding
NPM	Number Plan Manager
NRA	National Regulatory Authority
OFTEL	Office of Telecommunications (UK)
PNP	Private Numbering Plan
QoS	Quality of Service
R	Registrar

ROA   Recognised Operating Agency

RN   Routing Number

SgN   Serving Network

SN   Subscriber Number

SP   Service Provider

TN   Terminating Number

VoIP   Voice over IP

VPN   Virtual Private Network