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**ETSI**

European Telecommunications Standards Institute

**ETSI Secretariat**

**Postal address:** F-06921 Sophia Antipolis CEDEX - FRANCE

**Office address:** 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE

**X.400:** c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

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## Foreword

ETSI Technical Reports (ETRs) are informative documents resulting from ETSI studies which are not appropriate for European Telecommunication Standard (ETS) or Interim-European Telecommunication Standard (I-ETS) status. An ETR may be used to publish material which is either of an informative nature, relating to the use or application of ETSs or I-ETSs, or which is immature and not yet suitable for formal adoption as an ETS or I-ETS.

This ETR has been produced by the Network Aspects (NA) Technical Committee of the European Telecommunications Standards Institute (ETSI).

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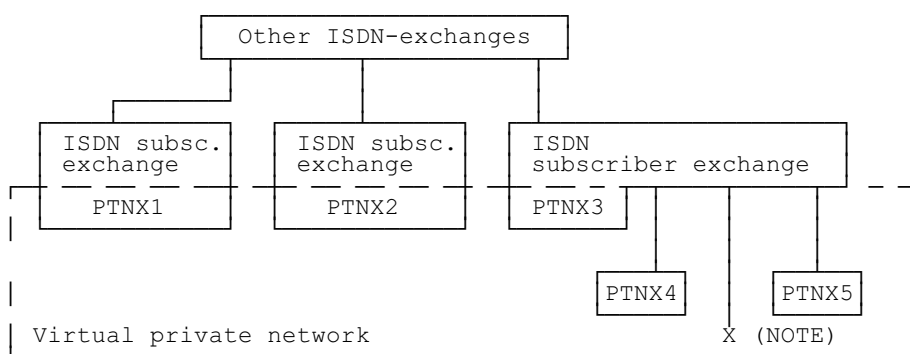
## 1 Scope and introduction

This ETR describes the translation mechanisms of a public ISDN that supports private numbers as defined by the authority of a Virtual Private telecommunication Network (VPN). The ETR shows, on the basis of examples, solutions for selecting users connected to different exchanges (PTNXs) of the VPN, as well as stand-alone users, see figure 1.

The application of this ETR, or part of it, to virtual private networks as defined and implemented in the context of an intelligent network requires further study.

It is assumed that the numbering functionality of VPN is the stage 1 description of support of private numbering plan (called private numbering plan in CCITT) elaborated by CCITT Study Group I (reference Com I-R20).

A VPN covers telecommunication within an organisation/administration connected to many ISDN subscriber exchanges in one or more countries. Figure 1 shows the components of VPN.



NOTE: X means individual 2B+D or 30 B+D centre connection.

**Figure 1: Components of VPN**

The organisation/administration may cover:

- a company internal network with divisions scattered around the country/world;
- a public department/organisation with regional divisions within a country;
- a group of individuals;
- a combination of one or more of the above mentioned groups.

Packet switching data communication is outside the scope of this ETR.

For VPN internal data communication between CCITT Recommendation X.25 [1] terminals it is necessary for the Numbering Plan Identifier (NPI) field of X.25 to be implemented within public data networks.

NOTE: The digit strings shown within the VPN internal numbering plan tables in the following sections have been included to illustrate each scenario covered, and should therefore be viewed as indicative only.

## 2 References

- [1] CCITT Recommendation X.25: "Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit".
- [2] CCITT Recommendation E.164: "Numbering plan for the ISDN era".
- [3] ETS 300 189: "Private Telecommunications Network (PTN); Addressing" (ECMA-155).

## 3 Numbering plans for VPN

Three different principles for allocation of numbers to VPN have been identified.

- a) private numbers used together with public location dependent numbers;
- b) private numbers used together with public location dependent and location independent numbers;
- c) partial ISDN numbers (see CCITT Recommendation E.164 [2]).

Partial ISDN numbers are VPN-internal numbers forming the end of the ISDN number. Use of the full ISDN number for VPN internal calls is for further study.

All the principles can be realised with DDI, but only a) and b) can be realised without.

Within VPN it is possible to combine the use of private and public numbers, especially the combination of private and public location independent numbers.

## 4 Abbreviations and definitions

### 4.1 Abbreviations

CC	Country Code
DDI	Direct Dialling In
ECMA	European Computer Manufacturers Association
ILDN	Internal Location Dependent Number
ILIN	Internal Location Independent Number
ISDN	Integrated Services Digital Network
ISPBX	Integrated Services Private Branch eXchange
LDNSN	Location Dependent National Significant Number
LDNSN1	Location Dependent National Significant Number with DDI
LINSN	Location Independent National Significant Number
LINSN1	Location Independent National Significant Number with DDI
NDC	National Destination Code, reference CCITT Recommendation E.164 [2]
NPI	Numbering Plan Identifier



PLDN	Private Location Dependent Number
PLIN	Private Location Independent Number
PTN	Private Telecommunication Network
PTNX	Private Telecommunication Network eXchange. A PTNX may be represented by an ISPBX, or by equipment which is physically part of the equipment of an ISDN
SN	Subscriber Number
VPN	Virtual Private Network

#### 4.2 Definitions

**Public location independent number:** a directory number that can be used to reach a called user wherever he is located, limited only by the capability of the networks involved.

(From a numbering point of view the public location independent number could be a universal personal telecommunication number or freephone number).

**Private location independent number:** a number within a VPN excluding partial ISDN numbers, that can be used to reach a called user wherever he is located within the VPN, limited only by the capability of the networks involved.

### 5 Private numbers

Private numbers may have a different structure and significance than public numbers. The numbers may be location dependent or location independent. Within VPN the location dependent numbers can either be allocated physically to each PTNX i.e. contiguous numbering, or be allocated individually to members of VPN i.e. non-contiguous numbering. The structure of private numbers can be illustrated as in figure 2:

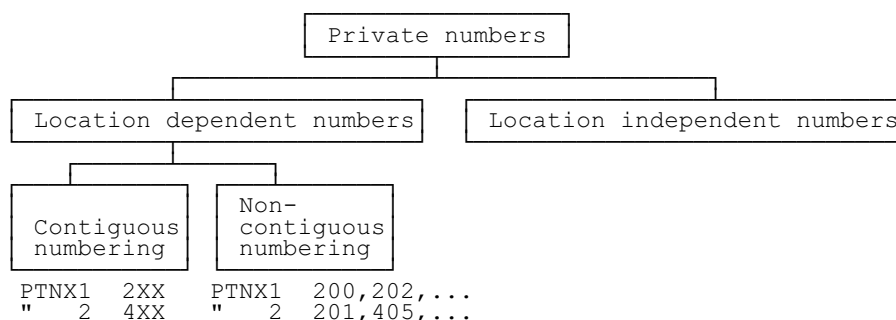


Figure 2

The private numbers are outside the public numbering plan (see ETS 300 189 [3]). This ETR encompasses the private numbering plan and unknown numbering plan of the ECMA standard ETS 300 189 [3].

All the examples in this report are based on contiguous numbering, but the description and comments are valid, irrespective of how the internal numbering for the location dependent numbers is done. Use of non contiguous numbering makes stronger demands on the VPN than contiguous numbering.

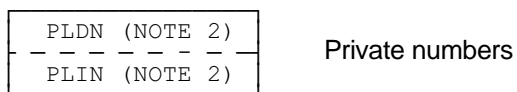
## 6 Private numbers used together with public location dependent numbers

### 6.1 Without DDI

Each member of a national or international VPN is allocated a minimum of one private location dependent number (see NOTE). The network is allocated one or more public location dependent numbers depending on how many PTNXs it includes. The public numbers will be the PTNXs main numbers, and as such common for many members of VPN.

NOTE: In addition some or all members may be allocated private location independent numbers.

The number structure is as follows:



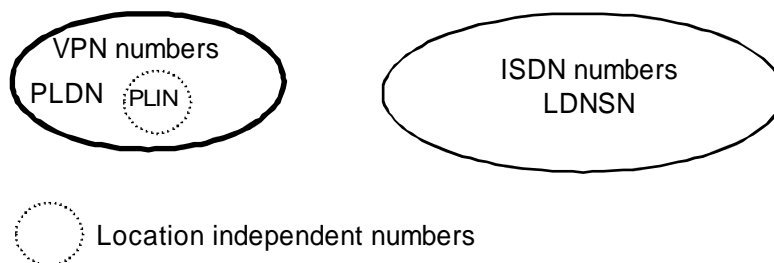
NOTE 1: The structure of LDNSN is NDC + SN as described in CCITT Recommendation E.164 [2].

NOTE 2: The structure of private numbers is given in ETS 300 189 [3].

**Figure 3**

The telecommunication authority assigns LDNSN and the VPN-owner assigns PLDN and PLIN.

The maximum length of the public location dependent numbers is 15 digits post time T and 12 digits pre time T. Figure 4 shows the relation between VPN numbers and public location dependent numbers without DDI.



**Figure 4: Relation between VPN numbers and public location dependent numbers without DDI**

The length of the private numbers is decided by the VPN-owner, and can either be constant within VPN or differ from PTNX to PTNX or between individual members of VPN.

With different number length from PTNX to PTNX it is normally assumed that the length can unambiguously be decided by analysing the most significant digits of PLDN. The private location dependent numbers and the private location independent numbers can be separated in the same way. An example of a VPN numbering plan based on private numbers without DDI is given in table 1.

**Table 1: Example of a VPN numbering plan based on private numbers without DDI**

VPN internal numbering plan	The number indicates	
0	VPN external call	(NOTE 1)
1xxx	PLDN, PTNX1	
2xx	PLDN, PTNX2	
3xx	PLDN, PTNX3	
4x	PLIN, (PLDN)	(NOTE 2)
5xx	PLIN (PLDN)	(NOTE 2)
6-8	Reserve	
9	Call to operator	(NOTE 1)
NOTE 1: Prefixes and access codes are outside the numbering plan.		
NOTE 2: (PLDN) indicates that each PLIN terminates on a PLDN.		

PLDN can be used between all members of VPN, but only the members with PLIN can maintain their internal numbers without administrative interference when moving between PTNXs. In the example the first digit 4 and 5 indicates that it is a location independent number, and that the database of the telecommunication administration shall be inquired to locate the actual member.

PLIN is translated to the main number of the actual PTNX (LDNSN) and the correct private number (PLDN).

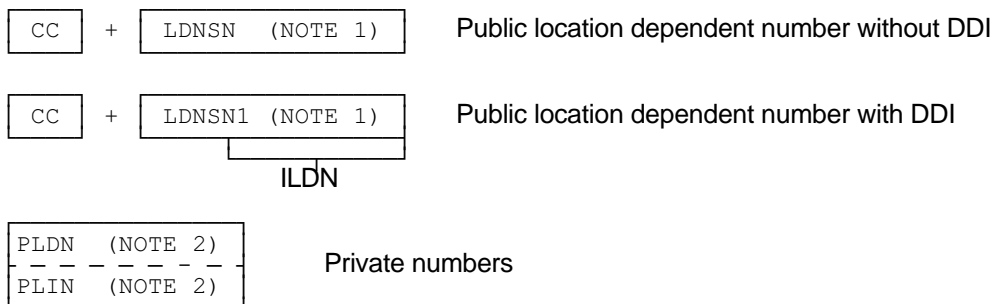
When using PLDN, translation will take place for VPN-internal calls outside the own PTNX. PLDN is translated to the actual LDNSN and PLDN is forwarded to the terminating PTNX. For PTNX-internal calls PLDN can be used without translation.

## 6.2 With DDI via location dependent numbers

Each member of a national or international VPN is allocated a minimum of one number. Members with DDI are allocated one public location dependent number (DDI-number), while members without DDI are allocated one private location dependent number (see NOTE). The network is allocated one or more public location dependent numbers (main numbers), depending on how many PTNXs and basic accesses it includes. Each main number is common for many members.

NOTE: In addition some or all members may be allocated private location independent numbers.

The number structure is shown in figure 5:



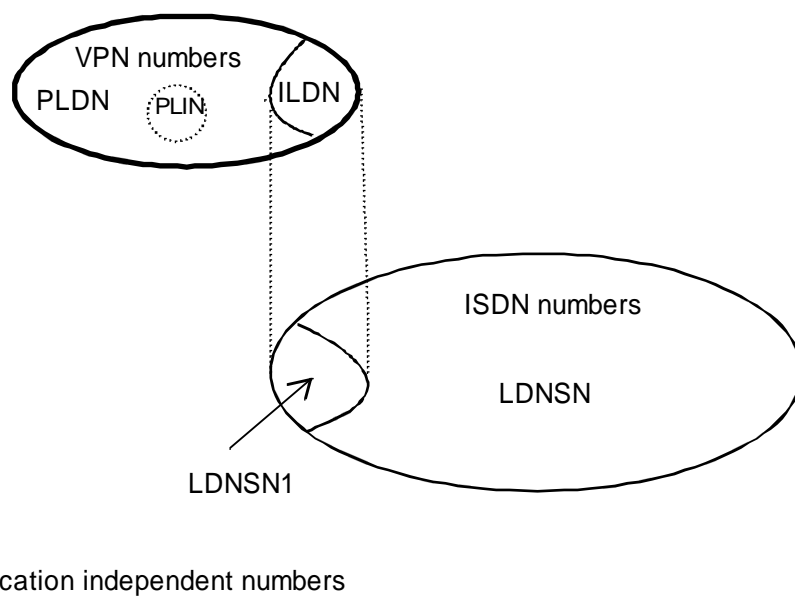
NOTE 1: The structure of LDNSN is NDC + SN as described in CCITT Recommendation E.164 [2].

NOTE 2: The structure of private numbers is given in ETS 300 189 [3].

**Figure 5**

The telecommunication authority assigns LDNSN, and the VPN-owner assigns PLDN and PLIN and organises ILDN.

The maximum length of the public location dependent numbers is 15 digits post time T and 12 digits pre time T. Figure 6 shows the relation between VPN numbers and public location dependent numbers with DDI.



**Figure 6: Relation between VPN numbers and public location dependent numbers**

The length of the private numbers is decided by the VPN-owner, and can either be constant within VPN, or differ from PTNX to PTNX or between individual members of VPN. With different number length from PTNX to PTNX it is normally assumed that the length can unambiguously be decided by analysing the most significant digits of PLDN. The private location dependent numbers and the private location independent numbers can be separated in the same way.

The VPN-internal numbering plan can be based upon the use of:

- a) PLDN and PLIN in parallel with ILDN;
- b) ILDN and PLIN, as shown in table 3;
- c) ILDN, PLDN and PLIN, as shown in table 2.

**Table 2: Example of a VPN numbering plan with public location dependent numbers with DDI to one of the PTNXs**

VPN internal numbering plan	The number indicates	
0	VPN external call	(NOTE 1)
1xxx	PLDN, PTNX1	
2xx	PLDN, PTNX2	
3xx	PLDN, PTNX3	
4x	PLIN (ILDN or PLDN)	(NOTE 2)
5xx	PLIN (ILDN or PLDN)	(NOTE 2)
6-8	Reserve	
9	Call to operator	(NOTE 1)
NOTE 1: Prefixes and access codes are outside the numbering plan.		
NOTE 2: (ILDN or PLDN) indicates that each PLIN terminates on a ILDN or PLDN.		

ILDN or PLDN can normally be used between all members of VPN, but only the members with PLIN can maintain their internal numbers without administrative interference, when moving between PTNXs. With DDI it is not necessary that all members have PLDN. Each member must, however, have one location dependent internal number, either a public (ILDN) or a private (PLDN) number.

If ILDN is to be used internally for calls to more than one PTNX, a conflict situation due to merging ILDNs may arise. Clause 9 describes three methods that can be used for co-ordination of public internal number series to avoid merging ILDNs.

PLDN can always be used in parallel with ILDN to avoid co-ordination with the telecommunication authority.

In the example ILDN for PTNX1 has become part of the VPN numbering plan. The rest of the PTNXs uses PLDN. First digit 4 and 5 indicates that it is a location independent number, and that the database of the telecommunication authority shall be inquired to locate the actual member.

PLIN is translated either to the actual DDI-number (LDNSN1) or to the actual PTNXs main number (LDNSN) and the correct private number (PLDN). Translation will also have to take place for each VPN-internal call outside the own PTNX when using location dependent numbers, either to translate ILDN to LDNSN1, or translate PLDN to LDNSN and forward PLDN to the terminating PTNX. For PTNX-internal calls PLDN and ILDN can be used without translation.

## 7 Private numbers used together with public location independent numbers

### 7.1 Without DDI

Each member of a national or international VPN is allocated a minimum of one private location dependent number (see NOTE). The network is allocated one public location independent number and one or more public location dependent numbers (main numbers), depending on how many PTNXs it includes. The location independent number will be the same for all members of VPN, while each main number will be common for many members, but not all.

NOTE: In addition some or all members may be allocated private location independent numbers.

The number structure will be as shown in figure 7:

CC	+	LDNSN (NOTE 1)	Public location dependent number without DDI
----	---	----------------	--

CC	+	LINSN (NOTE 1)	Public location independent number without DDI
----	---	----------------	--

PLDN (NOTE 2)	Private numbers
PLIN (NOTE 2)	

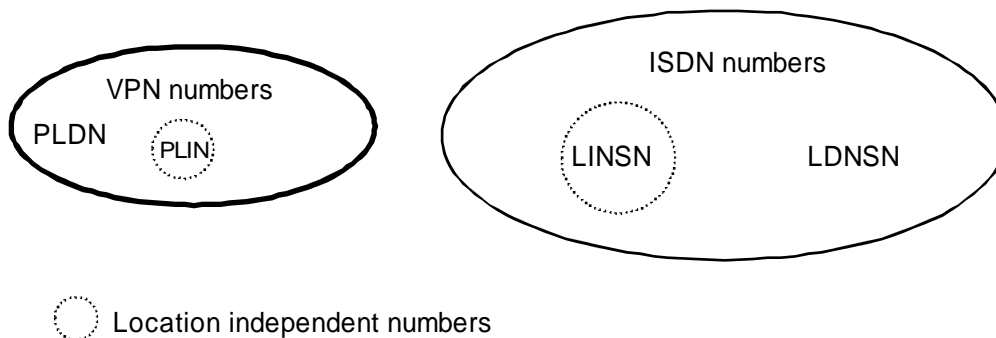
NOTE 1: The structure of LDNSN and LINSN is NDC + SN as described in CCITT Recommendation E.164 [2].

NOTE 2: The structure of private numbers is given in ETS 300 189 [3].

**Figure 7**

The telecommunication authority assigns LDNSN and LINSN, and the VPN-owner assigns PLDN and PLIN.

The maximum length of the public numbers is 15 digits post time T and 12 digits pre time T, while the length of the private number is decided by the VPN-owner. Figure 8 shows the relation between VPN numbers and public location dependent and independent numbers without DDI.



**Figure 8: Relation between VPN numbers and public location dependent and independent numbers without DDI**

The public location independent number functions as universal access number nationally (LINSN) and internationally (CC + LINSN) for calls to VPN, and can be used as a personal number for individuals.

The first digits of the national numbers separate LDNSN from LINSN, and indicate by that whether number translation is necessary or not. LINSN is translated to the actual LDNSN.

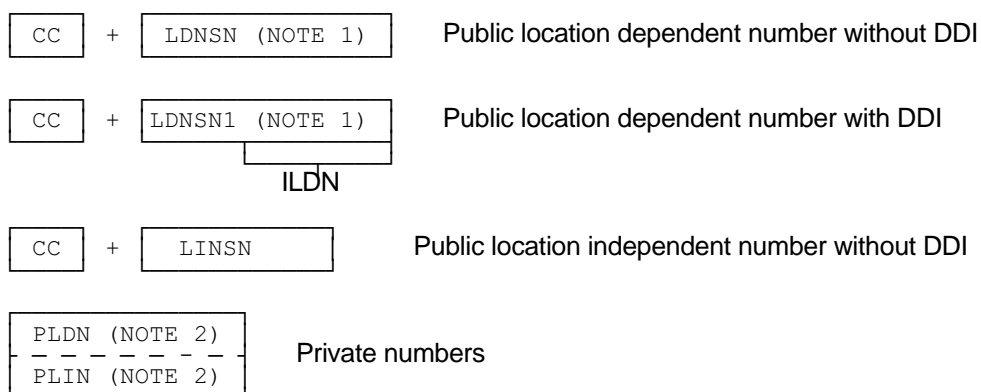
The numbering plan for VPN can be structured as outlined in subclause 6.1, and VPN-internal calls can be generated with PLDN or PLIN as described in the same section.

## 7.2 With DDI via location dependent numbers

Each member with DDI in a national or international VPN is allocated a minimum of one public location dependent number (DDI-number). Members without DDI is allocated one private location dependent number (see NOTE). The network is allocated one public location independent number, and one or more location dependent numbers, depending on how many PTNXs are included. The location independent number for the network is the same for all members of VPN, while the location dependent numbers are common for many members, but not all.

NOTE: In addition some or all members may be allocated private location independent numbers.

The number structure will be as shown in figure 9:



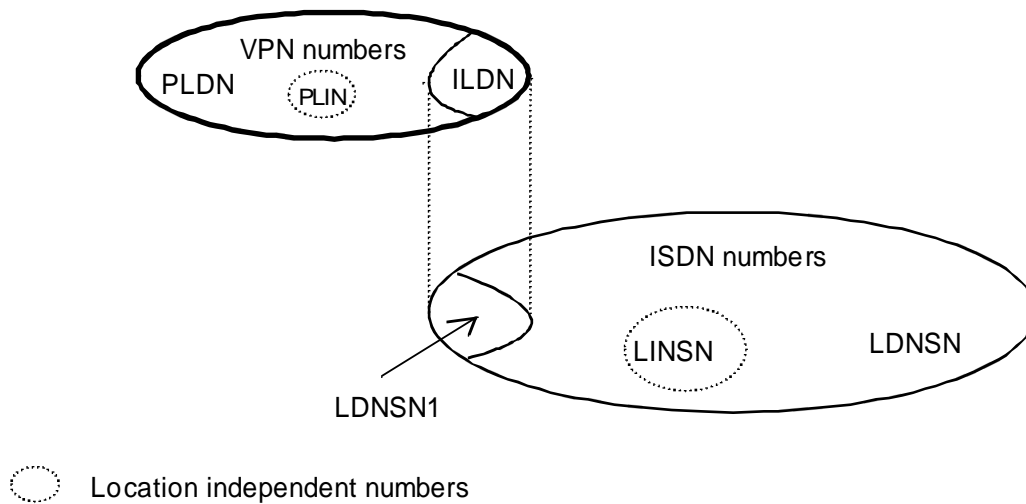
NOTE 1: The structure of LDNSN and LINSN is NDC + SN as described in CCITT Recommendation E.164 [2].

NOTE 2: The structure of private numbers is given in ETS 300 189 [3].

**Figure 9**

The telecommunication authority assigns LDNSN and LINSN, and the VPN-owner assigns all the private numbers and organises ILDN.

The maximum length of the public numbers is 15 digits post time T and 12 digits pre time T, while the length of the private numbers and ILDN is decided by the VPN-owner. Figure 10 shows the relation between VPN numbers and public numbers with DDI via location dependent numbers



**Figure 10: Relation between VPN numbers and public location dependent and independent numbers with DDI via location dependent numbers.**

The public location independent number functions as universal access number nationally (LINSN) and internationally (CC + LINSN) for calls to VPN.

The first digits of the national numbers separate LDNSN from LINSN, and indicate whether number translation is necessary or not. LINSN is normally translated to one of the actual main numbers (LDNSN) or DDI-numbers (LDNSN1). LINSN can be used to serve incoming calls to the company outside normal working hours.

If ILDN is to be used internally for calls to more than one PTNX, a conflict situation due to merging ILDNs may arise. Clause 9 describes three methods that can be used for co-ordination of public internal number series to avoid merging ILDNs.

Use of ILDN between PTNXs will require number translation from ILDN to the member's DDI-number.

The VPN-internal numbering plan can be based upon the use of:

- a) PLDN and PLIN in parallel with ILDN;
- b) ILDN and PLIN, as shown in table 3;
- c) ILDN, PLDN and PLIN, as shown in table 2.



**Table 3: Example of a VPN numbering plan with public location dependent numbers with DDI to all PTNXs.**

VPN internal numbering plan	The number indicates	
0	VPN external call	(NOTE 1)
1xxx	ILDN, PTNX1	
2xx	ILDN, PTNX2	
3xx	ILDN, PTNX3	
4x	PLIN (ILDN)	(NOTE 2)
5xx	PLIN (ILDN)	(NOTE 2)
6-8	Reserve	
9	Call to operator	(NOTE 1)
NOTE 1: Prefixes and access codes are not part of the numbering plan.		
NOTE 2: (ILDN) indicates that each PLIN terminates on a ILDN or PLDN.		

For PTNX-internal calls PLDN and ILDN can be used without translation.

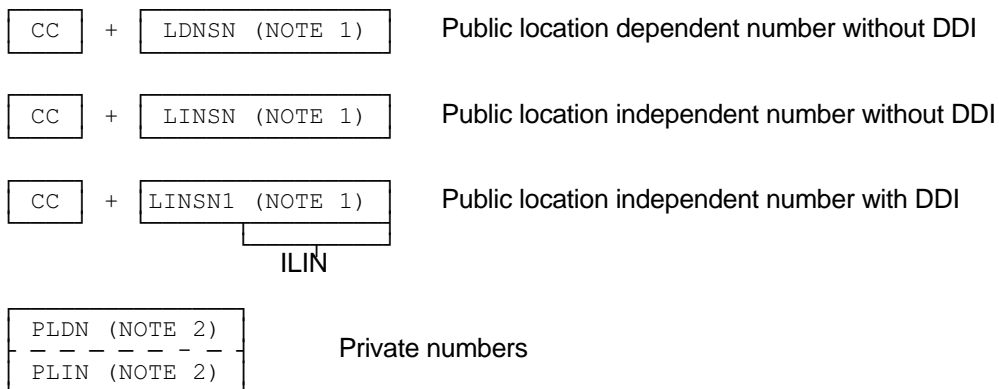
The number of digits in ILDN and PLDN can differ from VPN to VPN, but also between PTNXs within the same VPN. The number of digits in PLIN can differ between individual members of VPN.

### 7.3 With DDI via location independent numbers

Each member with DDI in a national or international VPN is allocated a minimum of one public location independent number and one private location dependent number. Members without DDI are basically allocated one private location dependent number (see NOTE). The network is allocated one public location independent number (universal access number), and one or more public location dependent numbers (main numbers) depending on how many PTNXs it includes. The universal access number will be common for many of the members, but not all.

NOTE: In addition some or all members may be allocated private location independent numbers.

The number structure will be as shown in figure 11:



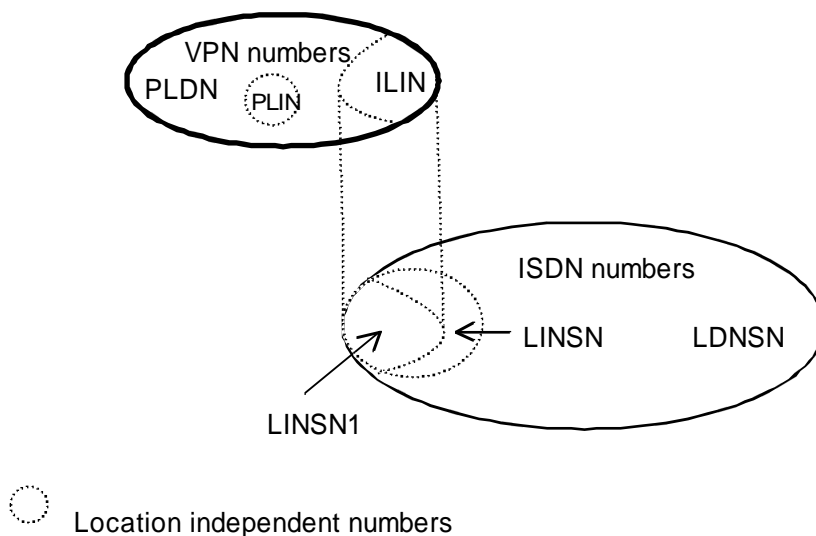
NOTE 1: The structure of LDNSN and LINSN is NDC + SN as described in CCITT Recommendation E.164 [2].

NOTE 2: The structure of private numbers is given in ETS 300 189 [3].

**Figure 11**

The telecommunication authority assigns LDNSN and LINSN, and the VPN-owner assigns all the private numbers and organises ILIN.

The maximum length of the public numbers is 15 digit post time T and 12 digits pre time T, while the length of the private numbers and ILIN is decided by the VPN-owner. Figure 12 shows the relation between VPN numbers and public numbers with DDI via location independent numbers.



**Figure 12: Relation between VPN numbers and public location dependent and independent numbers with DDI via location independent numbers**

The public location independent numbers function as universal access numbers nationally (LINSN) and internationally (CC + LINSN) for calls to VPN and to members who have such numbers.

The first digits of the national numbers separate LDNSN from LINSN, and indicate whether number translation is necessary or not. LINSN is translated to the actual main number (LDNSN) of the VPN, and LINSN1 is translated to the actual main number and PLDN where the member is located.

ILIN can easily be used for VPN-internal calls, if all members have DDI-numbers. If not a co-ordination between the owner and the telecommunication authority has to take place to harmonise the private and public numbers. ILIN is translated to the actual main number and PLDN where the member is located.

The co-ordination should take place after the assigning of the public location independent numbers, because the freedom to choose public numbers is more limited than when choosing private numbers. It is important that the VPN-owner is informed as early as possible about this.

If ILDN is to be used internally for calls to more than one PTNX, a conflict situation due to merging ILDNs may arise. Clause 9 describes three methods that can be used for co-ordination of public internal number series to avoid merging ILDNs.

The VPN-internal numbering plan can be based upon the use of:

- a) PLDN and PLIN in parallel with ILIN;
- b) ILIN and PLIN, as shown in table 4;
- c) ILIN, PLDN and PLIN, as shown in table 5.

NOTE: Each location independent number in tables 4 and 5 must terminate on a location dependent number (PLDN), which may be hidden for the caller.

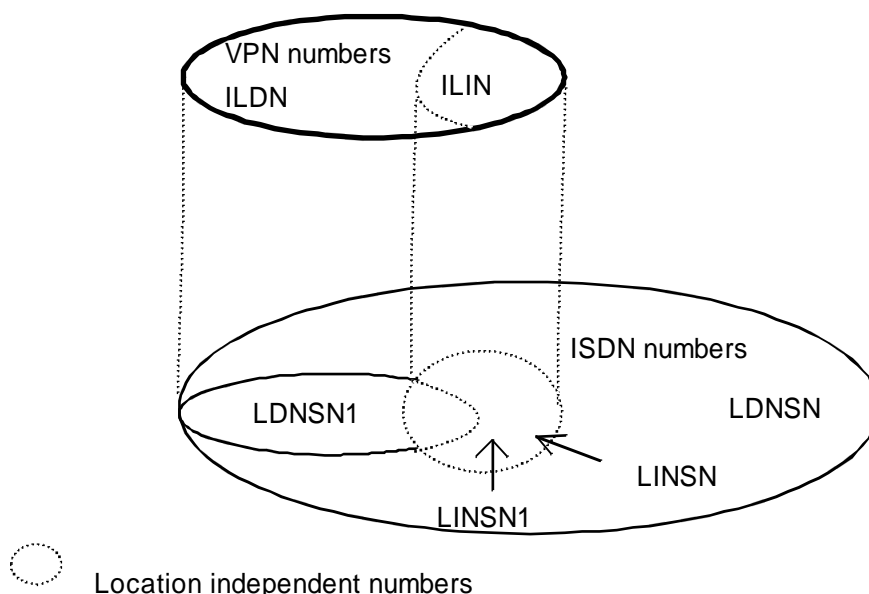
**Table 4: Example of a VPN numbering plan with location independent numbers to all members**

VPN internal numbering plan	The number indicates
0	VPN external call (NOTE 1)
1xxx	ILDN (PLDN) (NOTE 2)
2xx	ILDN (PLDN) (NOTE 2)
3xx	ILDN (PLDN) (NOTE 2)
4x	PLIN (PLDN) (NOTE 2)
5xx	PLIN (PLDN) (NOTE 2)
6-8	Reserve
9	Call to operator (NOTE 1)
NOTE 1: Prefixes and access codes are outside the numbering plan.	
NOTE 2: (PLDN) indicates that each PLIN terminates on a PLDN.	



The telecommunication authority assigns all numbers, and the VPN-owner organises ILDN and ILIN.

The maximum length of the public numbers is 15 digits post time T and 12 digits pre time T, while the length of ILDN and ILIN is decided by the VPN-owner. Figure 14 shows the relation between VPN numbers and public numbers with DDI via both location dependent and location independent numbers.



**Figure 14: Relation between VPN numbers and public location dependent and independent numbers with DDI via both location dependent and independent numbers without private numbers.**

The public location independent numbers function as universal access numbers nationally (LINSN) and internationally (CC+LINSN) for calls to VPN and to members which have such numbers. Since the members may have public location dependent numbers with DDI (LDNSN1) also, the owner decides which one is going to have one and which one is going to have two DDI-numbers.

The first digits of the national numbers separate LDNSN from LINSN, and indicate whether number translation is necessary or not. LINSN is translated to the actual location dependent number (LDNSN), and LINSN1 is translated to the actual public location dependent number with DDI (LDNSN1).

All internal calls use public internal numbers.

ILIN can be used for VPN-internal calls between and to members who have such numbers, but it always requires number translation. ILIN is translated to the actual LDNSN1. The number of digits in ILIN can differ from VPN to VPN, but also between members of the same VPN. ILIN functions as internal universal numbers.

ILDN can be used for VPN-internal calls too, but this would require internal harmonisation or co-ordination with the telecommunication authority, as described in Clause 9.

For PTNX-internal calls ILDN can be used without number translation.

The internal numbering plan can either be based on location independent internal numbers alone as shown in table 6, or on a combination of location dependent and independent internal numbers as shown in table 7.

**Table 6: Example of a VPN numbering plan with public location independent numbers with DDI to all members**

VPN internal numbering plan	The number indicates
0	VPN external call (NOTE 1)
1xxx	ILDN, PTNX1
2xx	ILDN, PTNX2
3xx	ILDN,, PTNX3
4x	ILIN (ILDN) (NOTE 2)
5xx	ILIN (ILDN) (NOTE 2)
6-8	Reserve
9	Call to operator (NOTE 1)
NOTE 1: Prefixes and access codes are not part of the numbering plan.	
NOTE 2: (ILDN) indicates that each ILIN terminates on an ILDN.	

**Table 7: Example of a VPN numbering plan with public location dependent and/or location independent numbers with DDI to all members**

VPN internal numbering plan	The number indicates
0	VPN external call (NOTE 1)
1xxx	ILDN, PTNX1
2xx	ILDN, PTNX2
3xx	ILDN,, PTNX3
4x	ILIN (ILDN) (NOTE 2)
5xx	ILIN (ILDN) (NOTE 2)
6-8	Reserve
9	Call to operator (NOTE 1)
NOTE 1: Prefixes and access codes are not part of the numbering plan.	
NOTE 2: (ILDN) indicates that each ILIN terminates on an ILDN.	

## 9 Merging internal numbers

ILDN can easily be used as internal number within a PTNX, but using it for all VPN-internal calls will require that all the DDI-series within VPN are coordinated. Table 8 shows an example of merging ILDNs in a VPN with 3 PTNXs and DDI to all of them.

Table 8: Example of a conflict situation with merging ILDNs

PTNX number	ISDN number series	ILDN
1	52 34 1x xx	1x xx
2	27 12 21 xx	1 xx
3	65 52 3x xx	3x xx

Four methods for co-ordination should be mentioned. An example of how these methods work is given in table 9:

- the merging ILDNs is separated by replacing one of the series with ILIN. Requires cooperation with the telecommunication authority;
- change DDI-series on one or more of the PTNXs within VPN. Requires cooperation with the telecommunication authority;
- adjust the number length of ILDN and ILIN to avoid merging internal number series. Can be accomplished almost without cooperation with the telecommunication authority, but will not always be possible;
- the merging ILDNs is separated by replacing one of the series with PLDN. Requires no co-operation with the telecommunication authority.

Table 9: Four methods to co-ordinate internal number series

DDI-series (NOTE 3)	a) ILDN	b) Replacing one ILDN with ILIN	c) Changing one DDI-series	d) Adjusting the length of one ILDN	Replacing one ILDN with PLDN
27 12 21 xx	1xx	4xx (ILIN)	2xx (NOTE 1)	21xx (NOTE 2)	5xx
65 52 3x xx	3xxx	3xxx	3xxx	3xxx	3xxx
52 34 1x xx	1xxx	1xxx	1xxx	1xxx	1xxx
NOTE 1:	The DDI-series 27 12 21 xx is changed to 27 16 12 xx.				
NOTE 2:	The ILDN series is increased by one digit.				
NOTE 3:	The DDI-series remain unchanged.				

## **10 Members of more than one VPN**

Individuals who are members of more than one VPN will be allocated a minimum of one VPN-internal number from each of the VPNs that he is a member of.

It is a matter of customer user procedures to establish access to any specific VPN when there is a choice of more than one VPN. Alternatively if bilateral agreements can be made between the owners of two VPNs then an integrated dialling plan could be provided by the networks supporting VPNs. Further study is necessary.

## **11 Managing the numbering plan**

Members of a VPN may be connected to the public network in different locations all over the country or all over the world.

When establishing a VPN for the first time some of the members will of course have old DDI-series that they used prior to the VPN-period. Some members have never had DDI and could only be reached through the help of an operator.

From a numbering point of view VPN can be looked at as one single item with connections to the public network scattered all over a country or the world. The most important part of managing a numbering plan for a VPN will be to ensure that most of the DDI-series, preferably all, have unique least significant digits that can be used for VPN-internal calls. If that is not possible without major changes in the existing numbering plans of the participating PTNXs, then the different alternatives identified within this report should be considered.

Usually the allocation of numbers to subscribers are done locally/regionally in such a way that each local/regional manager has responsibility for a part of the national public numbering plan. The aim in managing numbering plans for VPNs must be to ensure that the internal part of the DDI-numbers are unambiguous and unique to minimise the possible disadvantages for the VPN. This is a national responsibility, and should be handled from one national manager.

## **12 Evaluation**

Annex A contains an evaluation of some aspects that should be considered when implementing numbering plans for VPN.



## **Annex A: An evaluation of some aspects that should be considered when implementing numbering plans for VPN**

The evaluation concerns:

- the VPN-owner's disposal of internal numbers;
- the number structure for VPN-internal and national calls;
- the extent of co-ordination between the telecommunication administration and the VPN-owner;
- the ability to maintain the numbers without administrative interference when moving;
- possible requirements to the public numbering plan;
- number translation.

Annex B contains a summary of the evaluation, and in the following paragraphs some comments are given.

Most of the methods give the VPN-owner disposal of the internal numbers, but this right is diminished with increasing demands for DDI and location independence. The greatest freedom is attained without DDI. With DDI via the location dependent and location independent numbers and without private numbers the owner can only organise the connection between the location dependent and independent numbers.

All national incoming calls to VPN use national numbers with or without a trunk prefix. With DDI these numbers identify individual members of VPN, and the least significant digits can be used for VPN-internal calls. The members who have a location independent number in addition to the location dependent number can maintain this when moving. It is only the public location independent number that gives the members this advantage for incoming calls.

It should be mentioned that also individuals, without membership in a VPN, can have public location independent numbers. Such numbers should be attractive for people who know that they will move a great deal during their lifetime, and would like to have a fixed number for incoming calls. The public location independent numbers cover this, and is the individual's universal number.

For VPN-internal calls the method chosen will first of all depend upon the will to give individual members DDI or not, and secondly to what extent it should be attached importance to have the least significant digits of the DDI-numbers corresponding to the VPN-internal numbers. With or without DDI the internal numbering plan can be based on private numbers only. With DDI the result may be, that the VPN-internal numbers and the least significant digits of the DDI-series do not correspond. The VPN-owner can decide whether he will base the DDI on location dependent and/or independent numbers. Combined with private numbers the owner can decide who is going to have internal location independence and who is going to have nationwide location independence.

All VPN-external calls start with an opening prefix which gives the members access to the public network. 0 (zero) has gradually become a de-facto standard on this prefix, and it should be considered if this should become an ETS. In a world with increasing personal mobility this seems to be a reasonable requirement.

When structuring the internal numbering plan, the owner should realise that with increasing demands for correspondence between the VPN-internal numbers and the least significant digits of the DDI-series and with increasing demands for location independence, the requirements on co-ordination between the telecommunication authority and the VPN-owner increases. Without DDI no co-ordination is necessary, but if the DDI shall take place through both location dependent and location independent numbers it would require major co-ordination between the parties involved.

All location independent numbers are unaffected when the subscriber moves, but it is only the public location independent numbers that are nationwide. The private location independent numbers are unaffected as long as the moving takes place within VPN. The public location independent numbers will later also give global coverage.

All use of public location independent numbers requires reservation of number series for this purpose. Private numbers do not affect the public numbering plan.

It should be noticed that it is not only the use of location independent numbers that requires number translation. VPN-internal calls between members of different PTNXs through the use of internal numbers, will also require number translation.

**Annex B: A summary of the evaluation of different methods for the implementation of numbering plans for VPN**

**Table B.1**

The evaluation concerns	Private numbers used together with public location dependent numbers				Private numbers used together with public location independent numbers				With only public numbers			
	Without DDI		With DDI via LDNN		Without DDI		With DDI via LDNN		With DDI via LINN		With DDI via LDNN + LINN	
Can the VPN-owner decide the internal numbers?	Yes		Yes with use of PLIN		Yes with use of PLDN/PLIN		Yes with use of PLIN, no for the members with ILDN		Yes with of PLDN/P no for the members with ILIN		No, only the right to organise the internal numbers	
Number structure for inc. nat. calls	LDNSN		LDNSN LDNSN1 (NOTE 1)		LINSN(NOTE 1) LDNSN(NOTE 1)		LDNSN1 LDNSN/ LDNSN (NOTE 1)		LDNSN1 LINSN1 LDNSN/ LINSN (NOTE 1)		LINSN1 LDNSN/ LINSN (NOTE 1)	
Number structure for VPN-internal calls	PLDN, PLIN		ILDN (NOTE 2) ILDN, PLIN (NOTE 3) PLDN, PLIN (NOTE 5) ILDN, PLDN, PLIN (NOTE 3)		PLDN, PLIN -		ILDN (NOTE 2) ILDN, PLIN (NOTE 3) PLDN, PLIN (NOTE 5) ILDN, PLDN, PLIN (NOTE 3)		ILIN (NOTE 4) ILIN, PLIN (NOTE 3) PLDN, PLIN LIN, PLDN, PLIN (NOTE 3)		ILIN (NOTE 4) ILDN (NOTE 2) ILDN, ILIN (NOTE 3)	
Number structure for outg. calls	+ LDNSN + LINSN		+ LDNSN + LINSN		+ LDNSN + LINSN		+ LDNSN + LINSN		+ LDNS + LINS		+ LDNSN + LINSN	
Coordination with the tele-comm. auth.	None		Some		None		Much		Some		Major	
Can the numbers be maintained when moving?	Inc. calls	Local calls	Inc. calls	Local calls	Inc. call	Local calls	Inc. calls	Local calls	Inc. calls	Local calls	Inc. calls	Local calls
	No	Yes, PLIN	No	Yes, PLIN	Yes, LINN	Yes, PLIN	Yes, LINN	Yes, PLIN	Yes, LINN	Yes, ILIN/ PLIN	Yes, LINN	Yes, ILIN
Req. to the numbering plan	None		None		Number series for location independent numbers							
Number translation? (NOTE 6)	Yes with PLIN partly with PLDN		Yes with PLIN, partly with PLDN and ILDN		Yes with LINSN and PLIN, partly with PLDN		Yes with LINSN and PLIN, partly with PLDN and ILDN		Yes with LINSN and PLIN, partly with PLDN		Yes with LINSN and ILIN	
<p>Legend:</p> <p>+ = Represents optional network specific digits or other methods available to separate outgoing calls from VPN-internal calls.</p> <p>LDNN = Location Dependent National Number.</p> <p>LINN = Location Independent National Number.</p> <p>LDNSN = Location Dependent National Significant Number.</p> <p>LINSN = Location Independent National Significant Number.</p> <p>PLDN = Private Location Dependent Number.</p> <p>PLIN = Private Location Independent Number.</p> <p>ILDN = Internal Location Dependent Number.</p> <p>ILIN = Internal Location Independent Number.</p> <p>LDNSN1 = Location Dependent National Significant Number with DDI.</p> <p>LINSN1 = Location Independent National Significant Number with DDI.</p> <p>X/Y = X or Y.</p> <p>X,Y = X and/or Y.</p> <p>X,Y,Z = X and/or Y and/or Z.</p>												
<p>NOTE 1: Calls to the main numbers of VPN.</p> <p>NOTE 2: Requires major internal harmonisation of the internal numbers.</p> <p>NOTE 3: Requires internal harmonisation of the internal numbers.</p> <p>NOTE 4: Internal harmonisation not required.</p> <p>NOTE 5: In parallel with ILDN.</p> <p>NOTE 6: Translation is not necessary for PTNX internal calls.</p>												

## History

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