ETSI

Network Aspects;
Numbering and addressing for the Memorandum Of Understanding (MOU) on Integrated Services Digital Network (ISDN) (Priorities 1 and 2)

ETSI

European Telecommunications Standards Institute

Contents

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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   Introduction

The purpose of this ETR is to explain how CCITT international recommendations for Numbering and Addressing relate to the Services (Priority 1 and 2) declared within the Memorandum of Understanding (MOU) for the Integrated Services Digital Network (ISDN).

Additional explanations of the CCITT international recommendations are also given, so as to allow greater understanding of them, their implementation and effect within Europe.

Relevant CCITT Recommendations

E.163 Numbering plan for the international telephone service.
E.164 Numbering plan for the ISDN era.
E.165 Timetable for E.164 capability implementation.
E.166 Numbering plan interworking for the ISDN era.
E.167 ISDN network identification codes.

X.121 International numbering plan for data networks.
X.122 Numbering plan interworking for data networks in the short term.
X.180 Administrative arrangements for international CUGs.
X.200 Reference model of OSI for CCITT applications.

I.330 ISDN numbering and addressing principles.
I.331 Numbering for the ISDN era (E.164).
I.333 Principles for terminal selection.
I.334 Principles relating ISDN numbering and addressing to OSI.

2   Long term evolution

2.1   CCITT Recommendation E.164

This CCITT recommendation has been designed to allow and cater for, long term evolution. Because of this it provides an excellent foundation for the ISDN now and in the future.

2.2   Beyond CCITT Recommendation E.164

Because of the way CCITT Recommendation E.164 has been structured it is unlikely that it will be replaced or modified in any way.

The approach will be to build upon CCITT Recommendation E.164 in a structured fashion that will capitalise upon its standards. Examples of this may well be within the deployment and structuring of aspects such as location independent numbering.

2.3   Time "T"

Recognising the potential difficulties for some administrations in meeting the requirements of CCITT Recommendation E.164, CCITT have proposed that existing networks should not be required to interwork with ISDNs using the increased capacity before 31st December 1996, this being defined as Time "T". The concept and application for Time "T" is described in CCITT Recommendation E.165.

It is recommended that administrations avail themselves of every opportunity for early compliance with the provisions of CCITT Recommendation E.165.
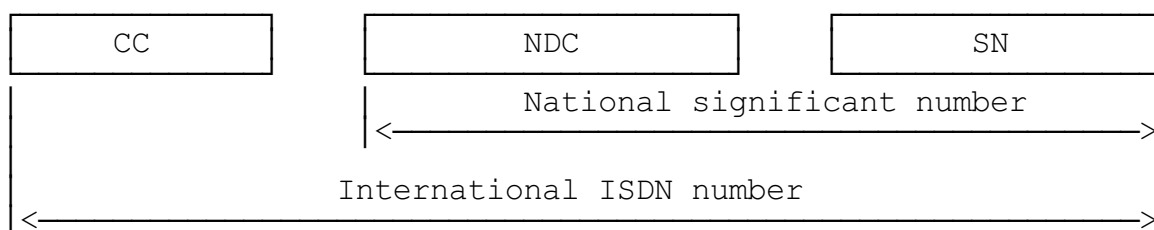
3   Numbering principles

CCITT Recommendation E.164 documents the numbering plan for the ISDN era. In evolving their Public Switched Telephone Networks (PSTNs) to ISDNs all administrations are expected to enhance the capability of their systems to accommodate the requirements for increased international number length from 12 to 15 digits.

It has also been recognised that there is a need to transport other network numbering and addressing information transparently. For this purpose the concept of Sub-addressing has been introduced.

3.2   NDC concept

The National Destination Code (NDC) is part of the national significant number.

```
┌──────────────────┐      ┌──────────────────┐      ┌──────────────────┐
│        CC        │      │       NDC        │      │        SN        │
└──────────────────┘      └──────────────────┘      └──────────────────┘
│                          National significant number                   │
│                         │<─────────────────────────────────────────>│  │
│                 International ISDN number                              │
│<─────────────────────────────────────────────────────────────────>│
```

> NOTE 1:   CC: Country code as defined by CCITT Recommendation E.163.
> NDC: National Destination Code.
> SN: Subscriber Number.

> NOTE 2:   National and international prefixes are excluded as they are not considered to be part of the ISDN number.

Figure 1: Number structure

The NDC may be used as a Destination Network (DN), a Trunk Code (TC) or any combination of these. The NDC will have one of the possible structures shown in figure 2. The composition of NDC is a national matter.

```
┌──────────┐
│   D N    │              Destination Network code
└──────────┘

┌──────────┐
│   T C    │              Trunk Code
└──────────┘

┌──────────┐  ┌──────────┐
│   D N    │  │   T C    │  Destination Network code plus Trunk Code
└──────────┘  └──────────┘

┌──────────┐  ┌──────────┐
│   T C    │  │   D N    │  Trunk Code plus Destination Network code
└──────────┘  └──────────┘
```

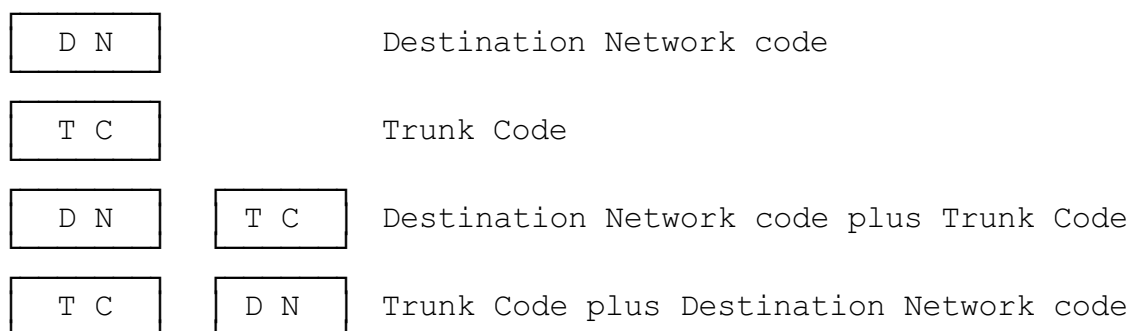**Figure 2: Possible structures of NDC**

Some administrations may find it advantageous to establish one and only one numbering area, and may have no need for a destination network identification outside the subscriber number. In such countries the NDC is superfluous and can be avoided.

Alternatively, other administrations may wish to exploit the NDC to support multiple operators combined with Trunk Codes.

3.4 Number length

CCITT Recommendation E.164 states the maximum number length as 15 digits. Although CCITT Recommendation E.164 will not become mandatory until 1996, it is recommended that wherever possible this standard is adopted.

Prefixes are not considered to be part of the international ISDN number and consequently not taken account of for international number length. When considering national schemes, nodal analysis may need to consider prefixes in overall number length.

3.3 Sub-address

The term Sub-address is defined in CCITT Recommendation E.164. The maximum length for a Sub-address is 40 digits/20 octets. The Sub-address is an additional addressing mechanism that may be applied as a supplement to the E.164 number. It may be considered as equivalent to the X.25 Network Address Extension (NAE). However, it must be made absolutely clear, that it is not a method of providing additional digits or an extension to an E.164 number.

Assuming the above, the following points can be made;

a) The functions related to the setting up of a call between two customer/network interfaces on a public ISDN are determined and performed solely on the basis of analysis of the ISDN number.

b) Public networks are not required to analyse the content of a Sub-address in any way, either for the purpose of setting up a connection to a subscriber/network interface or for establishing special call parameters relating to charging, quality of service etc.

c) Sub-address information within the ISDN must be conveyed transparently between the originating and terminating users without alteration to the structure or content. Exceptions to this is allowed when the Sub-address exceeds the authorised length for any fixed subscriber or network capability. In this circumstance none of the Sub-address will be sent to the called terminal for the following reasons:

The Sub-address is not only used to address a certain piece of terminal equipment (where a default code could be assumed on deletion of the Sub-address sent by the calling party), but also to address processes within functional entities of the called party. In this case the network will not be able to determine, whether the loss of information due to truncation of the Sub-address can be compensated for or not;

A Sub-address which is too long for the supporting networks, but within the agreed standards, could be as a result of an attempted fraudulent use of the transmitting mechanisms, and therefore, should not be transmitted.

d) In cases where interworking between different types of network is required, some mapping of the Sub-address information may be necessary.

e) In the context of OSI, Sub-addressing is a network layer function.

4 Terminal selection

4.1 General

CCITT Recommendation I.330 (ISDN numbering and addressing principles) describes the general concepts, principles and requirements for addressing; covering reference points S & T (located at subscribers' premises) and other functions for communications with terminals.

The MoU on ISDN defines a physical interface at the reference point T as the boundary between the network and the customer equipment. Hence a "virtual interface" at reference point T (i.e. for an integrated NT2 + NT1 configuration) will not be supported. The addressing of a "virtual interface" at reference point S (i.e. TA + NT1 configuration) should be supported.

The numbering plan for ISDN is E.164 (also known as I.331). In addition to this, CCITT Recommendation I.333 defines the procedures and options for terminal selection.

An ISDN number identifies any of the interfaces at reference points S or T. However, additional identifiers or terminal selection functions are needed in those cases where a number is not sufficient to make clear distinction among terminals in a multi-terminal configuration, in particular a basic access passive bus.

CCITT Recommendation I.333 addresses the general principles for the identification of;

- specific individual terminals or,
- groups of terminals where no further distinction is required by the user.

4.2 Relationship to OSI model

CCITT Recommendation I.334, described the "Principles relating ISDN numbers/Sub-addresses to the Open Systems Interconnect (OSI) reference model network layer addresses".

To achieve the routing of information within the OSI environment it may be useful to establish a correspondence between an ISDN address (ISDN number with possible Sub-address) and an X.200 network layer service access point (NSAP). The ISDN address may include the OSI network layer address and thereby offer a means to identify NSAPs. These cases are distinguished in relating an ISDN address to a particular OSI NSAP address (see subclause 1.2 of CCITT Recommendation I.334).

4.3 Service identification capability (HLC, DDI and MSN)

The ISDN number and the Bearer Capability (BC) constitute essential information for the identification of terminals the transfer of which is mandatory with every call request. In those cases where this is insufficient other optional information is needed. For telematic terminals, the guide-lines are given in CCITT Recommendation T.90. CCITT Recommendation I.333, clause 4, categorises any information which has to, or may, be used for the terminal selection process. This information may be service oriented or terminal oriented. A choice has to be made by the end users of which information should be used for their particular terminal installation. The following service/terminal identification capabilities are available:

- an ISDN number (mandatory);

- bearer capability (mandatory);

- other lower layer functionality (optional);

- high layer functionality (optional);

- DDI, MSN and SUB are all acceptable collectively or individually;

  (NOTE: SUB is not valid for ISDN PMBS terminal selection).

- ISDN/non-ISDN call source indicator (Progress indicator) (essential, to be provided by the network in the case of network interworking e.g. PSTN > ISDN);

- Local exchange functionality (user's Logical Terminal Profiles) (optional capability of the network, implementation is for national consideration).

All the above listed capabilities are supported by D-channel call set up protocols (refer to CCITT Recommendations Q.931, Q.932 and Q.921). In the Appendices A, B, C and D to CCITT Recommendation I.333 examples are given to demonstrate the possible use of the above capabilities.

4.4 Use of Sub-address

In an ISDN, a terminal selection function, in addition to the terminal E.164 subscriber number, may be required where multi-terminal installations are accessed via a user/network interface. The particular consideration for the MOU on ISDN is the terminal configuration of a passive bus.

The following limitations should be noted:

- Sub-addressing will not be available from PSTNs and ISDNs which do not provide it;

- Full international use of Sub-addressing in ISDN may not be possible due to limitations in some early national implementations of ISDN signalling protocols.

5 Impact on MOU declared services

5.1 Basic services

5.1.1 Video telephony

A videotelephony terminal may be called using an E.164 number. The videotelephony terminal is connected in a multi-terminal environment (e.g. a passive bus). The terminal is selected by using DDI/MSN or Sub-address. The use of HLC and SUB are national options which may be extended internationally with a bilateral agreement, although this would be limited.

5.1.2 Videotex (alpha syntax)

A videotex centre is called by using a special service number or an ordinary telephone number. The number is an E.164 number without any constraints. The type of videotex service has no significance regarding the number because all the service specific information is transmitted in-band after call set up.

5.1.3 X.31 case b

An X.31 terminal on an ISDN can always be identified by an E.164 number which is its native numbering plan. It is necessary to use E.164 numbers for terminal selection procedures on incoming calls for DDI or MSN supplementary services (NOTE: SUB is not used for terminal selection for ISDN PMBS). There is one exception to this, and that is, the case where no notification class is used on the D-channel (see ETS 300 007). In this case, and this case alone, it is acceptable to use an X.121 number.

The network requires the occupation of two numbers to handle the service (E.164 and X.121), although the customer has visibility of only the X.121 number for this service. The E.164 number is used to identify the logical connection to the D-channel of the ISDN terminal which has been called from another subscriber. This is regarded as a short term solution. It is only considered acceptable as this aspect can be considered as an extension to the PSPDN within the service of X.31 case b.

For outgoing and incoming calls numbering interworking procedures can be used as defined in E.166 and X.122. This means that before Time "T" (see CCITT Recommendation E.165) prefix and escape (ONSD) sequences are used.

5.2 Supplementary services

5.2.1 Calling Line Identity Procedures (CLIP)

This is a service available to the called customer, allowing presentation of the calling party number.

The calling line identity shall be passed internationally in the format specified in CCITT Recommendation E.164, i.e. Country Code + National Destination Code + Subscriber Number, plus Sub-address if required.

The maximum length of an international number will be 12 digits before time "T", although international number lengths of up to 15 digits may be used by bilateral agreement. After time "T" the maximum international number length will be 15 digits. This excludes the Sub-address, which may be up to 40 digits in length.

The international gateway will be required to perform the necessary functions to interface the international format of the Calling Line Identity to the format required in the national networks. This may mean inserting the international prefix or country code. Sub-address information is not required to be processed within the public network.

It is the responsibility of the originating network to mark a Calling Line Identity as either network provided, or user provided, verified and passed. This marking is then associated with the Calling Line Identity and passed to the terminating network.

5.2.2 Calling Line Identity Restriction (CLIR)

This is a service available to the calling customer, enabling that customer to prevent release of their Calling Line Identity to the called customer.

It is the responsibility of the originating network to mark a Calling Line Identity as restricted or unrestricted. This marking is then associated with the Calling Line Identity and passed to the terminating network. Passing the Calling Line Identity to the terminating network would allow for network identification of the calling customer, should this be required e.g. for MCID. However, as a national option where no bilateral agreement exists with another administration, restricted CLIs may be blocked in the originating network. Where a bilateral agreement does exist, CLIs which are passed on are considered to be the responsibility of the terminating network to ensure that a restricted Calling Line Identity is not passed to the called customer.

5.2.3 Direct Dialling In (DDI)

Direct Dialling In is a supplementary service which is described and defined in CCITT Recommendation I.251.1. DDI is based upon the use of numbers in the ISDN number domain (E.164). The allocation of ISDN numbers to each terminal to be identified in a multi-terminal installation is agreed as the most practical method of terminal selection. DDI is recommended as the method for accessing terminals on ISPBXs.

The use of DDI will enable ISDN terminals to be selected by users on;

- an ISDN,
- a PSTN,
- a dedicated data network.

Full international access will be possible. DDI has to be supported by all countries that signed the MOU on ISDN. DDI may have severe consequences for the necessary national number capacity of each country.

5.2.4 Multiple Subscriber Number (MSN)

Multiple Subscriber Number is a supplementary service which is defined and described in CCITT Recommendation I.251.2. MSN is based upon the use of numbers in the ISDN number domain (E.164). The allocation of ISDN numbers to each terminal, to be identified, in a multi-terminal installation is agreed as the most practical method of terminal selection. MSN is recommended as the method for accessing terminals on a basic access passive bus.

The use of MSN will enable ISDN terminals to be selected by users on;

- an ISDN,
- a PSTN,
- a dedicated data network.

Full international access will be possible. MSN has to be supported by all countries that signed the MOU on ISDN. MSN may have consequences for the necessary national number capacity of each country.

5.2.5 Closed User Group (CUG)

Closed User Groups (CUGs) when implemented in co-operation with other networks requires that the provision of an interlock code structure by validation of call requests within the CUG can be achieved. The CUG interlock code (International CUG Number - ICN) structure used by dedicated data networks is defined in CCITT Recommendation X.180.

The interlock code comprises of two parts. The first part (A) identifies the co-ordinating administration for the CUG; the second part (B) gives the unique identity of the CUG. In dedicated data networks the X.121 DNIC assigned to the network for numbering purposes offers a convenient basis for CUG administration identification. There is no direct relationship between X.121 numbers for DTE/DCE interface numbering and CUG interlock codes.

For ISDN based CUGs it is inappropriate to use DNICs for the part A function of the interlock code. The ideal, but impractical, approach would be the definition of a network independent interlock code series to replace that in X.180 which could be used by all networks to ensure security on CUG interworking calls. CCITT are currently considering the structure of CUG codes for ISDN.

An interim agreement pending the full definition of ISDN CUG interlock structure is required for CUG services. It is therefore proposed that an expedient interlock code based upon CCITT Recommendation E.167 should be adopted. The part A of the code should comprise a pseudo DNIC formed by preceding the TCC (Telephone Country Code) by the digit 9 or digit 0. Currently digit 0 is used in preference to digit 9.

A	B
ICCX/ICCC/ICXX	
0 or 9 + TCC	

Figure 3

Where the TCC is less than 3 digits, filler digits, in accordance with CCITT Recommendation E.167 may be required to imitate the 4 digit DNIC.

Security on CUGs interworking over ISDNs and PDNs is assured by the uniqueness of the coding.

In an environment where there is more than one operator within a country, then one of two approaches should be considered when allocating CUG interlock codes;

a)   for those countries that have a two digit country code then part A will be of the form;

```
┌────────┐
│  ICCX  │
└────────┘ ....Part A
```

Figure 4

X is a padding digit and can be used to allow between one and ten operators to administrate CUG interlock codes; X = 0-9.

If there are more than 10 operators then either of the alternatives within b) may be used, or a combination of both a) and b) for a mix of small and large operators.

b)   For those countries that have a three digit country code then part A will be of the form;

```
┌────────┐
│  ICCC  │
└────────┘ ....Part A
```

Figure 5

In this case either one nominated operator or administration will have to control the allocation of CUG interlock codes or the binary codes should be split into ranges within part B to pre-allocate blocks of CUG interlock codes to operators.

It is important to note that when a CUG environment is required for call set-up then the interlock code will traverse operator and network boundaries unchanged.

5.2.6   Sub-addressing (SUB)

Since the application of Sub-addressing is not mandatory for the MOU on ISDN, the impact of Sub-addressing on MOU declared services is considered minimal as long as the Sub-address is not used to transport that portion of addressing information which is essential for a successful call-setup. For ISDN packet Mode Bearer Services the Sub-address supplementary service is not used for terminal selection.

OSI NSAP addresses of up to 40 digits/20 octets may be conveyed between OSI End Systems using the Sub-address mechanism. Non-OSI supplementary address information of up to 40 digits/20 octets may also be conveyed using the same Sub-address mechanisms.

5.2.7   Connected Line Identity Presentation (CLIP)

This is a service available to the calling customer, allowing presentation of the called party number.

The international format of the Connected Line Identity, will be as for the Calling Line Identity, including Sub-address if required.

The international gateway will be required to perform the necessary functions to interface the international format of the Connected Line Identity to the format required in the national networks. This may mean inserting the international prefix or country code. Sub-address information is not required to be processed within the public network.

It is the responsibility of the terminating network to mark a Connected Line Identity as either network provided, or user provided, verified and passed. This marking is then associated with the Connected Line Identity and passed to the originating network.

5.2.8 Connected Line Identity Restriction (CLIR)

This is a service available to the called customer, enabling that customer to prevent release of their Connected Line Identity to the calling customer.

It is the responsibility of the terminating network to mark a Connected Line Identity as restricted or unrestricted. This marking is then associated with the Connected Line Identity and passed to the originating network. It is then the responsibility of, subject to bilateral agreements if necessary, the originating network to ensure that a restricted Connected Line Identity is not passed to the calling customer.

5.2.9 Malicious Call Identification (MCID)

MCID uses the Calling Line Identity to record the origin of a malicious call. The terminating network operator may then release the Calling Line Identity to a responsible authority, e.g. the Police, but not the called customer if the Calling Line Identity is restricted. MCID will override Calling Line Identity Restriction. Backward holding of the connection is a national option. Numbering implications are as for the Calling Line Identity Presentation service.

5.2.10 Meet Me Conference (MMC)

Any E.164 number may be used. Nationally the NDC (National Destination Code) may be exploited to identify service node(s) of the network.

5.2.11 Freephone service (FPH)

A freephone number consists of two parts, one identifying the service and the other identifying the served subscriber/customer. If the service is provided by more Administrations or RPOAs (Recognised Private Operating Agencys), the service identification part shall identify the Administration/RPOA which serves the subscriber/customer. Depending on service architecture it may be necessary to identify the particular service node that serves the subscriber. In this case additional digit(s) are added to the service identification part.

It is recommended that the number of digits are the same as the national number.

5.2.12 Call Diversion (CD)

There are no numbering plan aspects of the call diversion services, any E.164 number may be used. It may be necessary to prevent the use of special service numbers, e.g. the emergency number. This subject is a service aspect and as such outside the scope of a Technical Report on numbering aspects.

6 User procedures

Currently there are no known numbering aspects which are affected by user procedures. The development of user procedures are not within the scope of NA2, although it would be useful to contribute to any such schemes.

7   Interworking

Currently two CCITT Recommendations; E.166 and X.122 exist for number interworking.

These two Recommendations cover the two scenarios:

- ISDN > PSPDN
- PSPDN > ISDN.

Currently there is an initiative by CCITT to combine the two recommendations. This will be a complicated process as the philosophies of numbering for the total ISDN and dedicated PSPDNs do not align in the long term.

For pre-Time "T" environment both accept the use of escape codes as a means of interworking.

History

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