INTERNATIONAL TELECOMMUNICATION UNION

# CCITT

THE INTERNATIONAL
TELEGRAPH AND TELEPHONE
CONSULTATIVE COMMITTEE

**RED BOOK**

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**VOLUME VIII – FASCICLE VIII.6**



# DATA COMMUNICATION NETWORKS

# INTERWORKING BETWEEN NETWORKS, MOBILE DATA TRANSMISSION SYSTEMS

**RECOMMENDATIONS X.300-X.353**

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**VIIITH PLENARY ASSEMBLY**
MALAGA-TORREMOLINOS, 8-19 OCTOBER 1984

Geneva 1985

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**Recommendations X.300 to X.353**

**Data communication networks**
**Interworking between networks**
**and**
**Mobile data transmission systems**



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PRELIMINARY NOTES

1 The Questions entrusted to each Study Group for the Study Period 1985-1988 can be found in Contribution No. 1 to that Study Group.

2 In this Fascicle, the expression "Administration" is used for shortness to indicate both a telecommunication Administration and a recognized private operating agency.

3 The status of annexes and appendices attached to the Series X Recommendations should be interpreted as follows:

- an *annex* to a Recommendation forms an integral part of the Recommendation;
- an *appendix* to a Recommendation does not form part of the Recommendation and only provides some complementary explanation or information.

FASCICLE VIII.6

**Recommendations X.300 to X.353**

# DATA COMMUNICATION NETWORKS:

# INTERWORKING BETWEEN NETWORKS AND MOBILE DATA TRANSMISSION SYSTEMS

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SECTION 1

# INTERWORKING BETWEEN NETWORKS

**Recommendation X.300**

## GENERAL PRINCIPLES AND ARRANGEMENTS FOR INTERWORKING BETWEEN PUBLIC DATA NETWORKS, AND BETWEEN PUBLIC DATA NETWORKS AND OTHER PUBLIC NETWORKS

*(Former Recommendation X.87, Geneva, 1980; amended at Malaga-Torremolinos, 1984)*

The CCITT,

*considering*

(a) that Recommendation X.1 defines the international user classes of service in public data networks and ISDN;

(b) that Recommendation X.2 defines the international user services and facilities in PDNs and ISDN;

(c) that Recommendation X.10 defines the different categories of access of data terminal equipments (DTEs) to the different data transmission services provided by public data networks (PDNs) and ISDN;

(d) that Recommendation X.96 defines call progress signals including those used in conjunction with international user facilities;

(e) that Recommendations X.20, X.20 *bis*, X.21, X.21 *bis*, X.25, X.28 and X.29 already specify the detailed procedures applicable to different types of DTE/DCE interfaces on PDNs;

(f) that Recommendations X.61, X.70, X.71 and X.75 already specify the detailed procedures applicable to call control between two PDNs on the same type;

(g) that PDNs may be used to support CCITT recommended services (in particular telematic services);

(h) that Recommendation X.200 specifies the reference model of open system interconnection for CCITT applications;

(i) that Recommendation X.213 defines the Network Layer service of open systems interconnection for CCITT Applications;

(j) that interworking with the Common Channel Signalling Network (CCSN) needs to be considered, in view of the requirements for transferring operational information between Administrations;

(k) the need that DTEs can communicate through different networks, and through different interworking conditions between networks;

(l) the need for general principles and arrangements for interworking between public data networks and between public data networks and other public networks;

(m) the need, in particular:

- for certain user facilities and network utilities for communication through the national networks between the internationally defined data terminal equipment interface protocols and international inter-exchange control and signalling procedures;
- for certain internationally defined network utilities for international operation of public data networks;
- for compatibility and uniformity in the principles for realization of international user facilities and network utilities in public data networks;

*unanimously declares the view*

that general principles and arrangements for interworking between public data networks and between public data networks and other public networks, and that the necessary elements:

- for realization of interworking between different networks providing data transmission services,
- and for realization of international user facilities and network utilities for data transmission services which may support CCITT recommended services (in particular telematic services),

be in accordance with the principles and procedures specified in this Recommendation.

CONTENTS

## 1 Introduction

1.1 The rapid evolution of data transmission services has resulted in a large number of international standards in this field. The increasing complexity of the totality of these standards creates a need to rationalize common aspects in order to achieve a coherent relationship between the standards.

1.2 Data transmission services and user facilities may be provided by different types of public networks such as public data networks and integrated services digital networks (ISDN). As a result, there may be a demand to interconnect these networks in order for a DTE on one network to communicate in a uniform way with a DTE on the same network, or with a DTE on another network of the same type, or with a DTE on a network of another type.

1.3 The internetwork signalling between the various types of networks can be of the type defined by Recommendations such as X.70, X.71, X.75, or of the common channel signalling type such as X.61.

In particular, at an internetwork signalling interface, network utilities may be exchanged between the networks involved. These network utilities may be handled by different types of networks.

1.4 In addition, as a part of the scope of Recommendation X.200 (Reference Model of Open Systems Interconnection for CCITT applications) is to enable different users to communicate with each other by encouraging the compatible implementation of communication features, the use of this Reference Model is expected to be encouraged in future user terminal designs.

1.5 As defined by this reference model, one of the major functions of the network layer is to establish a network-connection between network-service users (within end-systems). This may involve the concatenation of dissimilar networks.

Therefore, the arrangements and procedures for internetwork signalling between PDNs and other public networks should provide the users with the capability to operate the OSI Network Layer Service over the connections derived over either one network, or over concatenated networks.

*Note* – This does not imply that any individual public network involved, implements all the mechanisms related to the OSI Network Layer Service.

1.6 Interworking between more than two networks is included in the scope of this Recommendation.

1.7 The scope of this Recommendation is:

- to define principles and detailed arrangements for the interworking of different networks in order to provide a data transmission service;
- to specify, in a general network context, the necessary interaction between elements of customer interfaces, interexchange signalling systems and other network functions; in particular, the necessary interaction to provide the full capability of the OSI Network Layer Service where appropriate;
- to define the principles for realization of international user facilities and network utilities for data transmission services, which may support CCITT recommended services (in particular Telematic services).

## 2 Public networks to be interconnected and data transmission services to be offered

This section lists the Public Networks considered in this Recommendation for the provision of Data Transmission Services, and indicates where appropriate, the extent to which those public networks provide support for the full capability of the OSI Network Layer Service at the DTE/DCE interface.

International data transmission services may be provided through the interworking of different types of public networks, as follows:

- Public data networks (PDNs)
- Integrated services digital network (ISDN)
- Public switched telephone network (PSTN)
- Mobile networks or systems.

*Note 1* – Other services, not related to data transmission services, may also be provided by interworking involving PDNs. In particular, the requirements for a PDN when interworking with the public telex network in respect of CCITT Telex Service are for further study.

*Note 2* – Common Channel Signalling Network (CCSN) is also considered in this Recommendation, for interworking with PDNs, and to provide a means of data transmission of operational information (see also § 2.5, in particular the Note in § 2.5.2).

*Note 3* – In addition, certain aspects of interworking between PDNs and private equipment are considered in this Recommendation.

### 2.1 *Packet switched public data network (PSPDN)*

2.1.1 The packet switched public data networks (PSPDNs) are considered in this Recommendation.

2.1.2 The data transmission services and user facilities offered through the PSPDNs are described in Recommendations X.1 and X.2, and are the packet switched data transmission services.

2.1.3 The categories of access for DTEs to the data transmission services offered through PSPDNs are specified in Recommendation X.10.

2.1.4 The data transmission services to be considered through PSPDNs are equivalent to the connection – oriented network layer service defined for Open Systems Interconnection (OSI), on the basis of the capability offered by X.25 and X.75 protocols.

### 2.2 *Circuit switched public data network (CSPDN)*

2.2.1 The circuit switched public data networks (CSPDNs) are considered in this Recommendation.

2.2.2 The data transmission services and user facilities offered through the CSPDNs are described in Recommendations X.1 and X.2, and are:

- either synchronous data transmission services;
- or asynchronous data transmission services.

*Note* – The synchronous data transmission services should also be considered in the case of interworking between ISDN and CSPDN (see also § 2.3.2).

2.2.3 The categories of access for DTEs to the data transmission services offered through CSPDNs are specified in Recommendation X.10.

2.2.4 In addition to the basic synchronous data transmission services, a CSPDN may be considered in association with any appropriate interworking function, for the support of the OSI connection-oriented Network Layer Service.

*Note* – The extent to which CSPDNs provide support for the full capability of the OSI connection-oriented Network Layer Service, is for further study. It is intended to reflect the result of this study in the present Recommendation, when appropriate.

2.3 *Integrated services digital network (ISDN)*

2.3.1 The integrated services digital network (ISDN) is considered in this Recommendation for the interworking with public data networks, and for the provision of data transmission services.

*Note* – One objective of the ISDN is to provide in the future data transmission services currently provided through PDNs. However, before such an objective can be fully achieved:

- ISDN may not be available in some countries;
- PDNs still be required in countries where ISDN would be introduced.

2.3.2 The data transmission services considered through the ISDN are described in Recommendation X.1, and are:

a) circuit switched data transmission services, as already mentioned in § 2.2.2;

b) packet switched data transmission services, expected to be equivalent to the OSI connection-oriented Network Layer Service. Such equivalence is for further study (see also § 2.1.4).

*Note* – In addition, other types of data transmission services may have to be considered in the future for interworking with the ISDN for new applications (e.g. telemetry).

2.3.3 The categories of access for DTEs to the data transmission services on ISDN are described in Recommendation X.10.

2.4 *Public switched telephone network (PSTN)*

2.4.1 The public switched telephone network (PSTN) is considered in this Recommendation for the interworking with Public Data Networks, and for the provision of data transmission services.

*Note 1* – One objective of the ISDN is to replace in the future the current PSTN. However, before such an objective can be fully achieved:

- PSTN may have to be considered in countries where ISDN would not yet be introduced;
- PSTN may also have to be considered in countries where ISDN would be introduced.

*Note 2* – PSTN with or without enhanced signalling capability (e.g., calling line identification capability) should be considered for interworking.

2.4.2 The data transmission services which should be considered through the PSTN for interworking with PDNs depend on the exact interworking situation (see also § 4). Depending on the interworking situation, such data transmission services are either based on synchronous or asynchronous data transmission services, or based on packet switched data transmission services which are expected to be equivalent to the OSI connection-oriented Network Layer Service (see also § 2.1.4).

2.5 *Common channel signalling network (CCSN)*

2.5.1 The purpose of a common channel signalling network (CCSN) is to control signalling for another network (e.g., ISDN, CSPDN).

The controlled network may interwork with another PDN, as illustrated in Figure 1/X.300. Such an interworking is not considered as interworking between CCSN and PDN in this Recommendation.

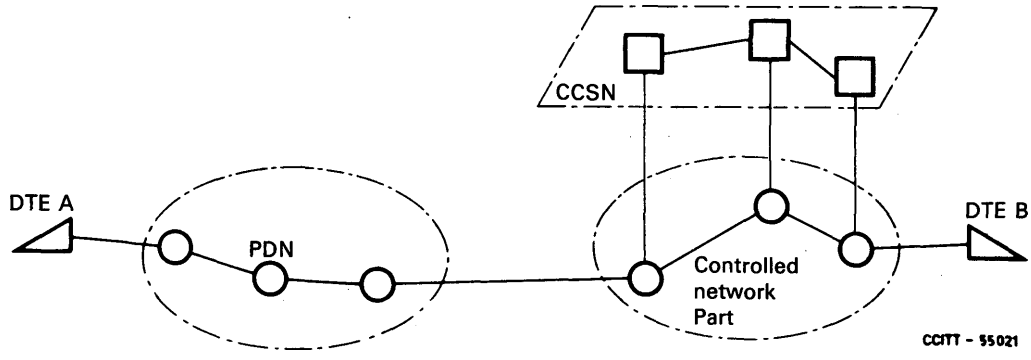



FIGURE 1/X.300

**Interworking between a PDN and a network controlled by a CCSN (not between a PDN and a CCSN)**

2.5.2 For the transmission of operational information between Administrations, CCSN and PDN may also need to interwork at the same level, to provide a means of data transmission between operational centres and/or terminals for those Administrations, as illustrated in Figure 2/X.300. Such an interworking *is to be considered as interworking between CCSN and PDN* (see Note).

*Note* – This does not preclude consideration of the interworking between PDNs and common channel signalling networks for the transfer of user data. The provision of this capability is for future study.

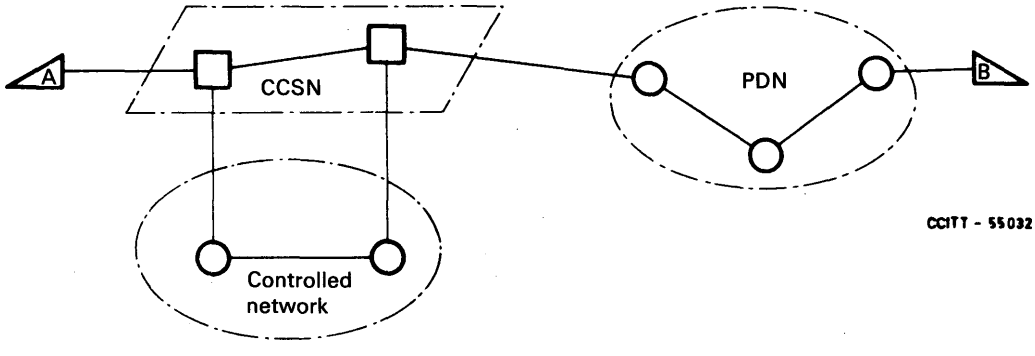



FIGURE 2/X.300

**Interworking between a PDN and a CCSN**

2.5.3 A CCSN, for the interworking with a PDN, and for the transmission of operational information, should be considered, in association with any appropriate interworking function, for the provision of the OSI connection-oriented Network Layer Service.

2.6 *Mobile systems*

The requirements for interworking between packet switched public data networks and the maritime satellite data transmission system are defined in Recommendation X.352.

The requirements for interworking between PDNs and other types of mobile systems (e.g., land mobile) are for further study.

## 3 Categories of interworking

This section describes the different categories of interworking to be considered, in the context of data transmission services provided through public data networks, and between public data networks and other networks. It also indicates where appropriate, the extent to which the interworking networks involved provide support for the full capability of the OSI Network Layer Service.

### 3.1 *Concepts and principles related to the interworking functions*

The different categories of interworking may involve different levels of functions:

- in some cases only the functions related to the transparent transfer of information between two DTEs through the network(s) (Transmission Capability);
- in other cases also additional functions built upon those related to the transparent transfer of information (Communication Capability).

This § 3.1 describes the basic concepts and principles related to those two levels of functions.

#### 3.1.1 *Concepts related to services and levels of functions*

For the purpose of describing the different categories of interworking, the following concepts are used.

3.1.1.1 *CCITT service* (see Note below)

3.1.1.1.1 Service defined in CCITT Recommendations, to be marketed to the users by the Administrations.

Different types of CCITT services may be marketed, as follows:

a) Data transmission services, as defined in Recommendations X.1 and X.2 (e.g., Packet switching data transmission service);

b) Services involving additional functions, on top of those functions providing transmission capability (e.g., PAD, telex, Teletex).

*Note* – The term "CCITT service" in this Recommendation is used to mean a service defined by CCITT, that is, a "CCITT defined service".

3.1.1.1.2 On top of a data transmission service, users may establish a privately defined application.

3.1.1.1.3 Figure 3/X.300 illustrates examples of CCITT services.

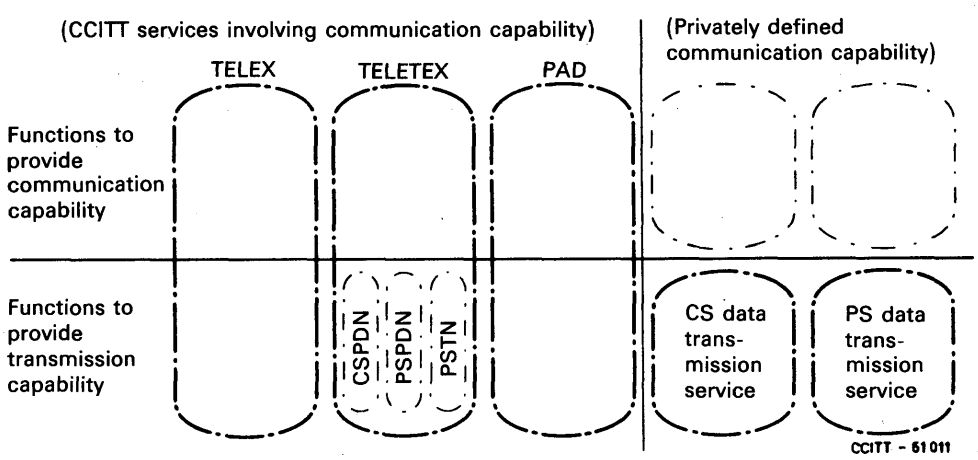



FIGURE 3/X.300

**Examples of CCITT services**

3.1.1.2 *Transmission capability*

3.1.1.2.1 Transmission capability consists of all the necessary mechanisms required through a network or networks interworking for the transparent transfer of data between users' equipment. This includes all mechanisms required for the support of data transmission services as defined in Recommendation X.1, and for the implementation of appropriate user facilities as defined in Recommendation X.2. It may also include special management functions if required for CCITT Services; such functions are for further study.

3.1.1.2.2 Every CCITT service involves a transmission capability. Some CCITT services may involve additional functions on top of this transmission capability. Other CCITT services contain only this transmission capability, and any additional functions on top are defined privately by the users.

3.1.1.2.3 Different pieces of equipment may be involved in a communication between two users for performing the functions which are related to the transmission capability between both users, i.e., the functions related to the transparent transfer of data through a network used between both users:

a) the end elements (i.e., data terminal equipments – DTEs) are always involved;

b) in most cases, relay elements (i.e., switching exchanges are also involved).

3.1.1.2.4 Figure 4/X.300 illustrates one example of the provision of a transmission capability, where both relay and terminal types of equipments are involved.

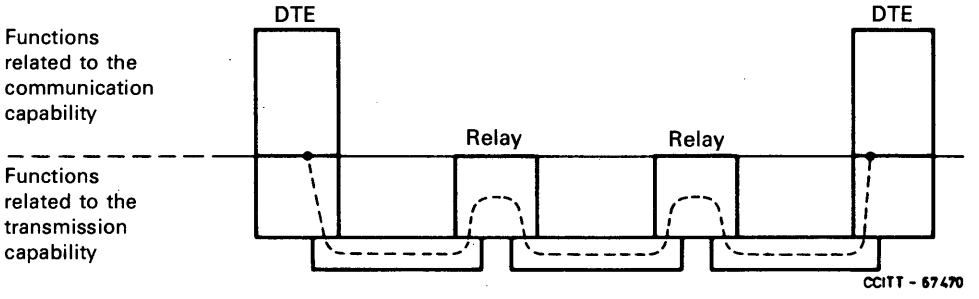



FIGURE 4/X.300

**Example of the provision of transmission capability**

3.1.1.3 *Communication capability*

3.1.1.3.1 The communication capability consists of the means of communication between two systems, related to the functions above transmission capability.

3.1.1.3.2 A communication capability may be defined by CCITT; it may also be privately defined by users themselves.

3.1.1.4 *Data transmission service*

3.1.1.4.1 In cases where DTEs communicate through a public data network (PDN), the relay elements mentioned in § 3.1.1.2 are the switching equipments of the PDN involved.

3.1.1.4.2 As a particular set of relay elements, the PDN participates in performing the functions related to the transmission capability. This participation consists of the provision, through the PDN and between both DTE interfaces, of one of the data transmission services listed in Recommendation X.1: circuit switched service, packet switching service, leased circuit service. Figure 5/X.300 illustrates one example of the PDN participation in the transmission capability.

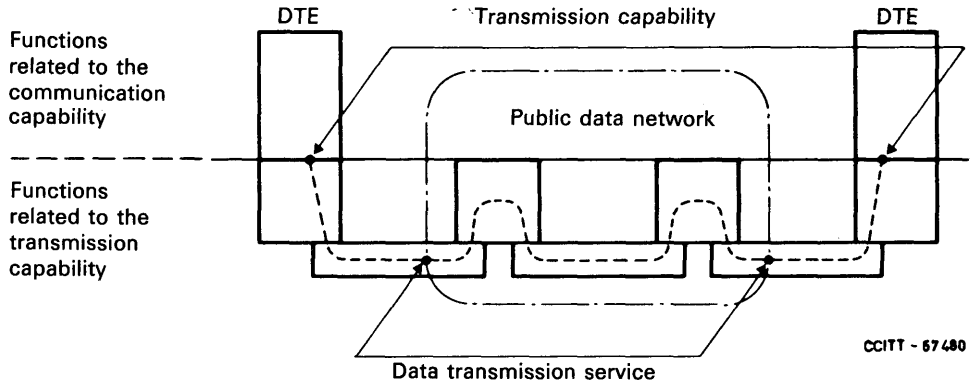



FIGURE 5/X.300

**Example of data transmission service offered by a PDN to participate in the provision of a transmission capability**

3.1.1.5 *Interworking unit (IWU)*

3.1.1.5.1 The interworking units considered in this Recommendation are functional entities involved for the establishment of a call between two end terminals, whenever two networks are involved between those two end terminals.

*Note 1* – The description of interworking units in examples given in further sections of this Recommendation does not make any assumption on the implementation of such units: either within one network involved, or as a separate piece of equipment. Also several interworking units between two networks may be combined into one single piece of equipment.

*Note 2* – An interworking unit may be involved in cases where two dissimilar networks are involved, or in cases where two networks of the same type are involved.

3.1.1.5.2 In some cases of interconnection between two networks, several interworking units may be involved. However, for a given communication between two end terminals, only one of those IWUs is involved.

3.1.1.5.3 Figure 6/X.300 illustrates an example of interworking between two networks by means of interworking units. There may be other cases, where more than two networks would be involved, possibly with more interworking units.

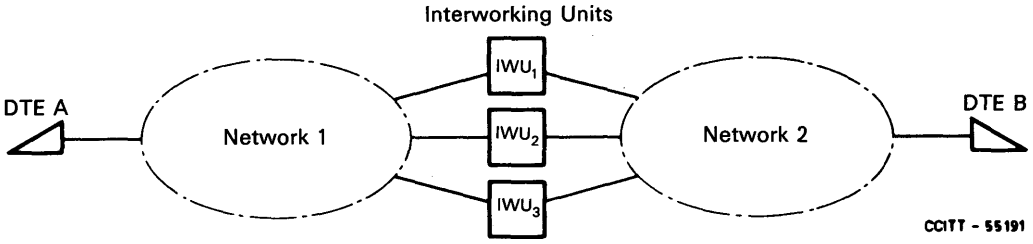



FIGURE 6/X.300

**Example of interworking between two networks by means of Interworking Units**

3.1.2 *Relationship with the Reference Model of OSI for CCITT applications*

3.1.2.1 In cases where the functions needed for DTEs to communicate are structured in conformance with the Reference Model of OSI for CCITT applications (see Recommendation X.200), the boundary between functions related to the communication capability and functions related to the transmission capability corresponds to the boundary between Network Layer and Transport Layer. Figure 7/X.300 illustrates one example of such OSI structure.

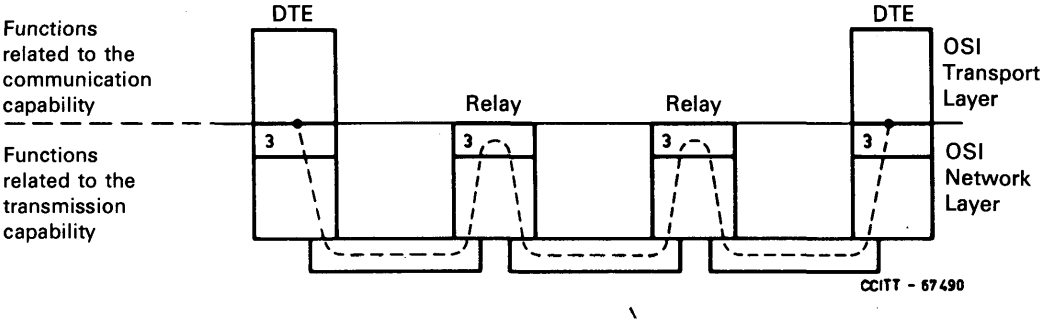



FIGURE 7/X.300

**Example of the provision of OSI-structured transmission capability**

3.1.2.2 Furthermore, the transmission capability considered in some cases may exactly conform to an OSI Network Layer Service, e.g., the OSI connection-oriented Network Layer Service.

*Note* – There are cases where the transmission capability established between two DTEs is not related to an OSI Network Layer Service; for example, the transmission capability established between two asynchronous terminals is not considered to be related to the OSI Network Layer Service.

3.1.2.3 In some cases, the type of transmission capability established between two DTEs may be similar to the data transmission service provided by the PDN between those DTEs.

In particular, the transmission capability established between both DTEs may be the OSI connection-oriented Network Layer Service, using the virtual call data transmission service offered by a packet switched public data network (PSPDN). In this case, the PSPDN is expected to have the full capability of supporting the OSI connection-oriented Network Layer Service; no additional protocol would then be needed between both DTEs and on the top of the data transmission service access protocol, to provide the transmission capability.

*Note* – See also § 2.1.

3.1.2.4 In other cases, the type of transmission capability established between two DTEs may be different from the data transmission service provided by the PDN between those DTEs.

In particular, the transmission capability already considered in § 3.1.2.3 (i.e., the OSI connection-oriented Network Layer Service) may be established through a circuit switched public data network (CSPDN) which offers a synchronous circuit switched data transmission service. In this case, an additional data transfer protocol is usually needed between both DTEs, to provide the transmission capability. An example of such protocol can be found in Recommendation T.70 for the case of Teletex service.

3.1.2.5 Through PDNS, it should be possible to accommodate both OSI and non-OSI types of communication capabilities. The requirements for describing a communication capability as an OSI Oriented communication capability needs further consideration.

3.1.3 *Basic principles in relation with service indication parameters*

3.1.3.1 PDNs and ISDN will be used for the support of various telematic services, i.e., CCITT services involving communication capabilities defined by CCITT.

3.1.3.2 The mechanism or mechanisms to be used to satisfy any requirement related to service indications, e.g., compatibility checking, should in particular accommodate the case of those CCITT services which are designed in accordance with Recommendation X.200 (Reference Model of OSI for CCITT Applications) and other Recommendations applicable to OSI protocols at layers 4 to 7.

3.1.3.3 The pieces of equipment involved in realizing the transmission capability will only act upon the parameters related to this transmission capability.

3.1.3.4 The parameters related to the communication capability will not be seen by the equipment realizing the transmission capability, and will be coded independently from the parameters defining the transmission capability.

3.1.3.5 For efficient handling through the network, parameters of each category may be conveyed globally in one or several profiles.

3.1.3.6 In a call request a facility/utility can only be considered in the context of OSI, as an element of protocol at the Network Layer (Layer 3). It cannot be considered as an element of protocol at layer(s) higher than the Network Layer.

3.1.3.7 Consequently, in the case of a CCITT service designed in full accordance with the Reference Model of OSI for CCITT applications, the use of a facility/utility in the call request can only be related to the transmission capability of such a CCITT service (see also § 3.1.2.1).

*Note* – Through a PSPDN, a call request packet can contain user data conveying elements of protocol related to the communication capability (i.e., at layer(s) higher than the Network Layer).

## 3.2 *Interworking involving transmission capability*

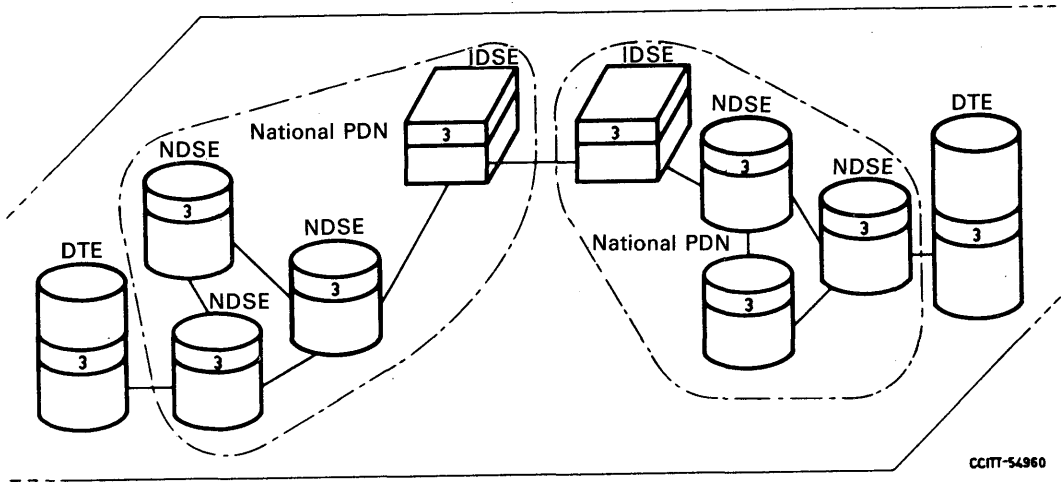
This § 3.2 describes the categories of interworking that involve functions related to the transmission capability only (see also § 3.1.1.2). Two different categories of interworking between two networks have to be considered in this section:

a) an interworking at the Network Layer of OSI;

b) an interworking by port access.

### 3.2.1 *Interworking at the Network Layer of OSI*

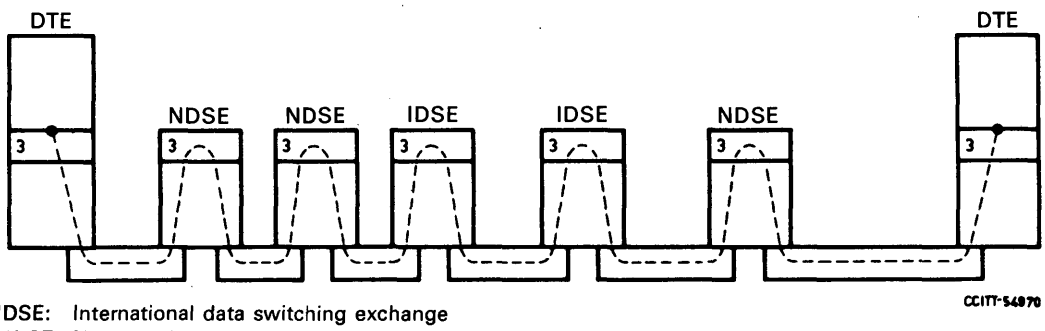
In such a case of interworking, one or several intermediate nodes (in particular one or several intermediate DSEs) may be involved in the provision of the transmission capability for a call, mainly routing and switching functions as described in the Network Layer (Layer 3) of the Reference Model of OSI for CCITT applications. The corresponding Network Layer entities cooperate, as indicated in the example of the Figures 8/X.300 and 9/X.300. Although the intermediate modes operate at the Network Layer of OSI to provide the transmission capability, the networks involved in the call may or may not have themselves the full capability of providing the OSI connection-oriented Network Service, as indicated later in this § 3.2.1.




IDSE: International data switching exchange
NDSE: National data switching exchange

FIGURE 8/X.300

**Example of an international public data network configuration with interworking at the network layer**




IDSE: International data switching exchange
NDSE: National data switching exchange

FIGURE 9/X.300

**Intermediate nodes for a network connection**

It is not always necessary to consider individual intermediate systems involved in a given call. For example, it is not necessary to consider individual national data switching exchanges (NDSEs) of a national public data network, since the question of protocols between such NDSEs is a national matter. Also the question of protocols between a NDSE and an international data switching exchange (IDSE) in the same national PDN is a national matter. Therefore, and for the purpose of studying interworking arrangements between networks, it may be of interest to consider those DSEs which are in the same national PDN as only one intermediate abstract system involved in the call, as indicated in Figure 10/X.300 (giving two equivalent representations of intermediate systems involved in the call).

Interworking at the Network Layer of OSI should be based on the interworking condition described in § 3.2.1.1.; however, specific interworking arrangements are also possible in cases mentioned in § 3.2.1.2.

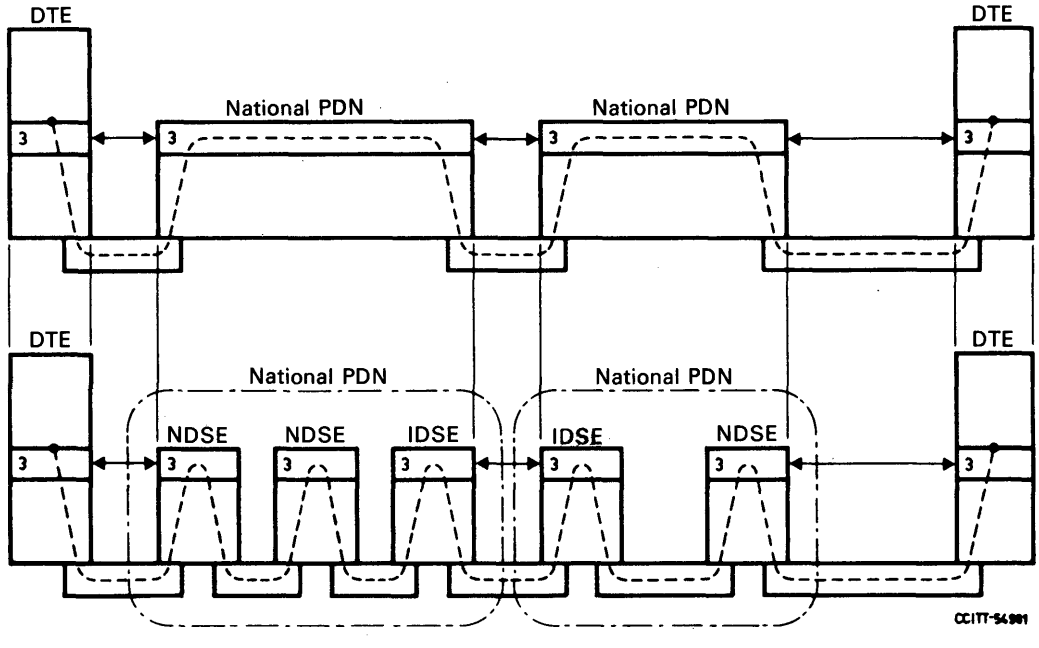



FIGURE 10/X.300

3.2.1.1 *Interworking to provide the OSI connection-oriented Network Layer Service*

In the future, user terminal designs may be predominantly based on the Reference Model of Open Systems Interconnection (OSI) for CCITT applications. This § 3.2.1.1 describes the cases of interworking at the network layer, where the arrangements and procedures for internetwork signalling provide support for the OSI Connection-Oriented Network Layer Service.

In such interworking, and as already mentioned in this § 3.2.1, it is not necessary to consider any individual intermediate system involved in a given network connection. Each network should be considered globally, in association with any appropriate interworking whenever it is necessary. Each network with associated interworking unit(s) should have the full capability of providing the OSI connection-oriented Network Layer Service, it is also designated as an "OSI-subnetwork" in the following sections of this Recommandation (see Figure 11/X.300).

In having the full capability of supporting the OSI connection-oriented Network Layer Service, each network should support all mandatory elements of this service, and may additionally support any provider option(s) of this service.

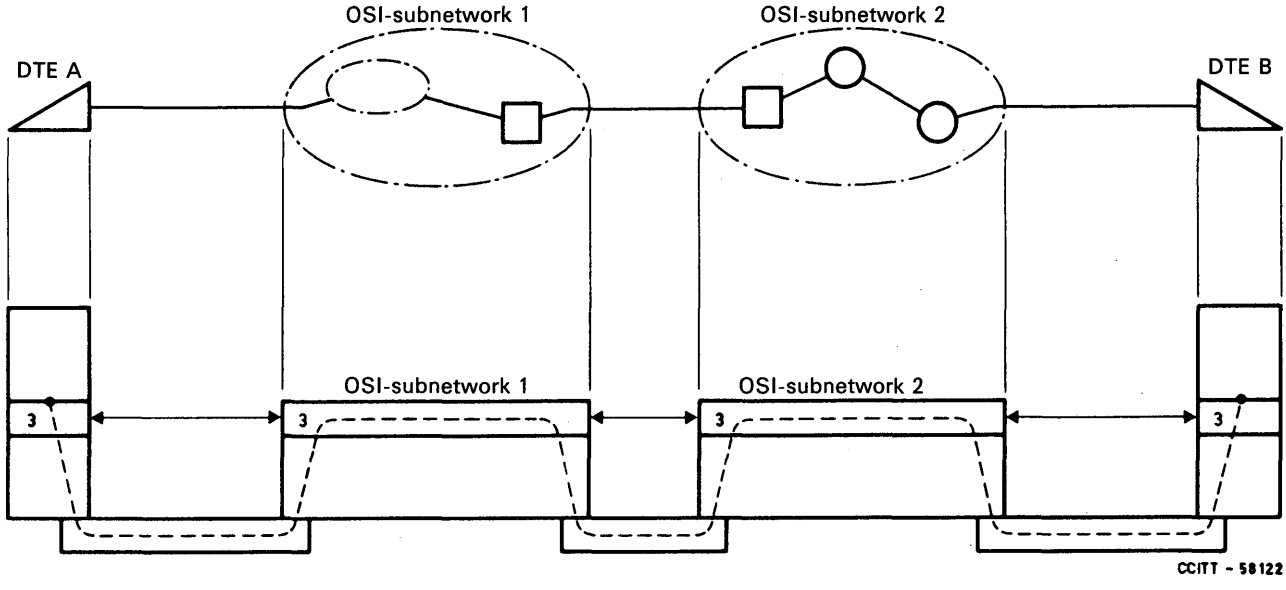



FIGURE 11/X.300

**Example of interworking at the network layer to provide the OSI connection-oriented Network Layer Service**

3.2.1.2 *Interworking with specific arrangements*

In some cases of interworking at the network layer, the transmission service that is considered to be offered through the interconnected networks may be based on specific arrangements defined between those networks. This is the case, for example, when the interconnection between two CSPDNs is considered for the provision of a synchronous data transmission service.

Specific arrangements in some cases of interworking at the network layer may be defined for the provision of one of the following two types of transmission services:

- synchronous circuit switched data transmission service;
- asynchronous circuit switched data transmission service.

3.2.2 *Interworking by port access*

3.2.2.1 In such a category of interworking, one network is used to establish a physical connection to the other network, on a temporary basis. Figure 12/X.300 illustrates this type of interworking, where an interworking unit is used between both networks.

*Note* – In this example, the exact location of the interworking unit is for further study.

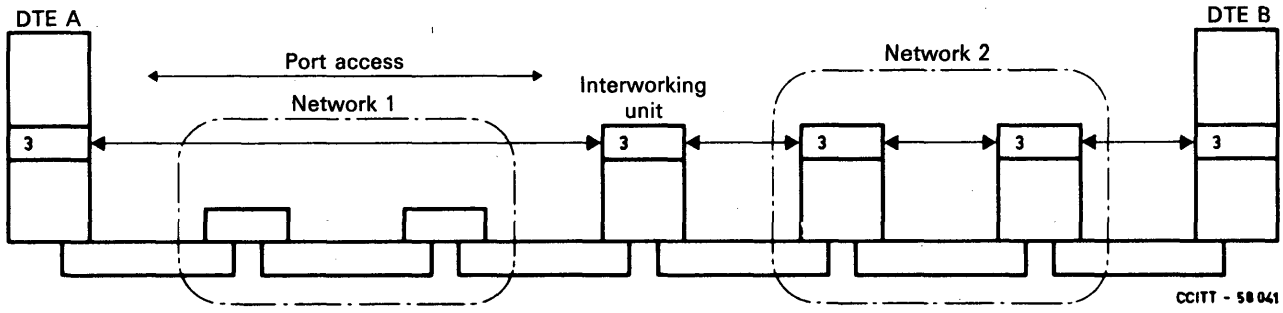



FIGURE 12/X.300

**Example of interworking by port access**

3.3 *Interworking involving communication capability*

This § 3.3 describes the categories of interworking that involve functions related to the communication capability (see also § 3.1.1.3). Three different categories of interworking are identified in this section:

a) an interworking at higher layers of OSI;

b) a direct interworking via a non-OSI adapter;

c) an interworking via a non-OSI adapter based on port access.

3.3.1 *Interworking at higher layers of OSI*

In such a category of interworking, an interworking unit is involved, which acts with functions at layers up to and including the application layer, as illustrated in Figure 13/X.300.

In this case, two different network layer connections are established, with the IWU acting as an application layer relay between those two network layer connections.

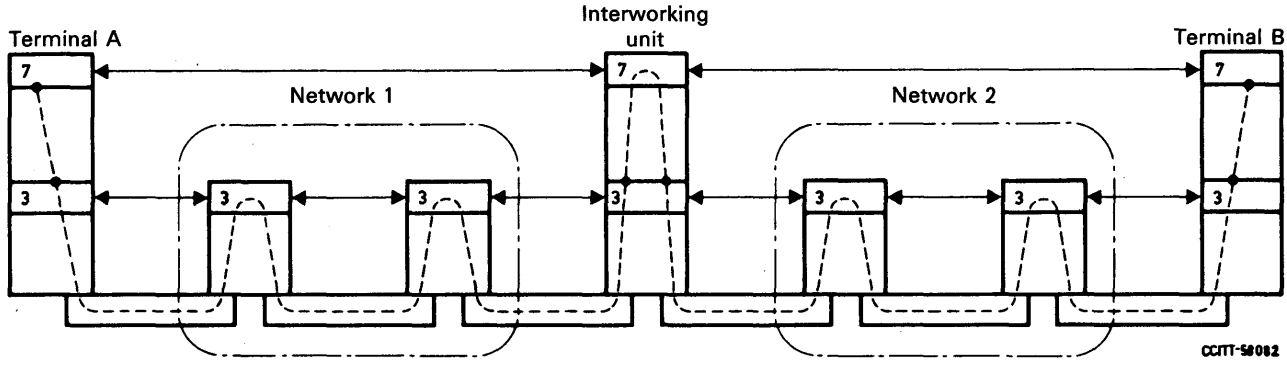



FIGURE 13/X.300

**Interworking unit at the application layer**

3.3.2 *Direct interworking via a non-OSI adapter*

Figure 14/X.300 illustrates this type of interworking, where DTE A and DTE B are communicating via a non-OSI adapter, with the possibility for DTE A to indicate directly the address of DTE B (see also § 4.5.1).

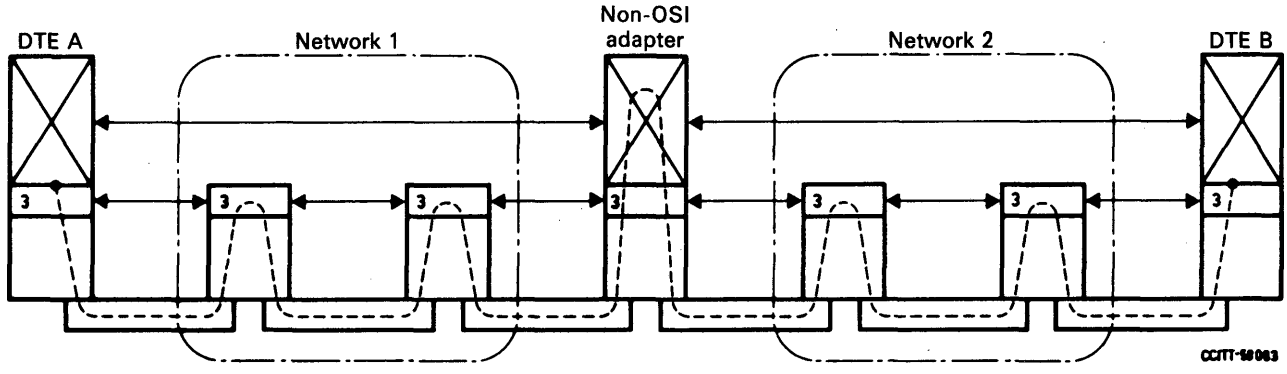



FIGURE 14/X.300

**Direct interworking via a non-OSI adapter**

3.3.3 *Interworking via a non-OSI adapter by port access*

In this method, network 1 is used to establish a physical connection between DTE A and a non-OSI adapter, on a temporary basis, as shown in Figure 15/X.300.

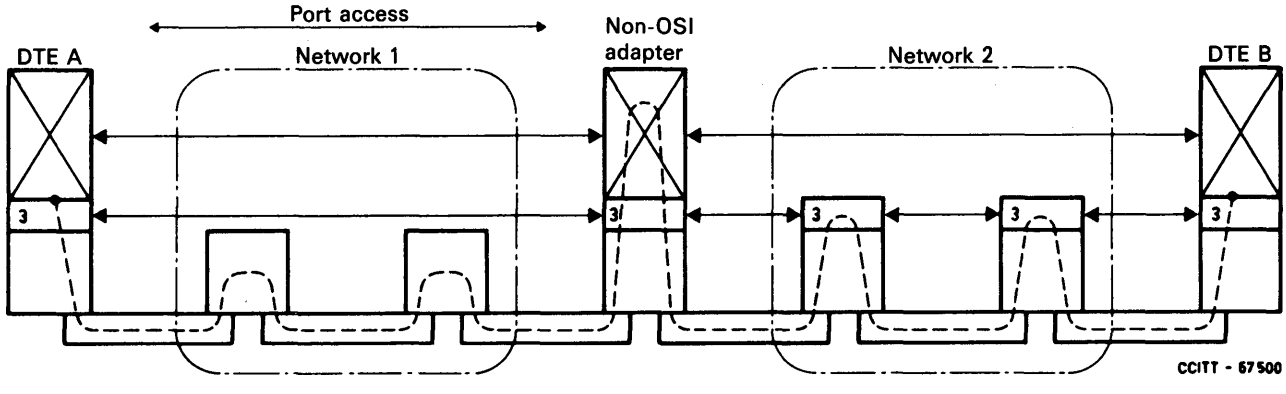



FIGURE 15/X.300

**Interworking via a non-OSI adapter based on port access**

## 4 Description of the different interworking conditions

This section describes the different conditions for interworking between networks mentioned in § 2, on the basis of the categories of interworking described in § 3.

### 4.1 *General*

Table 1/X.300 describes the conditions for interworking, between either two PDNs or one PDN and another network to provide data transmission services, to support CCITT recommended services (in particular telematic services) based upon them. Description of interworking conditions where more than two networks are involved requires further study; in cases where more than two networks are involved in a given connection, Table 1/X.300 applies as appropriate at each interworking between two networks.

*Note* – Conditions for interworking between two PDNs or between one PDN and another network to provide services not related to data transmission services are not presently described. In particular, the requirements for a PDN, when interworking with the public telex network in respect of CCITT telex services, are for further study.

TABLE 1/X.300

**Interworking conditions**

| | | | | | | |
|---|---|---|---|---|---|---|
| PSPDN | Note 1 | | | | | |
| CSPDN | Notes 2, 4, 11, 13, 14 | Note 3 | | | | |
| ISDN | Note 15 | Note 5 | Note 6 | | | |
| CCSN | Notes 1, 7, 8 | Note 8 F.S. | Note 6 | Note 6 | | |
| PSTN | Notes 2, 4, 13, 14 | Note 12 F.S. | Note 6 | Note 6 | Note 6 | |
| Mobile data systems | Note 9 | F.S. | Note 10 | Note 6 | Note 6 | Note 10 |
| | PSPDN | CSPDN | ISDN | CCSN | PSTN | Mobile data systems |

F.S.: For further study.

*Note 1* – Interworking through an X.75 interface, for the provision of packet switched data transmission service, based upon the OSI connection-oriented Network Layer Service.

*Note 2* – In the case of interworking between either PSTN and PDNs or between CSPDN and PSPDN, the operation may be asymmetrical, that is, in the direction from the PSTN toward the PDNs or from the CSPDN toward the PSPDN a port access method may be required. In both cases for the reverse direction a method based on interworking at the Network Layer of OSI may be utilized. This is for further study.

*Note 3* – Interworking between CSPDNs through existing X-series Recommendations X.61, X.70, X.71 and X.80, for the provision of synchronous or asynchronous data transmission services.

*Note 4* – Interworking units described in § 3 may be required. The type of unit and method of operation are for further study.

*Note 5* – As far as the call control phase is concerned, interworking can be operated according to either the Common Channel Signalling System No. 7 or to Recommendation X.71. In the last case, the signalling conversion function is intended to belong to the CSPDN environment.

*Note 6* – This interworking, if required, is out of the scope of the present Recommendation.

*Note 7* – See also § 4.3.

*Note 8* – Interworking between CCSN and PDN is required for the transmission of operational information between Administrations only.

*Note 9* – See Recommendation X.352, Interworking between packet swiched public data networks and the maritime satellite data transmission system.

*Note 10* – Consideration of this interworking in the present Recommendation, is for further study.

*Note 11* – See also § 4.2.

*Note 12* – For interworking between CSPDN and PSTN, see Recommendation X.310.

*Note 13* – For interworking between start-stop DTEs on either the PSTN or CSPDN and PSPDN, see Recommendation X.28. See also § 4.5 in the case of PSTN.

*Note 14* – For interworking between packet mode DTEs on either the CSPDN or PSTN and PSPDN, see Recommendation X.32. See also § 4.3.

*Note 15* – In the case of maximum integration scenario of Recommendation X.31 (I.462), interworking through an X.75 interface for the provision of packet switched data transmission service, based upon the OSI connection-oriented network layer service. In the case of minimum integration scenario of X.31 (I.462), interworking by port access method applies.

## 4.2 *International interworking at the Network Layer between CSPDN and PSPDN*

4.2.1 Interworking between PSPDN and CSPDN for the provision of CCITT recommended services should provide the end network service users with the standard Network Layer Service defined by CCITT in the context of Open Systems Interconnection (OSI).

4.2.2 Each PSPDN and CSPDN should, in association with any appropriate interworking function whenever it is necessary, have the full capability of providing the OSI Network Layer Service.

4.2.3 The association of a CSPDN and an interworking function should offer the full capability of OSI Network Layer Service. Such an association could be considered globally as an "OSI subnetwork".

4.2.4 A PSPDN should also offer the full capability of OSI network service. Such a PSPDN could be also considered as an "OSI-subnetwork".

4.2.5 Consequently and from an OSI point of view, the interworking of a CSPDN and a PSPDN can be considered as the interworking between two "OSI-subnetworks".

4.2.6 The interworking arrangement between CSPDN and PSPDN is illustrated in Figure 16/X.300.

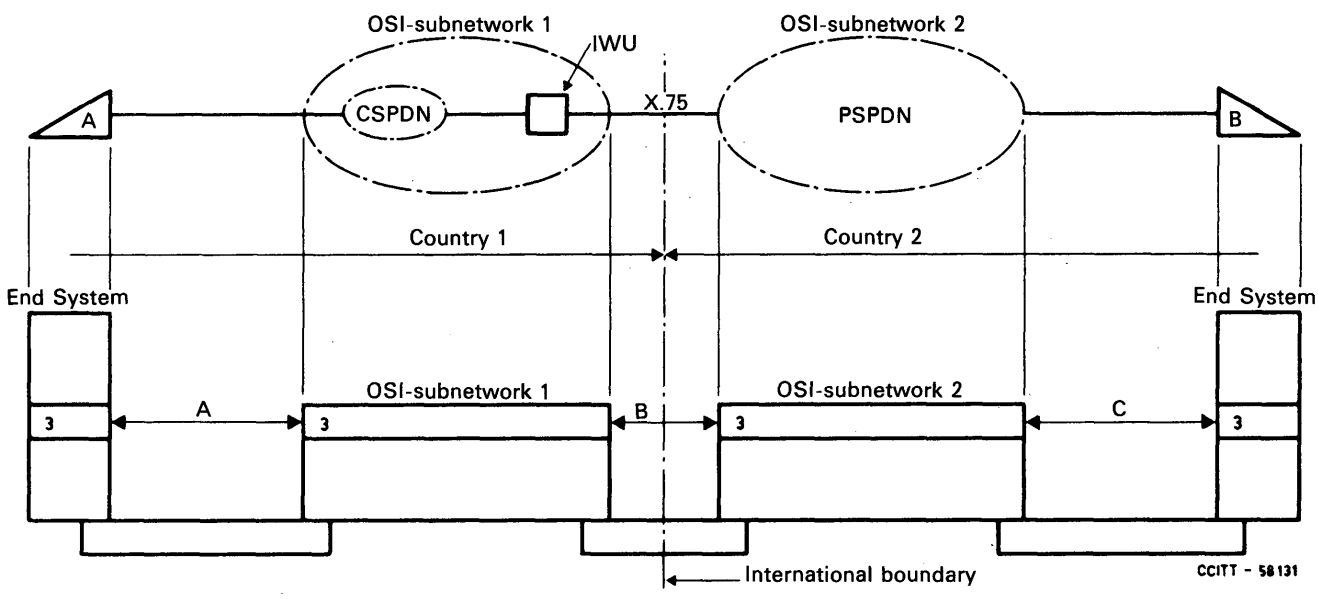



FIGURE 16/X.300

In this interworking arrangement:

a) the international arrangement between both OSI subnetworks (i.e., in Figure 16/X.300 between the interworking functions and the PSPDN) is based on Recommendation X.75;

b) the interworking unit (IWU) provides conversion between signalling system X.71 or X.61, and X.75. During data transfer phase, and for telematic terminals mentioned in Recommendation T.70, the protocols defined in §§ 3.3.2 and 3.3.3 of T.70 are used on CSPDN at layers 2 and 3; for other terminals on CSPDN, the application of these protocols or alternative protocols are possible.

*Note* – In establishing international accounting principles in relation with this interworking arrangement, consideration should be given to the distribution of the functional elements involved in this interworking arrangement (e.g., costs/revenues of the IWU).

4.2.7 Within each country, there may be multiple interconnected networks making up a single "OSI-subnetwork" per country, with internal interworking in each country being transparent to the interface at the international boundary. This is illustrated by the example in Figure 17/X.300.

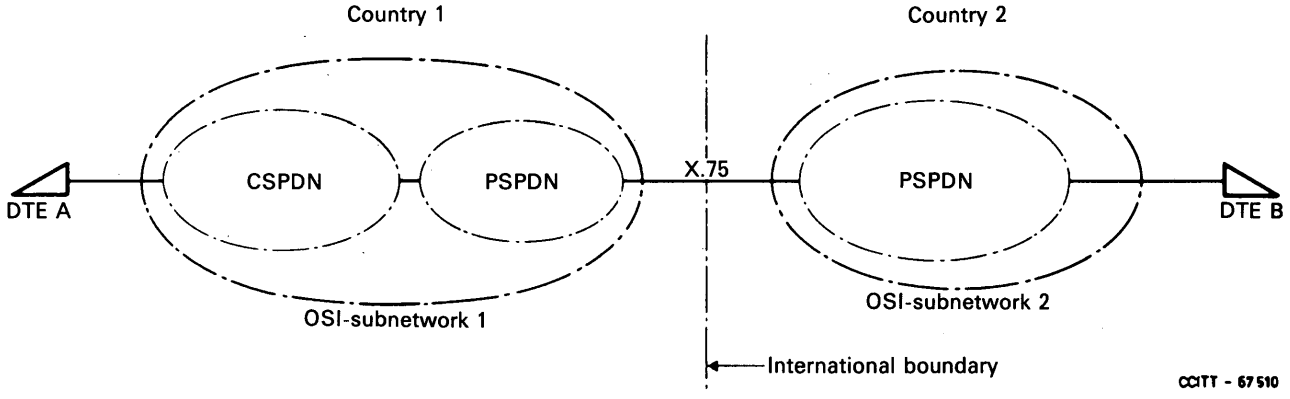



FIGURE 17/X.300

4.2.8 In the case of more than two interconnected "OSI-subnetworks" (i.e., a transit PSPDN), the interworking arrangements at each international boundary are independent. This is illustrated in Figure 18/X.300.

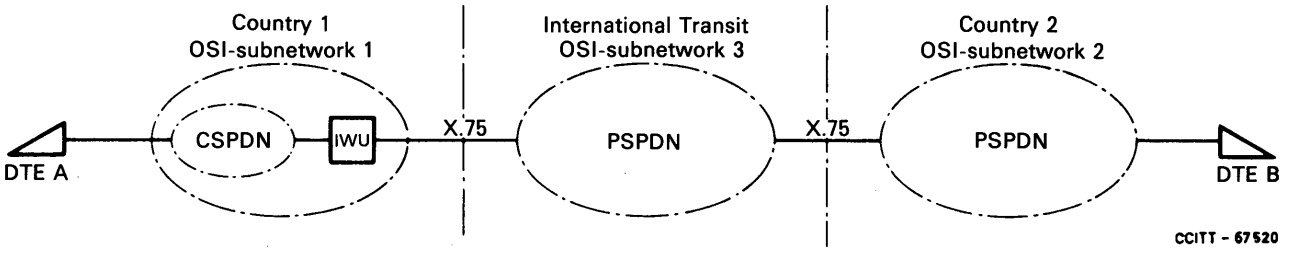



FIGURE 18/X.300

*Note* – For any of the cases in § 4.2, the Administrations involved may agree exceptionally that the interworking unit or crossover point between the CSPDN and PSPDN be placed in a country different from the CSPDN (Country 1 in Figures 16, 17 and 18/X.300).

4.3 *Switched access through a PSTN or CSPDN to a PSPDN by a packet-mode DTE*

An X.25 DTE can access a PSPDN by a switched path through either a PSTN or CSPDN. In this case, an interworking unit, as such, is not involved. For PSTN access, the DTE/DCE interface is in accordance with Recommendations V.24 and V.25. For CSPDN access during call establishment, the interface up to and including the Network Layer is in accordance with Recommendation X.21 (or for an interim period, Recommendation X.21 *bis*). During data transfer phase, the frame and packet level protocols are in accordance with Recommendation X.25. These procedures for switched access are specified in Recommendation X.32.

The method of access to a PSPDN, whether dedicated or switched, within an "OSI-subnetwork", will be transparent to interworking conditions between the PSPDN and other networks across an international boundary.

The switched access case is illustrated in Figure 19/X.300.

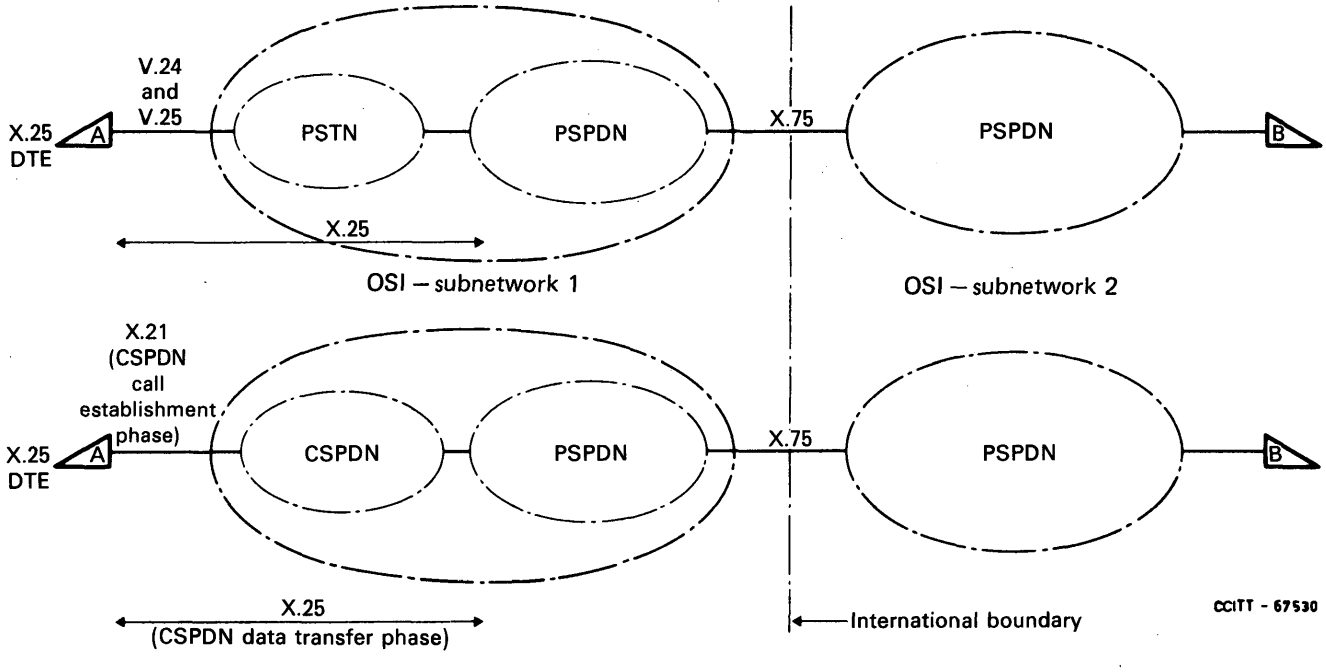



FIGURE 19/X.300

4.4 *Interworking at the Network Layer between CCSN and PSPDN*

4.4.1 Interworking between CCSN and PSPDN, which is required for the transmission of operational information between Administrations, should provide the end systems with the connection-oriented Network Layer service defined in the context of Open Systems Interconnection (OSI).

4.4.2 For such an interworking, the PSPDN should offer the full capability of the OSI Network Layer service, and could be considered globally as an abstract OSI relay system.

4.4.3 For the interworking with PSPDN, the CCSN should, in association with any appropriate interworking function whenever it is necessary, offer the full capability of the OSI connection-oriented Network Layer Service. In the context of OSI, CCSN and associated interworking unit(s) could be considered globally as an abstract OSI relay system.

4.4.4 Consequently, the interworking between CCSN and PSPDN could be considered in the context of OSI as the interworking between two "OSI-subnetworks", each one of them being fully capable of providing the OSI connection-oriented Network Layer Service. Figure 20/X.300 illustrates such an OSI representation.

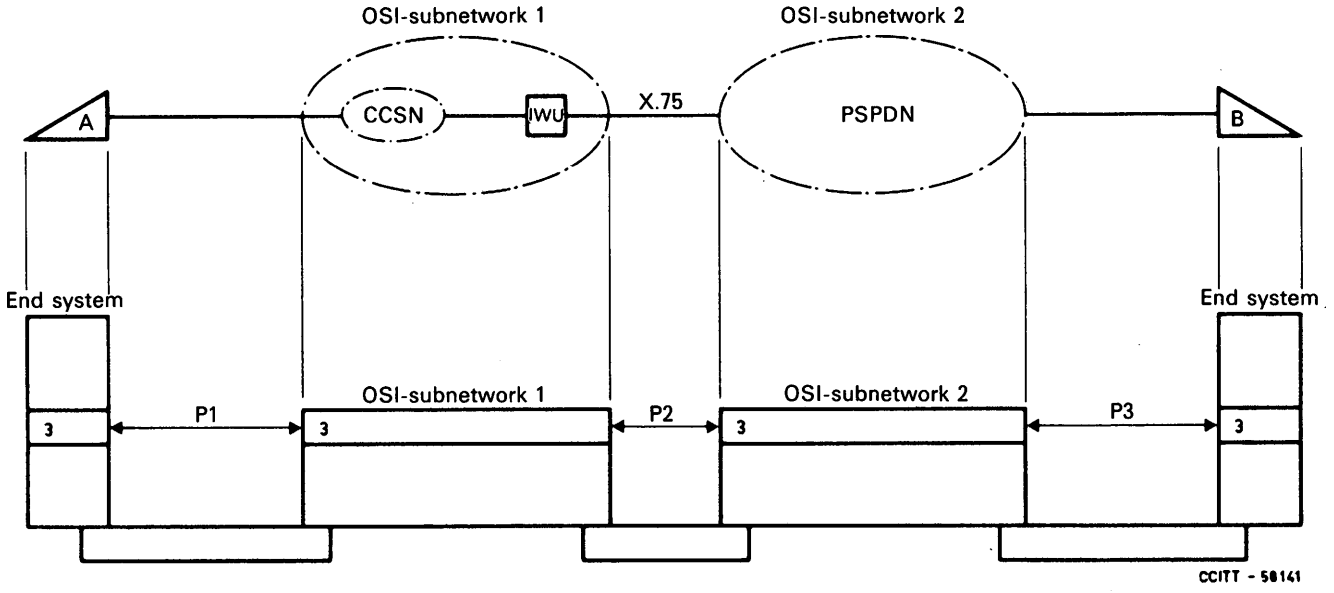



FIGURE 20/X.300

**Interworking at the Network Layer between CCSN and PSPDN**

4.4.5 The arrangements between both OSI subnetworks should be based on Recommendation X.75.

4.5 *Interworking via a non-OSI adapter between PSTN and PSPDN*

4.5.1 *Direct interworking via a non-OSI adapter*

In the outgoing access from PSTN to PSPDN, a calling DTE originates a PSTN call request indicating the address of a called DTE connected to the PSPDN, so that the PSTN can provide the called DTE address to the non-OSI adapter. Therefore no separate X.28 call request procedure is required.

In this interworking method, a PSTN can offer a non-OSI adapter which provides e.g., PAD function. Moreover, a PSTN can provide direct interworking non-OSI adapter routing selection to indicate directly the address of DTE B.

A possible interworking arrangement between PSTN and PSPDN is illustrated in Figure 21/X.300.

In this interworking arrangement:

a) arrangement between a non-OSI adapter in PSTN and PSPDN is based on Recommendation X.75;

b) non-OSI adapter provides conversion between a conventional telephone signalling and X.75 during call set up phase;

c) during data transfer phase, the protocols defined in Recommendations X.28 and X.29 are used in PSTN and PSPDN, respectively.

*Note* – The condition for using X.75 as mentioned in a) and b) above are for further study.

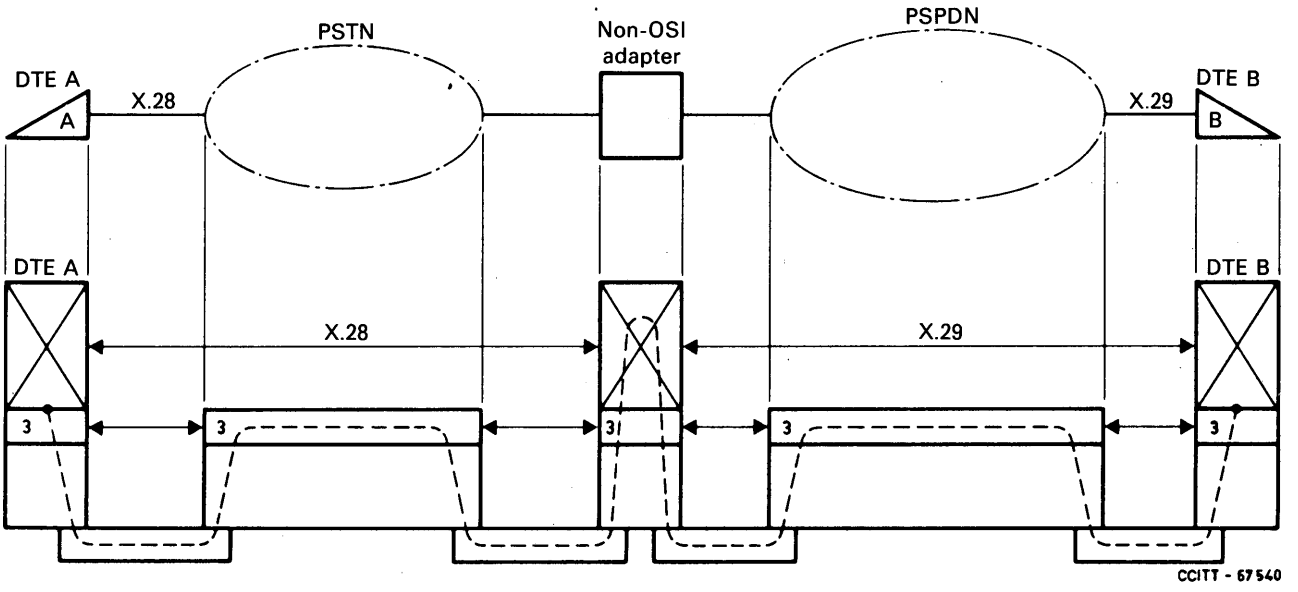



FIGURE 21/X.300

**Direct interworking via a non-OSI adapter**

4.5.2 *Interworking via a non-OSI adapter based on the port access method*

In the outgoing access from PSTN to CSPDN, a calling DTE originates an X.28 call request to a non-OSI adapter indicating the address of a called DTE connected to the PSPDN, after establishing a PSTN connection with the non-OSI adapter, this means a two-stage call request procedure.

In this interworking method, a PSPDN can offer the non-OSI adapter which provides e.g., PAD function.

A possible interworking arrangement between PSTN and PSPDN is illustrated in Figure 22/X.300.

In this interworking arrangement:

a) non-OSI adapter (X.3 PAD) provides conversion between X.28 and X.29 DTE/DCE interfaces;

b) the X.28 DTE/DCE interface protocol is used to set up the call from the non-OSI adapter to the called DTE B;

c) during data transfer phase, the protocols defined in Recommendations X.28 and X.29 are used at the DTE/DCE interfaces in PSTN and in PSPDN, respectively.

## 5 Detailed internetwork arrangements for call control

This section describes the detailed internetwork arrangements for call control applicable to interworking at the OSI Network Layer, including some of the arrangements necessary to provide support for the full capability of the OSI Network Layer Service. Further study is required to describe the other arrangements needed to support the full OSI Network Service. Different cases of this type of interworking are described in § 3.2.1.

These arrangements are not applicable to interworking involving communication capability as described in § 3.3.

It is for further study whether or not any of these arrangements are also applicable to other types of interworking, for example, interworking by port access as described in § 3.2.2.

### 5.1 *General*

#### 5.1.1 *Model applicable to internetwork arrangements*

The internetwork arrangements for call control are established according to the model illustrated in Figures 23/X.300 and 24/X.300.

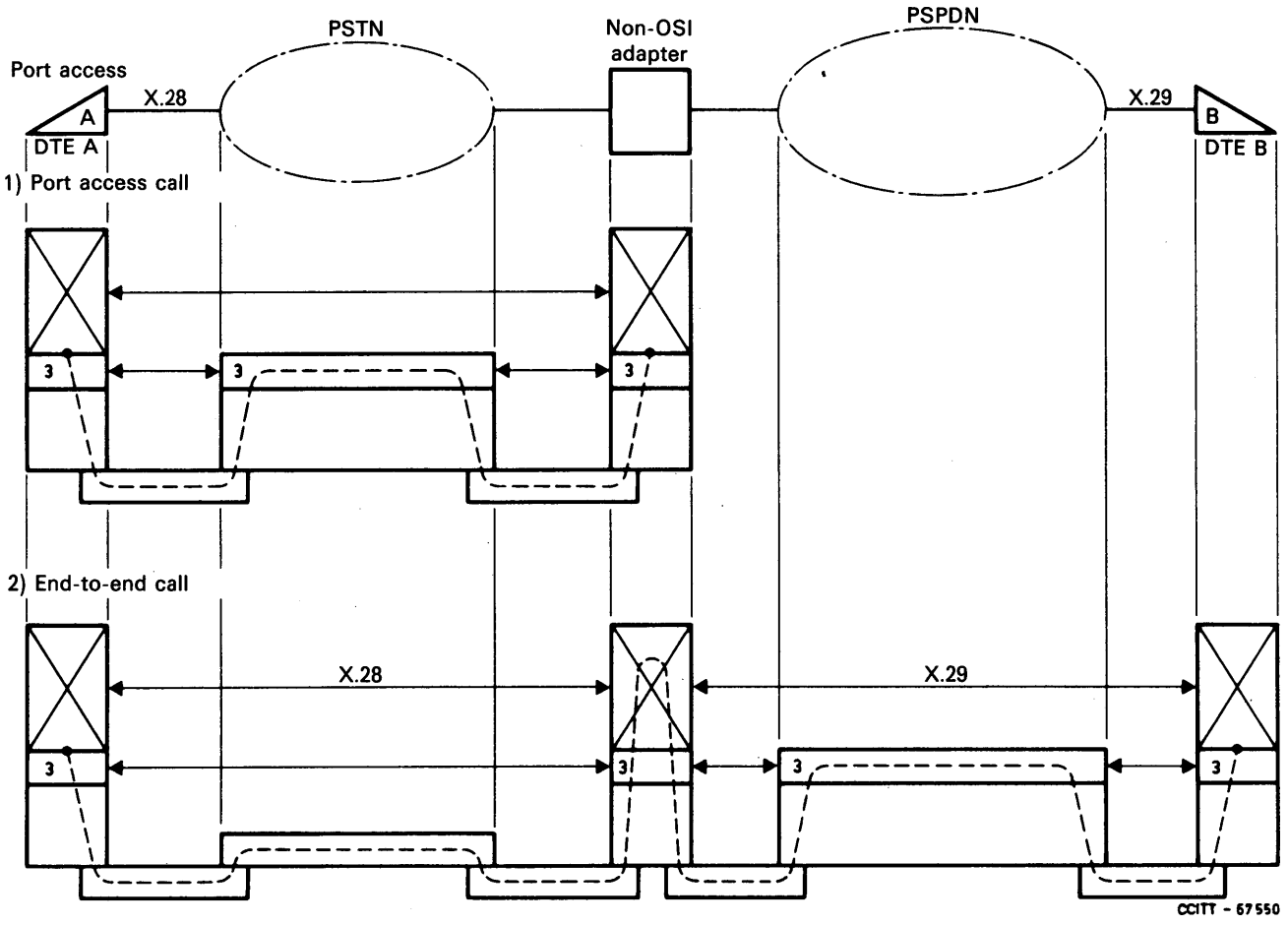



FIGURE 22/X.300

**Interworking via a non-OSI adapter based on port access beween PSTN and PSPDN**

5.1.2 *Classification of internetwork signals*

Recommendations dealing with inter-network signalling systems describe various signals that can be classified as follows:

5.1.2.1 *Internetwork data link control signals*

Data link control signals (e.g., availability of physical circuit(s)) are related to the particular considered data link and therefore normally are confined within the two ends of the link itself. Thus these signals do not normally pass across the interworking function.

An exception to this may be when, for example, a large number of data links in a network are unavailable or faulty, so to prejudge routing of the calls from an interconnected network. In this case, appropriate operation signals may be generated towards the interconnected network at the extent allowed by the signalling arrangements provided in it.

*Note 1* – A given data link may convey signalling data and/or user data.

*Note 2* – Between two packet switching networks, Recommendation X.75 indicates that a given data link may employ several physical circuits.

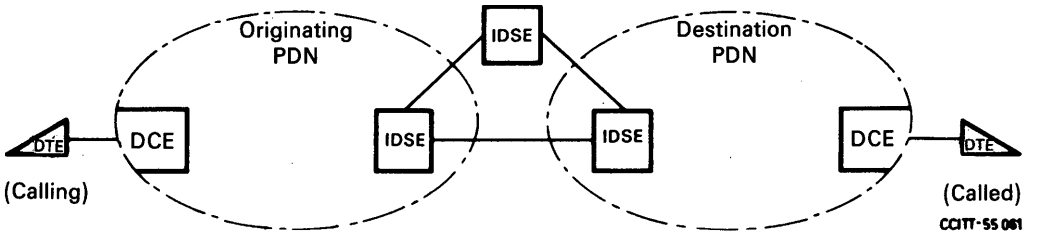



FIGURE 23/X.300

**Model for call establishment phase**

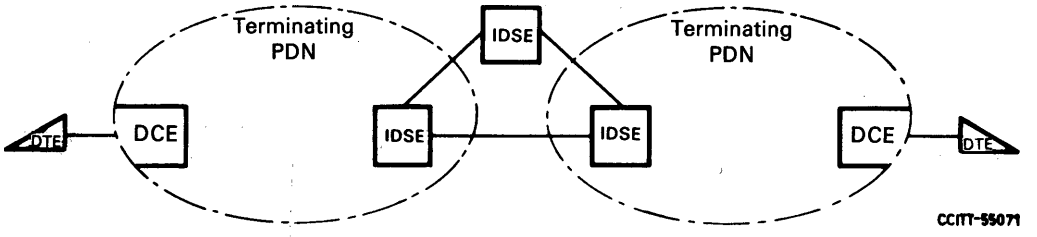



FIGURE 24/X.300

**Model for data transfer and clearing phases**

5.1.2.2 *Internetwork call control signals*

This type of signal includes all signals that convey between two networks the appropriate data and control information for a given call. These signals are essentially related to:

- call set-up,
- data transfer,
- call clear-down.

*Note 1* – Some signals are essential for call establishment, for example, DTE addresses, indications for user facilities whenever required, call progress signals. These signals are subject to general descriptions in the relevant Recommendations (for example, DTE addresses in Recommendation X.121, call progress signals in Recommendation X.96). Also, the way to convey these signals between two networks is described in the Recommendations dealing with the inter-network signalling systems.

*Note 2* – Some internetwork signalling systems specify that all call control signals employ a unique data link; this is the case in the X.75 signalling system. Some other internetwork signalling systems specify that the call control signals employ more than one data link; this is the case in the common channel signalling system, where both a signalling channel and a data channel are used for the same call.

5.1.2.3 *Internetwork operation signals*

This type of signal would consist of all signals that are not directly related to the control of a specific data link or a specific call between two networks; those operation signals would provide the necessary general information for a satisfactory operation of the internetwork connections such as:

- system availability,
- circuit efficiency,
- congestion or failure conditions, ...

*Note 1* – The transmission of some internetwork operation signals may cause a network to modify general rules applying to the network operation, such as: change in routing scheme, control of data flow when applicable, clearing of some calls, etc.

*Note 2* – The transmission of such internetwork operation signals does not prevent networks to process some of the signals used for internetwork operation. In particular, a network may wish to note the exact circumstances of a call clearing related to a remote network failure, in order to take necessary actions as soon as possible (change in routing scheme, etc.).

### 5.1.3 *General principles concerning internetwork signals*

This section describes some general principles that could be used as a basis for the interworking between different types of networks.

#### 5.1.3.1 *Basic status of a data link*

On every data link established in a network, the data link control signals should provide both ends with the capability of controlling at any time the status of the link. In particular, each end should be able to know whether or not the data link is fully operational; in the case the data link is not fully operational whether or not it is still available for additional data transmission signals related to existing call(s), signals related to new call(s); also whether or not existing call(s) should be cleared (or reset), due to that data link problem.

*Note 1* – Following that principle, provision should be made within the appropriate internetwork signalling Recommendations, so that each network could be aware of the status of the links in an interconnected network whenever required.

#### 5.1.3.2 *Call request and call confirmation phases*

The establishment of a call between two subscribers should consist of two consecutive phases:

- first a *call request* phase, when:
  - a call is requested by a subscriber, with specific parameters,
  - this call request is processed and routed through the network(s), unless it cannot be accepted by the network(s),
  - the call request is indicated to the called subscriber;
- then, a *call confirmation* phase, when:
  - a call acceptance is reported by the called subscriber, unless this subscriber does not accept the call,
  - final arrangements are made through the network(s) for that call,
  - the call establishment is confirmed to the calling subscriber.

*Note 1* – During each one of those two phases, the various actions are not necessarily carried on separately. For example, a network equipment may process some call request signals received from a subscriber, before further parameters for the call request are transmitted by that subscriber.

*Note 2* – Currently, the establishment of a call through certain combinations of networks necessitates more than the two phases mentioned in this section; for example, when accessing a packet switching network from a switched network, the complete establishment of the switched access is usually required before the virtual call can be requested. Following the principle indicated in this section, provision should be made within the appropriate internetwork signalling Recommendations, in order to be able to establish direct calls between both end users whenever it is possible. Consequently, provision should also be made within the numbering plan so that a subscriber line could be directly and uniquely identified from any network.

*Note 3* – The way to accept and route a call through different networks may depend not only on the called DTE address, but also on parameters or facilities defined for that call. Following the principle indicated in this section, in the case some parameters or facilities require a negotiation during the call establishment:

- the calling DTE can only indicate its specific requirements for the call when it requests the call,
- the called DTE can only modify the call characteristics when it accepts the call.

5.1.3.3 *Call clearing*

Any network or user involved in a call should have the possibility to clear immediately that call.

At the time a call is cleared, any network involved in the call would immediately stop transmitting user data on the call, and report the call clearing to the adjacent networks, unless they are already informed of that clearing. The clearing signal should then be transmitted with all necessary details, i.e., cause and diagnostic.

As soon as a call clearing is locally completed, any resource used for that call can be re-used by the network for other calls.

*Note 1* – Following that principle, the receipt of a clear confirmation does not necessarily mean that the end user was already informed of the clearing, and confirmed it.

*Note 2* – The call clearing principle indicated in this section does not prevent both users to exchange end-to-end information about clearing the call, if they wish to do so at the end of data transfer (example: invitation to clear data packet in Recommendation X.29).

## 5.2 *Transfer of addressing information*

The internetwork arrangements described in this section provide the capability to transfer all elements of addressing information at the Network Layer of OSI. This information comprises that defined in Recommendation X.121 and any additional addressing information defined at the Network Layer of OSI.

### 5.2.1 *Transfer of X.121 calling address*

This section describes arrangements for the transfer of calling address information defined in Recommendation X.121. Such information is referred to in this section as the "X.121 calling address".

#### 5.2.1.1 *Transfer during call request phase*

The X.121 calling address shall be provided by the originating PDN. In some cases this will occur automatically and in others it is provided only when requested by the destination PDN (see § 5.2.1.4). The originating PDN is responsible for the accuracy of the X.121 calling address when it is provided.

However, the following particular situations occur:

5.2.1.1.1 In some cases, even where techically the transfer of the X.121 calling address is possible, there may be administrative reasons why the identity of the calling user, and therefore the X.121 calling address related to it, cannot be passed over an international boundary. In such a case the identification of the originating network shall be provided instead of the X.121 calling address.

5.2.1.1.2 Networks other than public data networks, whenever they are used in conjunction with public data network for offering data transmission services, should, if possible, provide for the transfer of X.121 calling address. However, this transfer is not technically possible through some current networks; for example, for a call passing through a public switched telephone network, into a public data network, the telephone network is not always able to indicate the X.121 calling address to the data network. In such a case, information transferred through the public data network instead of the X.121 calling address is for further study.

5.2.1.1.3 In the circuit switched service the X.121 calling address can be transferred as the calling line identification. It is transferred to the called DTE only if the called DTE subscribes to the calling line identification facility (see § 5.2.1.4).

5.2.1.1.4 In packet switched service the X.121 calling address is transferred to the called DTE in the calling DTE address field signalled to the called DTE.

#### 5.2.1.2 *Transfer during call confirmation phase*

Provided the route for the call is selected during the *call set-up* phase, the X.121 calling address does not need to be transferred back through the PDNs during the *call confirmation* phase.

5.2.1.3 *Transfer during other phases of the call*

The X.121 calling address does not need to be transferred through the PDNs during any other phase of the call.

5.2.1.4 *Calling line identification*

5.2.1.4.1 *General*

*Calling line identification* is a user facility, standardized for circuit-switched services, that enables a user to be informed for incoming calls of the identity of the calling user. When provided the facility applies to all incoming calls.

It is an optional user facility assigned to the user for an agreed contractual period.

The calling line identity is the X.121 data number of the calling user. For international calls the identity is the complete X.121 international data number including the DNIC or DCC component as applicable.

*Note* – The implications of a possible combination of *calling line identification* and the *bilateral closed user group* facility are for further study.

Information indicating that a user has the *calling line identification* facility is stored at the exchange to which the user is connected. The identity sent to the called user is originated under control of the exchange to which the calling user is connected.

Facility registration is controlled by the Administration or Recognized Private Operating Agency.

5.2.1.4.2 *Call set-up procedure*

The procedure for a call to a user having the *calling line identification* facility varies depending on whether the calling line identity is included in the initial call control information received by the destination exchange at call set-up.

a) In the case where the calling line identity is included in the call control information received by the destination exchange, it sends this identity to the called user in accordance with the applicable DTE/DCE interface protocol.

b) In the case where the calling line identity is not included in the call control information received by the destination exchange, it sends a request for identification towards the originating exchange.

   i) In the case where the originating network provides the *calling line identification* facility, the originating exchange responds with the calling line identity which is forwarded by the destination exchange to the called user in accordance with the applicable DTE/DCE interface protocol.

   ii) In the case where the originating network does not provide the *calling line identification* facility, it responds with the originating network identity (see § 5.4.1.2). In this case the identification sent by the destination exchange to the called user is in accordance with the applicable DTE/DCE interface protocol.

The destination exchange must not connect through until the identity has been completely sent to the called user. Also, in the case where decentralized signalling is used, transit exchanges have to delay through-connection in certain situations until a possible identification has been completed in accordance with the applicable interexchange signalling procedures (see Recommendations X.70 and X.71).

5.2.2 *Transfer of X.121 called address*

This section describes arrangements for the transfer of called address information defined in X.121. Such information is referred to in this section as the "X.121 called address".

5.2.2.1 *Transfer during call request phase*

As it is essential for the purposes of call establishment, including routing, the X.121 called address is systematically transferred through the PDNs during the call request phase.

5.2.2.2 *Transfer during call confirmation phase*

The destination network does not need to provide the X.121 called address (or called line identity) if not requested. When provided, the destination PDN is responsible for the accuracy of the X.121 called address.

However, the following particular situations occur:

5.2.2.2.1 In the circuit switched service the X.121 called address can be transferred to the calling DTE as the called line identity. It is transferred if the calling DTE requests the called line identification facility (see § 5.3.5.4). If the call has been redirected or if a hunt group facility has been invoked in the destination PDN, the address of the called DTE/DCE interface over which the call is established shall be transferred.

5.2.2.2.2 In the packet switched service, the X.121 called address can be transferred to the calling DTE. In the case of call redirection or hunt group facility, address of the called DTE/DCE interface over which the call is established is always transferred.

5.2.2.3 *Transfer during other phases of the call*

The X.121 called address does not need to be transferred through the network during any other phase of the call.

However, the following particular situation occurs:

5.2.2.3.1 In the packet switched service, a clear request issued by a DTE, to which a call has been redirected or distributed among a hunt group as a direct response to the call request packet should contain the address of the DTE/DCE interface.

5.2.2.4 *Called line identification*

5.2.2.4.1 *General*

*Called line identification* is a user facility, standardized for circuit switched service, that enables a user to be informed for outgoing calls of the identity of the user to which the call has been connected. When provided, the facility applies to all outgoing calls.

It is an optional user facility assigned to the user for an agreed contractual period.

The called line identity is the X.121 data number of the user to which the call has been connected. For international calls the identity is the complete X.121 international data number including the DNIC or DCC component as applicable.

Information indicating that a user has the called line identification facility is stored at the exchange to which the user is connected. The identity sent to the calling user is originated under control of the exchange to which the called user is connected.

5.2.2.4.2 *Call set-up procedure*

In the case of a call from a user having the *called line identification* facility, the call control information forwarded by the originating exchange at call set-up includes a request for called line identification. The procedure then depends on whether or not the destination network provides the facility.

a) In the case where the destination network provides the *called line identification* facility, the destination exchange responds with the called line identity which is returned by the originating exchange to the calling user in accordance with the applicable DTE/DCE interface protocol.

b) In the case where the destination network does not provide the *called line identification* facility, it responds, depending on what type of signalling is used, with the destination network identity (Recommendation X.60) or with a "dummy" identification Recommendation X.70 or X.71. The information sent by the originating exchange to the calling user is in accordance with the applicable DTE/DCE interface protocol.

For circuit-switched calls the originating exchange must not connect through until the identity has been completely sent to the called user. Also, in the case where decentralized signalling is used, transit exchanges have to delay through-connection in certain situations until a possible identification has been completed in accordance with the applicable interexchange signalling procedures (Recommendations X.70 and X.71).

5.2.3 *Coding of X.121 addresses*

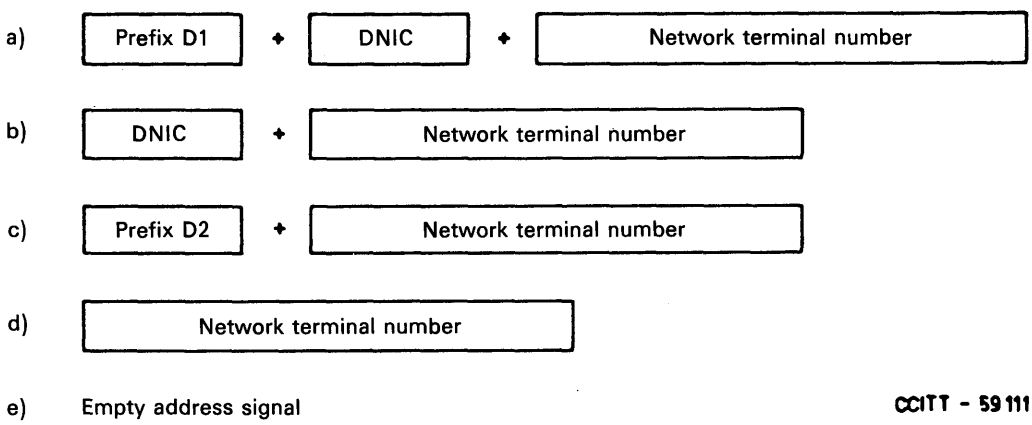
Address information defined in X.121 is referred to in this section as the "X.121 address".

Whenever an X.121 address has to be conveyed across a DTE/DCE interface or an IDSE X/Y interface, according to the requirements mentioned in this Recommendation, this transfer should be done according to the following principles:

5.2.3.1 For international calls the X.121 address shall be given explicitly in the form of the complete international data number including the DNIC or DCC component as applicable.

5.2.3.2 The exact coding (format) of an address signal may not necessarily be the same nationally. Such a coding is a matter for specific arrangement at each interface involved in the call: calling DTE/DCE interface, called DTE/DCE interface and interexchange interfaces.

For example, on an X.21 or X.25 interface, the same address of a DTE/DCE interface on a PDN may be represented in the following ways:




*Note 1* – D1 and D2 are distinct decimal digits.

*Note 2* – Case e) would only occur when the address is already known on the other side of the interface, e.g., at a DTE/DCE interface for the address corresponding to that DTE/DCE interface.

This example illustrates the use of a prefix, as recognized in § 2.5 of Recommendation X.121 as one way to distinguish between different codings (or formats) of the same address.

In the case of mobile services, a conversion between different address codings may be required at various interfaces throughout the network, for roaming subscribers.

*Note* – A roaming mobile subscriber is a subscriber who can obtain fully automatic connections, even when he moves out of his normal area of operation.

5.2.3.3 The specific format(s) that can be used at a given interface are defined in the appropriate CCITT Recommendation dealing with that interface.

5.2.4 *Transfer of address information additional to Recommendation X.121*

This section describes arrangements for the transfer of address information additional to that defined in Recommendation X.121.

5.2.4.1 *General*

The Network Addressing Extension (NAE) mechanism allows the transfer through PDNs on a per call basis of addressing information at the OSI Network Layer beyond the 14 digit total limit established for X.121 addresses. This mechanism is standardized for circuit and packet switching service.

If sufficient space exists in the fields carrying X.121 address information, and an arrangement exists between users and PDNs concerned, this constitutes an alternative capability, available on a per call basis without requiring the NAE mechanism, for the transfer of addressing information additional to that defined in Recommendation X.121. Whenever possible this should be the preferred method.

5.2.4.2 *Realization*

The detailed realization of the NAE mechanism at each type of internetwork and user interface is independently defined in the appropriate signalling and interface Recommendations.

5.2.4.3 *Principles*

The following principles apply equally and independently to both called and calling address information:

5.2.4.3.1 The transfer of adressing information at the OSI Network Layer additional to that defined in Recommendation X.121 is possible during any phase of the call in which address information defined in X.121 can also be transferred (see §§ 5.2.1 and 5.2.2 above).

5.2.4.3.2 The addressing information in the NAE can be of variable length. It can comprise (provisionally) up to 32 decimal digits (inclusive) (see Note). The content of the information is unrestricted with respect to the grouping of digits.

*Note* – The maximum length of 32 decimal digits is derived from the provisional maximum length of the OSI Network Service Access Point (NSAP) address defined in Recommendation X.213.

5.2.4.3.3 PDNs should not be required to look at or operate on a Network Addressing Extension for any purpose including routing; however, some PDNs may look at the Network Addressing Extension if they wish.

5.2.4.3.4 In cases where it is possible and an arrangement exists between users and PDNs concerned, the conveyance of the complete addressing information (i.e., all elements of OSI Network Layer Addressing) may be performed without Network Addressing Extension Mechanism.

5.2.4.3.5 Each internetwork interface should simultaneously accommodate the following partitions of the addressing information between existing protocol elements for Addressing and Network Addressing Extensions:

a) All elements of addressing information are contained in the existing protocol elements for addressing; no Network Addressing Extension is needed; the complete OSI Network Address is contained in the existing protocol elements.

b) The complete OSI Network Address is contained in the Network Addressing Extension; all elements of addressing information needed by the PDNs involved in the call are contained in the existing protocol elements for addressing.

   *Note* – In this case, for some OSI Network Addresses, part of the OSI Network Address information may be duplicated in the existing protocol elements for addressing.

c) The addressing information is split into two elements, one contained in the existing protocol elements for addressing, the other contained in the network addressing extension.

   *Note* – Examples of this case are for further study. Some OSI Network Addresses may be expected to contain X.121 number internally; exact relation with Recommendation X.121 is for further study.

5.2.4.3.6 It is for further study whether the following partition should be accommodated or not in addition to those described in § 5.4.2.3.5 above:

d) All elements of addressing information form a single string of decimal digits, longer than 14 digits; since existing protocol elements for addressing are not always sufficient to convey the addressing information, the Network Addressing Extension is used in conjunction with the existing protocol elements to convey such a string of decimal digits, when necessary.

5.2.4.3.7 It is also for further study whether any requirement can be identified in which some future public network addresses to be signalled through PDNs could exceed the existing limit of 14 decimal digits. It is also for further study whether or not, to accomodate any such cases, a part of the public network address not required to be operated upon by the PDNs for any purpose, including routing, might be conveyed partly in the field defined for X.121 address information and partly using the NAE mechanism.

## 5.3 *Arrangements for user facilities*

### 5.3.1 *Facilities related to the quality of service parameters for the call*

This section describes arrangements required to control the quality of service on a call, including arrangements necessary to provide the quality of service aspects defined for the OSI Network Layer Service.

Some mechanisms have already been defined that relate to the quality of service on a call, e.g., flow control parameters negotiation mechanisms in Recommendations X.25 and X.75.

*Note* – It is for further study whether there is a need to introduce new user facilities to request a target quality of service for a call and new network utilities to control that target quality of service. In particular, target transit delay may be a QOS parameter which can be requested by a user.

#### 5.3.1.1 *Transit delay selection and indication*

*Transit delay selection and indication* is an optional user facility applicable to the packet switched virtual call service, which may be requested by a DTE for a given virtual call. This facility permits selection and indication, on a per call basis, of the nominal maximum permissible transit delay applicable to that virtual call. The transit delay parameter is defined as t3c in Annex A of Recommendation X.135.

Nominal maximum permissible transit delay is signalled provisionally in milliseconds and expresses the value that should not be exceeded by 95% of the packets (128 octets size) sent by the user on that call.

A DTE wishing to select a nominal maximum permissible transit delay for a virtual call indicates the desired nominal maximum permissible value in the *call request packet.*

*Note* – The range and the number of reasonable values of the nominal maximum permissible transit delay are for further study.

The network, when able to do so, may allocate resources and route the virtual call in a manner such that the nominal transit delay applicable to that call does not exceed the desired nominal maximum permissible transit delay.

The *incoming call* packet transmitted to the called DTE, and the *call connected* packet transmitted to the calling DTE, will both contain the indication of the nominal transit delay applicable to the virtual call. This transit delay may be smaller than, equal to, or greater than the desired nominal maximum permissible transit delay requested in the *call request* packet.

### 5.3.2 *Facilities related to the charging conditions applying to the call*

#### 5.3.2.1 *Reverse charging and reverse charging acceptance*

##### 5.3.2.1.1 *General*

*Reverse charging* is an optional user facility that may be requested by the user on a per call basis. It enables a calling user to request that the call should be charged to the called user.

*Reverse charging acceptance* is an optional user facility assigned to the user for an agreed contractual period. It enables the user to accept reverse charging calls.

*Note 1* – The international accounting arrangements for reverse charging calls and the consequent implications on network capabilities have not yet been defined.

*Note 2* – All requirements of the *reverse charging* and *reverse charging acceptance* facilities have not yet been catered for in the DTE/DCE interface and interexchange signalling specifications.

The facilities are standardized for the circuit-switched and packet-switched services.

##### 5.3.2.1.2 *Call set-up procedure*

A calling user may request reverse charging by means of a facility request over the DTE/DCE interface.

a) In the case where reverse charging is allowed by the originating network, the call control information forwarded to the succeeding exchange will include a *reverse charging request* indication.

b) In the case where reverse charging is not allowed by the originating network, the call is rejected and an *invalid facility request* call progress signal is returned to the calling user.

When receiving a call including a reverse charging request indication the destination exchange will act as follows:

1) In the case where the called user subscribes to the *reverse charging acceptance* facility, the incoming call information including an indication that reverse charging is requested is sent to the called user.

2) In the case where the called user does not subscribe to the *reverse charging acceptance* facility, the call is rejected and a *reverse charging acceptance not subscribed* signal is sent towards the originating exchange.

The call may also be rejected for other reasons not related to the *reverse charging* or *reverse charging acceptance* facilities.

When the incoming call information is sent to the called user, the called user may deny establishment of the call by clearing if he is not willing to accept reverse charging for this particular call.

*Note* – The DTE/DCE interface arrangements necessary in the circuit-switched service to allow the called user to deny establishment of a reverse charging call, for example after *calling line identification*, have not yet been defined. The procedure chosen is likely to affect the network procedures for reverse charging calls.

### 5.3.3 *Facilities related to specific routing conditions requested by the users of the call*

#### 5.3.3.1 *Redirection of calls*

##### 5.3.3.1.1 *General*

*Redirection of calls* is an optional user facility assigned to the user for an agreed contractual period. It is standardized for the circuit switched service and the packet switched virtual call service.

The facility enables a user to have calls to his data number redirected to a predetermined address.

In the case of circuit switched service this shall apply to all calls to the data number. In the case of virtual call service this shall apply to calls which encounter the out-of-order condition, or optionally other conditions such as busy.

Provision of the facility and registration of the data number to which calls are to be redirected is controlled by the Administration.

It is for further study whether or not a facility is required allowing user control of the data number registered to which calls are to be redirected.

Depending on the possibilities offered by the Administration, facility activation and deactivation may be made:

a) by the user by means of user controlled activation and deactivation procedures;

b) by the network at predetermined times;

c) by the Administration or recognized private operating agency on request of the user;

d) by the Administration when providing and withdrawing the redirection of calls facility from the data number.

User controlled procedures for inquiry of the status of the facility (i.e. whether the facility is activated or deactivated) may also be provided.

For international calls redirection may only be made within the destination network. Some Administrations may allow redirection between networks within the destination country. In general a call may only be redirected once. However, some Administrations may provide for multiple redirections of a call in the virtual call service.

The redirection of call facility will not violate the integrity of the closed user group facility.

For the packet switched networks when the virtual call is redirected, the call connected or clear indication packets transferred to the calling DTE will contain the called address of the alternate DTE and the called line address modified notification facility, indicating the reason why the called address is different from the one originally requested.

When the virtual call is redirected, some networks may indicate to the alternate DTE the reason for redirection and the address of the originally called DTE, using the call redirection notification facility in the incoming call packet.

The order of call set-up processing at the originally called DCE as well as the alternate DCE will be according to the sequence of call progress signals in Table 1/X.96. For those networks that provide systematic call redirection with the prior request of the called DTE, the systematic call redirection request will have the highest priority in the call set-up processing sequence at the originally called DCE.

It is for further study whether there is a need for an optional user facility for the calling DTE, to indicate whether or not a redirection of a call originated by this DTE is permitted.

5.3.3.1.2 *Call set-up procedure for circuit switching*

5.3.3.1.2.1 *Calls not involving other facilities affecting the procedure*

Information that a user has the *redirection of calls* facility activated is stored, together with the redirection address, at the exchange to which the user is connected. When such a user is called, the call is set up to the redirection address in accordance with the following.

5.3.3.1.2.1.1 *The redirection address is at the same exchange*

In this case the destination exchange connects the call to the redirection address and returns the *redirected call* signal unless the call is rejected for one of the reasons indicated below. When receiving the *redirected call* signal, the originating exchange sends the corresponding call progress signal to inform the calling user that the call has been redirected.

In the case where the user at the redirection address also has the *redirection of calls* facility activated, the destination exchange rejects the call and returns the *access barred* call progress signal. The call may also be rejected for other reasons (e.g. number busy) in accordance with the ordinary procedures.

5.3.3.1.2.1.2 *The redirection address is at another exchange*

In this case the call is set up to the redirection address in accordance with one of the following procedures depending on the arrangements in the destination network.

The following procedure is based on the principle that the call is released back within the destination network and then set up to the new destination exchange. In the case of an international call it is realeased back to the incoming gateway exchange. In the case of a national call it is released back to the originating exchange. This procedure can be supported by common channel signalling (Recommendation X.61). The means necessary to support this procedure are not defined in Recommendations X.70 and X.71 as currently specified.

i) The first destination exchange returns the *redirection request* signal together with the redirection address towards the controlling exchange (i.e. the incoming gateway or originating exchange).

ii) In the case of an international call the incoming gateway exchange upon receipt of the *redirection request* signal, sets up a new forward connection to the redirection address. The call control information forwarded includes a *redirected call* indication. The forward connection to the first direction exchange is released.

iii) In the case of a national call the originating exchange acts in accordance with ii).

iv) Upon receipt of the redirected call the new destination exchange connects the call or rejects the call in accordance with § 5.3.3.1.2.1.1. The forward *redirected call* indication received by the new destination exchange is used to prevent a further redirection.

v) In the case where the call is connected to the redirection address, the originating exchange will receive the *redirected call* signal. It then sends the *redirected call* call progress signal to inform the calling user that the call has been redirected.

The following procedure is based on the principle that the connection is extended forward from the first destination exchange to the new destination exchange. This procedure can be supported by common channel signalling and decentralized signalling in accordance with Recommendations X.61, X.70 and X.71.

i) The first destination exchange sets up the forward connection to the redirection address. The call control information forwarded will include a *redirected call* indicator.

ii) Upon receipt of the redirected call the new destination exchange connects or rejects the call in accordance with § 5.3.3.1.2.1.1. The forward *redirected call* indication received is used to prevent a further redirection.

iii) In the case where the call is connected to the redirection address the originating exchange will receive a *redirected call* signal. It then sends the *redirected call* call progress signal to inform the calling user that the call has been redirected.

5.3.3.1.2.2 *Calls involving a closed user group facility*

Redirected calls are subject to the restrictions applying for the closed user group (CUG) facilities.

a) In the case where the call is a CUG call, or the originally called user has a CUG facility, the call is rejected before redirection unless the validation check requirements applying for the CUG facility(ies) concerned are satisfied.

b) In the case where the call is a CUG call, or the user at the redirection address has a CUG facility, the call is rejected unless the validation check requirements applying for the CUG facility(ies) concerned are satisfied.

c) In the case where:

i) the call is a CUG call, and

ii) the redirection address is at an exchange other than the first destination exchange, and

iii) the procedure for setting up the call to the redirection address is in accordance with § 5.3.3.1.2.1.2 (i.e. the call is released back), the first destination exchange has to send the CUG information received (e.g. the CUG call indication, and the interlock code) back to the controlling exchange together with the *redirected call* signal and the redirection address to enable the controlling exchange to include this CUG information in the call control information sent on the new forward connection.

5.3.3.1.2.3 *The calling user has the called line identification facility*

In the case where a call from a user that has the *called line identification* facility is redirected, the called line identity sent to the calling user is the data number of the redirection address.

5.3.3.2 *Hunt group*

5.3.3.2.1 *General*

The *hunt group* facility is a facility applicable to circuit switched service and packet switched virtual call service which distributes incoming calls containing a hunt group address across the available DTE/DCE interfaces associated with the facility.

Once a call is assigned to a DTE/DCE interface, the call is treated as a regular call.

Calls originated on a DTE/DCE interface belonging to the hunt group are handled as normal calls.

*Note 1* – One or more addresses may be associated with the facility. If more than one address is associated with the facility, the selection procedure is performed irrespective of the particular called address.

*Note 2* – A specific address may be assigned to each DTE/DCE interface associated with a hunt group. Calls placed directly to these specific addresses are treated normally (no distribution of calls). As an option, when distribution has been performed, the address assigned to the individual DTE/DCE interface should be returned to the calling DTE (as called line identification) together with an indicator indicating why the called line identification is different from the original called address.

5.3.3.2.2 *Call set-up procedure*

When receiving an incoming call having a hunt group address, the destination exchange performs the selection of DTE/DCE interface if there is at least one idle circuit/channel available for incoming calls on any of the DTE/DCE interfaces in the group.

When calls are placed to a hunt group address, in the case specific addresses have also been assigned to the individual DTE/DCE interfaces, information is transferred to the calling DTE which contains the called address of the selected DTE/DCE interface and also indicating the reason why the called address is different from the one originally requested; the exact arrangement if for further study.

For packet switching virtual call service, called line address modified notification facility is used for this purpose.

Some networks may apply call subscription time user facilities, common to all DTE/DCE interfaces in the hunt group, place a limit on the number of DTE/DCE interfaces in the hunt group, and/or constrain the size of the geographic region that can be served by a single hunt group.

5.3.3.3 *RPOA selection*

5.3.3.3.1 *General*

This facility is an optional user facility which may be either agreed for a period of time or requested by a DTE on a per call basis for use on either circuit switched or packet switched virtual call services.

In countries that have more than one RPOA transit network, there is a requirement for a user facility which, when requested, allows the calling DTE to select either one or a sequence of more than one RPOA transit network(s) within the originating country. In the case of international calls, this facility, when requested, allows the calling DTE to select a particular international RPOA within the country of that DTE.

*Note* – The procedure for selection of multiple RPOAs is not yet specified in the circuit switching interface Recommendations.

5.3.3.3.2 *Call set-up procedure*

A user in a network providing the RPOA selection facility may request selection of a particular or a sequence of more than one RPOA transit network(s), within the originating country, either for an agreed period of time or on a call by call basis by a facility request including the DNIC(s) identifying the RPOA transit network(s) selected.

In the case where a calling user requests selection of one or more RPOA transit network(s), the originating network will route the call to the gateway exchange of the first RPOA transit network selected. In the case where the call is routed via one or more transit exchanges within the originating network, an RPOA selection request indication and the DNIC(s) identifying the RPOA transit network(s) requested will be included in the internal network call control information forwarded by the originating exchange. In a similar manner, if the calling user selects a sequence of transit networks, the first transit network shall route the call to the gateway exchange of the second RPOA transit network. Furthermore, the sequence of DNICs identifying the RPOAs selected by the user will be passed across the internetwork interface. Pending further study, the facility/utility used to provide this information is subject to bilateral agreement between the connecting transit networks.

The call control information sent over the international network will be as for an ordinary call and will not contain any *RPOA selection* related information.

In the case where the selected RPOA transit network cannot accept the call, due to, for example, congestion or network failures, the call is rejected by the gateway exchange and an *RPOA out-of-order* signal is returned towards the originating exchange which sends the corresponding call progress signal to the calling user.

5.3.4 *Facilities related to protection mechanisms requested by the users*

5.3.4.1 *Closed user group*

5.3.4.1.1 *General*

The closed user group (CUG) facilities enable users to form groups with different combinations of restrictions for access from or to users having one or more of these facilities. The following CUG facilities are standardized for the circuit-switched and packet-switched, virtual call and datagram, services. They are all optional user facilities that are assigned to the user for an agreed contracted period (see Note 1):

a) *Closed user group* – this is the basic facility that enables a user to belong to one or more CUGs;

b) *Closed user group with outgoing access* – this is an extension to a) which also enables the user to make outgoing calls to the open part of the network, and to DTEs having the incoming access capability [see c) below];

c) *Closed user group with incoming access* – this is a variant of a) which also enables the user to receive incoming calls from the open part of the network, and from DTEs having the outgoing access capability (see b) above);

d) *Incoming calls barred within the closed user group* – this is a supplementary facility to a), b) or c) which, when used, applies per user per CUG;

e) *Outgoing calls barred within the closed user group* – this is a supplementary facility to a), b) or c) which, when used, applies per user per CUG.

A user may belong to one or more CUGs. In the case where the user belongs to only one CUG, and the closed user group facility is subscribed to, it becomes the preferential CUG of that user. In the case where the user belongs to more than one CUG, and the closed user group facility is subscribed to, one of these CUGs is nominated as the preferential CUG of that user.

Each user belonging to at least one CUG has either the closed user group facility or one of both of the closed user groups with outgoing access and the closed user group with incoming access. When the closed user group with outgoing access and/or the closed user group with incoming access facility is subscribed to, the DTE may choose whether or not to have a preferential CUG.

For each CUG to which a user belongs, either or none of the incoming calls barred within the closed user group or outgoing calls barred within the closed user group facilities may apply for that user. Different combinations of CUG facilities may apply for different users belonging to the same CUG.

The realization of the CUG facilities is done by the provision of interlock codes and is based on various validation checks at call set-up, determining whether or not a requested call to or from a user having a CUG facility is allowed. In particular, a validation check is performed by verification that both the calling and called users belong to the same CUG as indicated by interlock codes.

Membership of closed user group(s) is controlled by the Administration or Recognized Private Operating Agency in conjunction with user requests. Assignment of interlock codes is controlled by the Administration or Operating Agency, and cannot be controlled by the user.

The international interlock code of an international CUG is as specified in § 5.3.4.1.3. The international interlock code expresses the international CUG number assigned to the CUG in accordance with the administrative rules defined in Recommendation X.180.

The originating network identification utility specified in § 5.4.1 may be used for international CUG calls under control of the gateway exchange of the destination network (see § 5.3.4.1.2.2).

*Note 1* – Outgoing access and/or incoming access applies to an individual user and not to a specific closed user group.

*Note 2* – The requirements in § 5.3.4.1.2 include cases which do not necessarily exist in a particular network, either because the Administration (or RPOA) has chosen not to offer the full range of CUG facility combinations or because some combinations are not meaningful from the user's point of view.

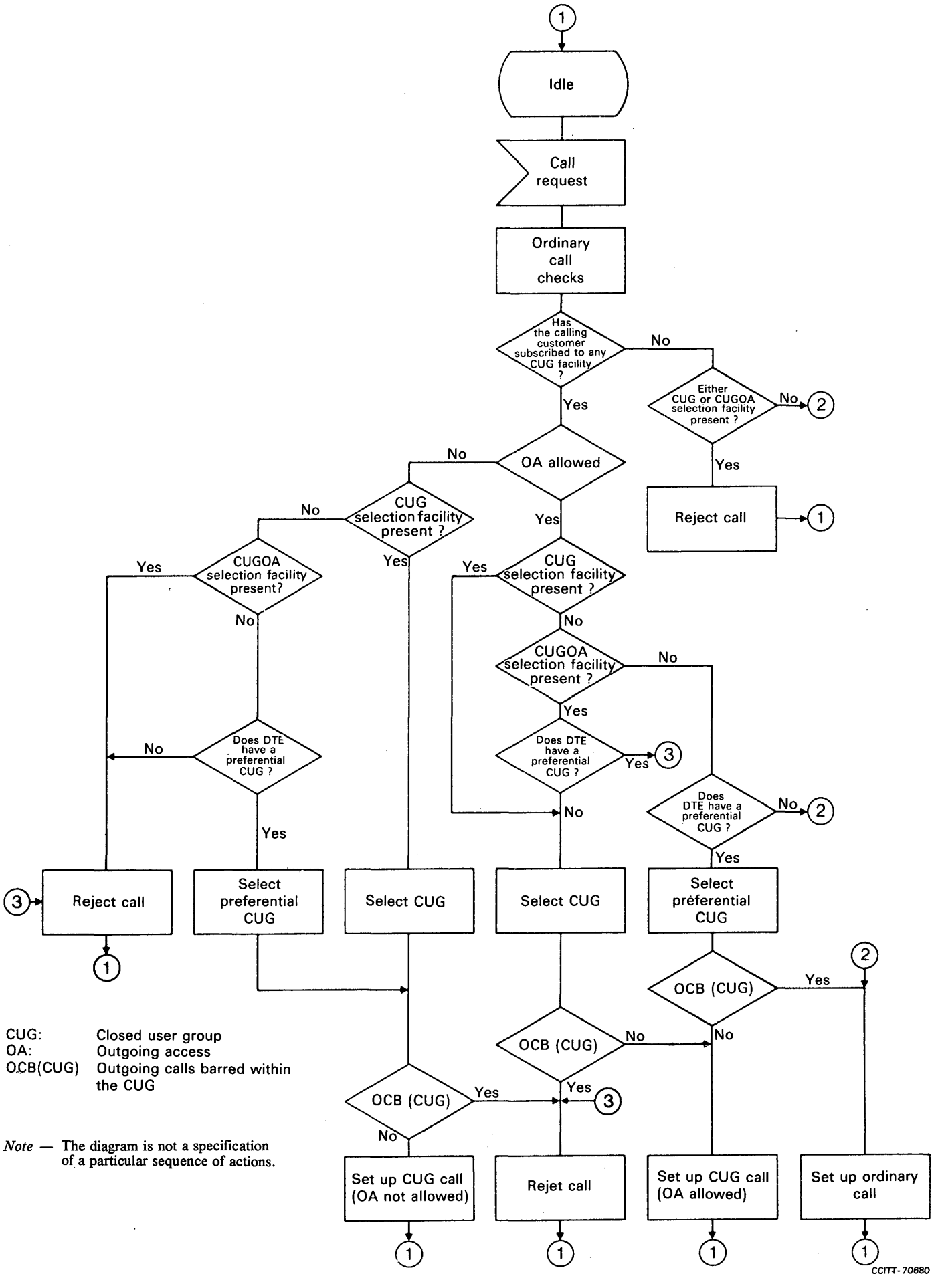
*Note 3* – A network should, also in the case where the *closed user group with outgoing access* facility is not provided, be capable of supporting the signalling necessary to complete incoming calls from users in another network providing that facility.

*Note 4* – Private networks, including several different terminals and types of terminals will be connected to the public data networks. In these private networks, the different terminals may belong to different groups internally in the private networks, and may also have a need to communicate into different CUGs in the public data network. The option by the private network not to have a preferential CUG when subscribing to the closed user group with outgoing access facility and/or the closed user group with incoming access facility allows for proper interpretation of the CUG facilities.

5.3.4.1.2 *Call set-up procedure*

5.3.4.1.2.1 *Originating exchange*

The DTE/DCE interface protocol and the actions at the originating exchange at call set-up from a user belonging to a CUG depends on whether the user belongs to one or more CUGs and on the combination of CUG facilities that applies. See also Figure 25/X.300.




CUG: Closed user group
OA: Outgoing access
OCB(CUG) Outgoing calls barred within the CUG

*Note* — The diagram is not a specification of a particular sequence of actions.

FIGURE 25/X.300

**Closed user group facilities: call set-up conditions at originating exchange**

5.3.4.1.2.1.1 *CUG selection*

For each CUG that a user belongs to, the interlock code assigned to the CUG is stored, associated to the user at the local exchange. In the case where a user belongs to more than one CUG, a selection of the CUG concerned, and thus of the corresponding interlock code, is required at call set-up. This selection is made on the following criteria.

In the case where the calling user makes a facility request including an index identifying a particular CUG, this CUG is selected by the originating exchange.

In the case where the calling user belongs to one or more CUGs and has a preferential closed user group, no facility request concerning CUG facilities is made in the case:

a) where the user belongs to one CUG only,

b) where a user who belongs to more than one CUG (with or without outgoing access) makes a call within the preferential CUG,

c) where a user having the *closed user group with outgoing access* facility makes an outgoing access call, or a call within the preferentiel CUG.

A facility request is always required for a call within any CUG other than the preferential CUG.

In the case where the calling user belongs to one or more CUGs and does not have a preferential closed user group, no facility request concerning CUG facilities is made in the case where a user having the closed user group with outgoing access facility makes an outgoing access call.

5.3.4.1.2.1.2 *Call set-up from a user having the closed user group or the closed user group with incoming access facility*

The case where a user has both the *closed user group with incoming access* and *closed user group with outgoing access* facilities is handled in accordance with § 5.3.4.1.2.1.3.

In this case CUG selection is performed in accordance with § 5.3.4.1.2.1.1.

In the case where the *outgoing calls barred within the closed user group* facility does not apply for the selected CUG, the call is set up at the originating exchange. The call control information forwarded to the next exchange then includes the interlock code of the selected CUG together with an indication that the call is a CUG call.

In the case where the *outgoing calls barred within the closed user group* facility applies for the selected CUG, the call is rejected and the *access barred* call progress signal is returned to the calling user.

5.3.4.1.2.1.3 *Call set-up from a user having the closed user group with outgoing access facility*

In the case where the calling user subscribes to the closed user group with outgoing access facility, and has a preferential (or only) CUG, the call is regarded as an outgoing access call and a call within the preferential (or only) CUG.

In the case where the *outgoing calls barred within the closed user group* facility does not apply for the preferential (or only) CUG, the call is set up at the originating exchange. The call control information forwarded to the next exchange then includes the interlock code of the preferential (or only) CUG together with an indication that the call is a CUG call for which outgoing access is allowed.

*Note* – With the above procedure it is not necessary to distinguish at the originating exchange between a call within a CUG and an outgoing access call.

In the case where the *outgoing calls barred within the closed user group* facility applies for the preferential (or only) CUG, the call is regarded as an outgoing access call. In this case the call is set up at the originating exchange and no interlock code or CUG call indication is included in the call control information forwarded to the next exchange.

In the case where the calling user subscribes to the closed user group with outgoing access facility, and does not have a preferential closed user group, the call is regarded as an outgoing access call, unless the calling user makes a facility request identifying a particular CUG for the call.

5.3.4.1.2.2 *Transit exchange*

With the possible exception of some gateway exchanges, each transit exchange sets up a CUG call as an ordinary call. The information related to the CUG facilities received from the preceding exchange, i.e. an interlock code, a CUG call indication and possibly an indication that outgoing access is allowed, is forwarded to the succeeding exchange.

In the case of an international CUG call, no special functions are required at the gateway exchange provided that the international interlock code assigned to the international CUG concerned is used in the national network. However, in the case where a national interlock code other than the applicable international interlock code is used within a national network, interlock code conversion is required at the gateway (or corresponding) exchange.

In the case where a destination network has a requirement for identification of the originating network for CUG calls, the *originating network identification* utility specified in § 5.4.1 may be employed.

5.3.4.1.2.3 *Destination exchange*

At the destination exchange a validation check of the acceptability of a call is made where either the calling user (as indicated by a CUG call indication in the control information received) or the called user belongs to a CUG. The call is connected only in cases where the information received checks with the information stored at the destination exchange, associated to the called user, as specified in the following. In cases where a call is rejected because of incompatible CUG information an *access barred* signal is sent towards the calling user.

The conditions for acceptance or rejection of calls because of the CUG facilities are illustrated in Figure 26/X.300.

*Note* – A call may be rejected for other reasons than those related to the CUG facilities.

5.3.4.1.2.3.1 *Calls to a user having the closed group or the closed user group with outgoing access facility*

The case where a user has both closed user group with incoming access and closed user group with outgoing access facilities is handled in accordance with § 5.3.4.1.2.3.2.

In this case an incoming call is accepted only when:

a) it is a CUG call, including the case where outgoing access is allowed, and

b) correspondence is found between the interlock code received and an interlock code associated with the called user, and

c) the *incoming calls barred within the closed user group* facility does not apply for the CUG identified by the interlock code received.

If all the above conditions are not met, the call is rejected.

5.3.4.1.2.3.2 *Calls to a user having the closed user group with incoming access facility*

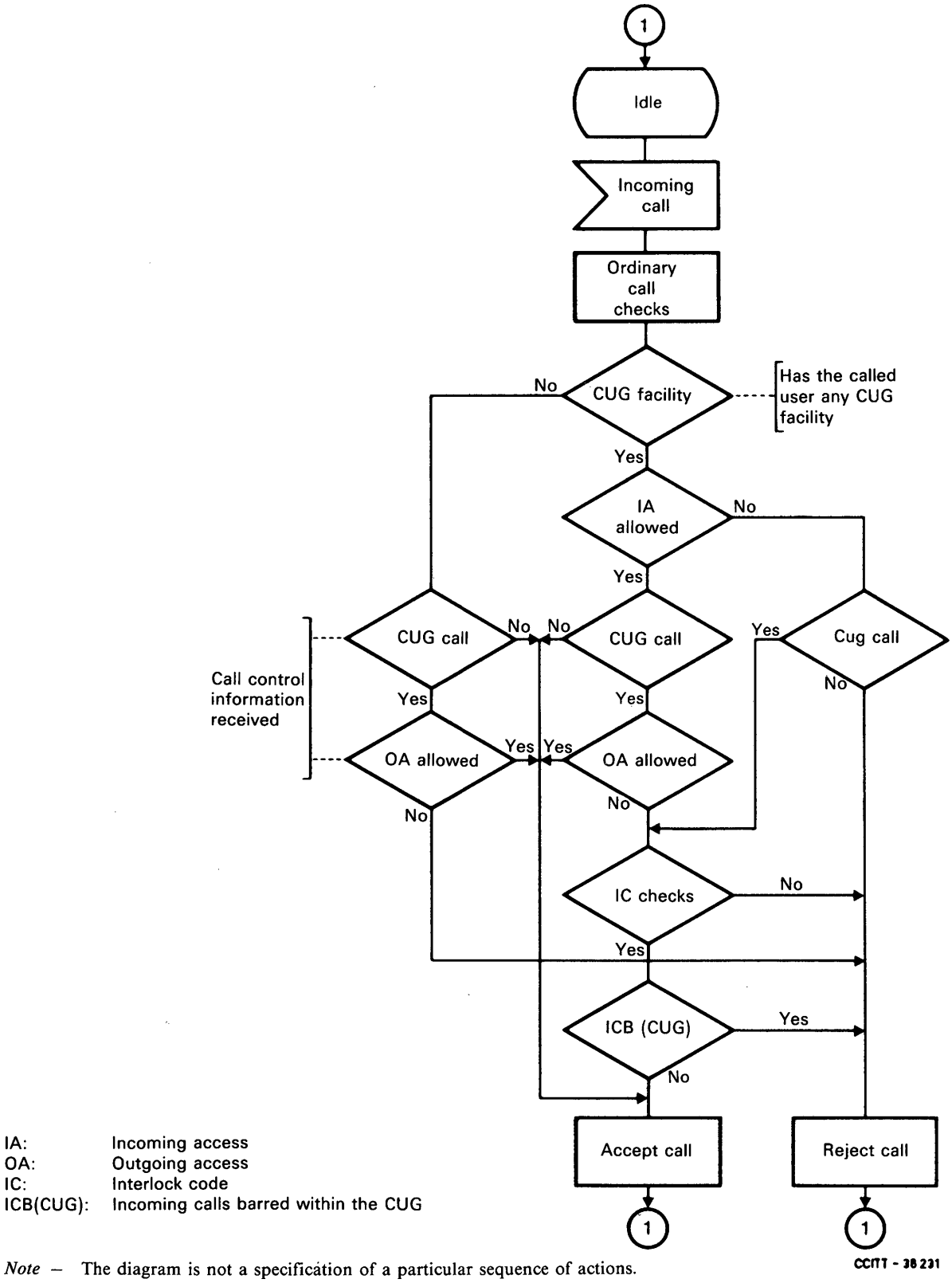
An incoming call is accepted in the cases when:

a) it is an ordinary call; or

b) it is a CUG call for which outgoing access is allowed; or

c) it is a CUG call for which outgoing access is not allowed, and both conditions specified in § 5.3.4.1.2.3.1 b) and c) apply.

In all other cases, the incoming call is rejected.




*Note* – The diagram is not a specification of a particular sequence of actions.

FIGURE 26/X.300

**Closed user group facilities: call set-up conditions at destination exchange**

5.3.4.1.2.3.3 *CUG calls to a user not belonging to any CUG*

In the case where the incoming call is:

a) a CUG call for which outgoing access is allowed, it is accepted;

b) a CUG call for which outgoing access is not allowed, it is rejected.

5.3.4.1.3 *International interlock code*

Each international CUG is assigned a unique *International CUG Number* (ICN) according to the administrative rules defined in Recommendation X.180.

Each international interlock code includes:

a) four binary coded decimal digits expressing the DCC plus one digit, or DNIC, of the country or network of the coordinating Administration (or Recognized Private Operating Agency), i.e. the decimal number *A* of the international CUG number;

b) a 16-bit code expressing in pure binary representation the value of the decimal number *B* of the international CUG number.

The interlock code is transferred, DNIC/DCC portion first, in accordance with the procedures specified by the relevant Recommendations X.61, X.70, X.71 or X.75.

*Note 1* – In some cases of signalling, all, some or none of the leading zeros are transmitted, see Recommendations X.70 and X.71. The binary code should then have the same meaning regardless of the number of the leading zeros.

*Note 2* – It is for further study whether or not the accommodation of international CUGs with members on public networks other than PDNs will require any additional arrangements for handling international CUG interlock codes in PDNs.

5.3.4.2 *Bilateral closed user group*

5.3.4.2.1 *General*

The bilateral closed user group (BCUG) facility is a user facility that enables pairs of users to form bilateral relations allowing access between each other while excluding access to or from other users with which such a relation has not been formed. A user may belong to more than one BCUG.

The bilateral closed user group with outgoing access (BCUGO) facility is a user facility that enables a user to form BCUGs as with the *bilateral closed user group* facility, but at the same time allows the user to access by outgoing calls open users not having the *bilateral closed user group* or *bilateral closed user group with outgoing access* facilities.

A user may at the same time have the *bilateral closed user group* or *bilateral closed user group with outgoing access* facility and one or more of the *closed user group* (CUG) facilities. In such a case a call within a CUG is handled separately from the *bilateral closed user group* facility and is not regarded as an outgoing access call in relation to the *bilateral closed user group* facility.

*Bilateral closed user group* and *bilateral closed user group with outgoing access* are optional user facilities assigned to the user for an agreed contractual period. They are standardized for the circuit-switched and packet-switched, virtual call and datagram, services.

Registration and cancellation of a BCUG of two users to the *bilateral closed user group* or *bilateral closed user group with outgoing access* facilities are controlled by the users concerned by means of automatic registration and cancellation procedures.

The *bilateral closed user group* and *bilateral closed user group with outgoing access* facilities, including automatic user controlled facility registration and cancellation, can be supported by common channel signalling (Recommendation X.61) for the circuit switched service and by the control procedures (Recommendation X.75) for the packet switched, virtual call or datagram, service. Decentralized signalling (Recommendations X.70 and X.71) for the circuit switched service cannot support the facilities.

The procedures for the *bilateral closed user group* facility are based on the mutual registration method. This method makes use of the features of *abbreviated address calling.* Thus, a user having the *bilateral closed user group* facility uses a local index (i.e. an abbreviated address) for each remote user with which a BCUG is formed. In the exchange to which the user is connected a table associated to that user is available. The local index used to address a remote user corresponds to a position in the table containing the data number (address) of the remote user, the local index used by that remote user to address the local user and an indication (association bit) about the status of the BCUG.

5.3.4.2.2 *Registration procedure*

5.3.4.2.2.1 When requesting registration of a BCUG, the user A makes a facility request including the data number B of the remote user and the local index *x* used for that user. The originating exchange checks whether a data number has been registered or not in the position corresponding to the local index *x* received, in the local user *A* table.

a) In the case where a data number has not yet been registered in position *x* in the user *A* table, the originating exchange registers data number *B* in that position. The originating exchange then sends a BCUG registration request to the destination exchange, including a data number *B* as a destination address, data number *A* as a source address and the local index *x.*

b) In the case where data number *B* for the remote user has already been registered in position *x* in the user *A* table and its association bit has not yet been set, indicating that registration has not yet been completed, the originating exchange sends a BCUG registration request to the destination exchange, including the same information as described in a) above.

c) In the case where data number *B* for the remote user has already been registered in position *x* in the user *A* table and its association bit has already been set, the originating exchange sends the *registration/cancellation confirmed* call progress signal to user *A.*

d) In the case where the data number registered in that position is different from the data number *B* received, the originating exchange sends the *local procedure error* call progress signal to user *A.*

5.3.4.2.2.2 When receiving the BCUG registration request, the destination exchange checks the addressed user *B* table.

a) In the case where user *B* has already registered user *A* in a position *y*, where *y* is the local index used by user *B* for user *A*, and its association bit has not yet been set, indicating that registration has not yet been completed, the destination exchange sets the association bit and registers local index *x* in that position. The destination exchange then responds to the originating exchange with a *registration completed* signal together with the local index *y.*

b) In the case where user *B* has already registered user *A* in position *y* and its association bit has already been set, the destination exchange checks the local index registered in that position. In the case when that local index is equal to the local index received, the destination exchange responds to the originating exchange as under item a) above.

c) In the case where user *B* has not registered data number *A* in any position, the destination exchange responds to the originating exchange with a *registration accepted* signal.

d) In the case where user *B* does not subscribe to the BCUG facility, the destination exchange responds to the originating exchange with an *access barred* signal.

e) In the case where user *B* is not accessible by user *A* for any other reason, the destination exchange responds to the originating exchange with the appropriate call progress signal.

5.3.4.2.2.3 When receiving the response to a BCUG registration request from the destination exchange, the action at the originating exchange depends on the signal received.

a) In the case where a *registration completed* signal is received, the originating exchange sets the association bit and registers the local index *y* in position *x* in the user *A* table and sends the *registration/cancellation confirmed* call progress signal confirming registration to user *A*.

b) In the case where a *registration-accepted* signal is received, no further registration is made at the originating exchange and the *registration/cancellation confirmed* call progress signal is sent to user *A*.

c) In the case where a signal is received indicating that BCUG registration has been rejected by the destination exchange, the originating exchange clears all the information in position *x* in the user *A* table and sends the corresponding call progress signal to user *A*.

5.3.4.2.2.4 With the above procedures, registration of a BCUG is completed when both users concerned have requested registration of each other and have received positive responses.

5.3.4.2.3 *Cancellation procedure*

5.3.4.2.3.1 When requesting cancellation of a BCUG, user A makes a facility request, including local index *x*. The originating exchange checks the status of position *x* in the user *A* table.

a) In the case where a data number is registered in position *x*, the originating exchange sends a BCUG cancellation request with data number *B* as address and including remote local index *y* and the calling user number *A*. Also, the originating exchange resets the association bit if it was set.

b) In the case where no data number is registered in position *x*, the originating exchange returns the *registration/cancellation confirmed* call progress signal to user *A*.

5.3.4.2.3.2 When receiving the BCUG cancellation request the destination exchange checks the addressed user *B* table.

a) In the case where the data number in position *y* in the user *B* table is equal to the data number *A* received, the destination exchange clears all information in position *y*.

b) In all other cases, and in particular in the case where the data number stored in position *y* is different from the data number *A* received, the destination exchange does not alter any information stored in the user *B* table.

In cases a) and b) the destination exchange sends a *cancellation completed* signal to the originating exchange.

5.3.4.2.3.3 When receiving the *cancellation completed* signal in response to a BCUG cancellation request, the originating exchange clears all the information in position *x* in the user *A* table and sends the *registration/cancellation confirmed call* progress signal to user *A*.

5.3.4.2.3.4 With the above procedure, a BCUG is cancelled when either of the two users concerned has requested cancellation and has received the *registration/cancellation confirmed call* progress signal.

5.3.4.2.3.5 Possible implications of abnormal conditions at cancellation may require further study.

5.3.4.2.4 *Time-out supervision in registration/cancellation procedure*

At the originating exchange in the facility registration/cancellation procedure, it is necessary to wait for receipt of the response from the destination exchange after sending a BCUG registration/cancellation request. The duration of such periods has to be controlled by appropriate time-outs.

The following time-outs are necessary:

*T1* – The time between the sending of the BCUG registration request and receipt of a response in accordance with § 5.3.4.2.2.

*T2* – The time between the sending of the BCUG cancellation request and receipt of a *cancellation completed* signal.

On expiry of a time-out *T1* or *T2*, the originating exchange sends the *network congestion* call progress signal to user *A* thus indicating that the requested registration or cancellation has failed. User *A* then has to repeat the request for registration or cancellation.

The value of *T1* and *T2* should (provisionally) be 5-10 seconds.

5.3.4.2.5 *Call-set up procedure*

5.3.4.2.5.1 *Originating exchange*

5.3.4.2.5.1.1 When making a call within a BCUG, the calling user *A* uses the local index *x* as address for the called user (in accordance with the procedure for the *abbreviated address* calling facility). The originating exchange checks the position corresponding to the local index *x* registered in the calling user *A* table.

a) In the case where the association bit is set, indicating that the BCUG is registered by both the calling and called users, the originating exchange sets up the call towards the destination exchange, using the called user data number *B* stored in the calling user *A* table. The call control information forwarded by the originating exchange includes an indication that the call is a BCUG call.

b) In the case where the association bit is not set, indicating that the BCUG is not completely registered, the originating exchange rejects the call and sends the *access barred* call progress signal to the calling user.

5.3.4.2.5.1.2 In the case where a user having the *bilateral closed user group* facility makes a call with an ordinary data number or an abbreviated address not registered as a BCUG, the originating exchange rejects the call and sends the *access barred* call progress signal to the calling user.

*Note* – In the case where the user also belongs to a closed user group (CUG), calls within a CUG are handled independently and are not rejected because of the *bilateral closed user group* facility.

5.3.4.2.5.1.3 In the case where a user having the *bilateral closed user group* with *outgoing access* facility makes a call with an ordinary data number or an abbreviated address not registered as a BCUG, the call is handled as an outgoing access call and is set up by the originating exchange in accordance with ordinary call set-up procedures.

5.3.4.2.5.1.4 The possibility of transfer of the local index *x* (in the forward direction) and local index *y* (in the backward direction) and the possibility of additional verification checks at the destination exchange are for further study.

5.3.4.2.5.2 *Transit exchange*

A transit exchange handles a BCUG call as an ordinary call.

5.3.4.2.5.3 *Destination exchange*

When receiving a BCUG call the destination exchange may accept the call without checking whether the called user has the *bilateral closed user group* facility.

When receiving an ordinary call (i.e. not a BCUG call) to a user having the *bilateral closed user group* facility, the destination exchange rejects the call and responds with the *access barred* signal to the originating exchange.

The call may be rejected for other reasons not related to the bilateral closed user group facility. *Closed user group calls* can be accepted regardless of the above conditions, provided that the requirements of that facility (see § 5.3.4.1) are met.

5.3.4.2.5.4 *Combination of BCUG and line or terminal identification facilities*

The possible arrangements for combinations of the *bilateral closed user group* or *bilateral closed user group with outgoing access* facilities and the *calling line identification* and/or *called line identification* facilities and the form of calling or called DTE identification of BCUG calls are for further study.

5.3.5 *Other facilities*

5.3.5.1 *Manual answer*

5.3.5.1.1 *General*

*Manual answer* is a DTE operating mode allowed by some networks for the circuit-switched service. DTEs operating in this mode may, when called, delay responding by the *call accepted* signal. Information indicating that a user DTE operates with *manual answer* is stored at the exchange to which the user is connected.

5.3.5.1.2 *Call set-up procedure*

In the case of a call to a user DTE operating with *manual answer*, the destination exchange sends the *terminal called* signal to the originating exchange at connection of the call. At the originating exchange this results in sending of the *terminal called* call progress signal to the calling user. It also results in extending the value of any time-out applicable to this phase of the call.

The call is completed as an ordinary call when the *call accepted* signal is received from the called user by the destination exchange and a signal indicating that the call has been connected is sent towards the originating exchange. If the *call accepted* signal is not received by the destination exchange within the applicable DCE time-out after sending of the *incoming call* signal to the called user, the call is cleared from the destination exchange without sending of any call progress type backward signal.

*Note* – In the case where the originating network does not allow *manual answer* and the called user operates with *manual answer*, the originating network may charge the calling user for the time from the receipt of the *terminal called* signal.

5.3.5.2 *Connect when free and waiting allowed*

5.3.5.2.1 *General*

*Connect when free* and *waiting allowed* are optional user facilities assigned to the user for an agreed contractual period. They are standardized for the circuit-switched service.

A user subscribing to the *connect when free* facility is assigned a number of waiting positions at his local exchange at which incoming calls received can wait when the access line(s) to the user is busy. The *waiting allowed* facility enables a user calling a busy user having the *connect when free* facility to wait for completion of the call when the called user becomes free. During waiting the connection is maintained.

The two facilities thus provide an opportunity for users having certain data traffic characteristics to make more efficient use of the network than in the ordinary case when a call to a busy user is rejected.

Facility registration is controlled by the Administration or Recognized Private Operating Agency.

5.3.5.2.2 *Call set-up procedure*

5.3.5.2.2.1 When receiving a call to a busy user (i.e. at least one access line to the called user is occupied by a call in progress) having the connect when free facility, the destination exchange checks the waiting positions at the called user:

a) In the case where a free waiting position exists the call is placed in the queue and the *connect when free* signal is sent towards the originating exchange.

b) In the case where all waiting positions are occupied the call is rejected and the *number busy* signal is sent towards the originating exchange.

The call may be rejected for other reasons not related to the *connect when free* facility.

5.3.5.2.2.2 The action at the originating exchange depends on whether the calling user has the waiting allowed facility and which signal is received.

a) In the case where the *connect when free* signal is received and the calling user has the *waiting allowed* facility, the *connect when free* call progress signal is sent to the calling user. The calling user can then either wait for completion of the call or clear the call. In the case where the calling user chooses to wait, the connection is maintained but is not through-connected. The normal time out for completion of the call at the originating exchange is inhibited. The calling user cannot make or receive another call on the same access line during waiting.

b) In the case where the *connect when free* signal is received and the calling user does not have the *waiting allowed* facility, the *number busy* call progress signal is sent to the calling user and the call is cleared.

c) In the case where the *number busy* signal is received, the *number busy* call progress signal is sent to the calling user and the call is cleared; this is also the case when the calling user has the *waiting allowed* facility.

5.3.5.2.2.3 When an access line becomes free to the called user, the destination exchange connects the first call in the queue in the normal manner. A signal indicating that the call has been connected is sent towards the originating exchange.

5.3.5.2.2.4 When receiving the signal indicating that the call has been connected, the originating exchange through-connects the call in the normal manner.

5.3.5.2.2.5 The waiting time will be charged. The calling user may send a clear request at any time to terminate the waiting which will result in normal network clearing and removal of the call from the queue. The waiting may also be terminated by the destination exchange in some abnormal situations resulting in a clearing sequence towards the calling user.

*Note* – The possible provision of a network time-out to limit the waiting time is for further study.

5.3.5.3 *Calling and called line identification*

Internetwork arrangements for the calling line identification and called line identification user facilities are described in §§ 5.2.1.4 and 5.2.2.4 respectively.

5.3.5.4 *Network Addressing Extension*

The Network Addressing Extension (NAE) user facility allows DTEs, including groups of different terminals forming private data networks, to transfer through PDNs on a per call basis subaddressing information at the OSI network layer beyond the 14-digit total limit established for X.121 addresses. This facility is standardized for circuit and packet switching service and assigned to a user for an agreed contractual period.

The internetwork arrangements for this facility are described in § 5.2.4.

5.3.5.5 *Called line address modified notification*

*Called line address modified notification* is a user facility applicable to packet switched virtual call service, used by the DCE in *call connected* or *clear indication* packets to inform the calling DTE as to why the called address in the packet is different from that specified in the *call request* packet.

When more than one address applies to a DTE/DCE interface, the *called line address modified notification* facility may be used by the DTE in the *clear request* packet (when no *call accepted* packet has been transmitted) or the *call accepted* packet, when the called address is present in the packet and different from that specified in the *incoming call* packet. When this facility is received from the DTE:

1) The DCE will clear the call if the called address is not one of those applying to the interface.

2) If call redirection has taken place in the public data network, the DCE will replace the reason contained in the *called line address modified notification* facility with the reason reflecting the status of the originally called DTE; otherwise, the reason is passed transparently.

   *Note* – The DTE should be aware that a modification of any part of the called DTE address field without notification by the *called line address modified notification* facility may cause the call to be cleared.

The following reasons can be indicated with the use of the *called line address modified notification* facility in *call connected* or *clear indication* packets transmitted to the calling DTE:

1) Call distribution within a Hunt Group.

2) Call redirection due to originally called DTE out of order.

3) Call redirection due to originally called DTE busy.

4) Call redirection due to prior request from the originally called DTE for systematic call redirection.

5) DTE originated.

In *call accepted* or *clear request* packets, the reason indicated in conjunction with the use of the *called line address modified notification* facility should be "DTE originated".

5.3.5.6 *Call redirection notification*

Call redirection notification is a user facility, in packet switched networks, used by the DCE in the incoming call packet to inform the alternate DTE as to why the call is redirected and the address of the originally called DTE.

The following reasons can be indicated with the call redirection notification facility:

i) Call redirection due to originally called DTE out of order.

ii) Call redirection due to originally called DTE busy.

iii) Call redirection due to prior request from the originally called DTE for systematic call redirection.

## 5.4 *Arrangements for internal network utilities*

### 5.4.1 *Network identification*

#### 5.4.1.1 *General*

The international *network identification* utilities provide information about the network(s) from, via or to which an international call is routed.

A network is identified by four decimal digits that indicate:

a) in the case of the network of a country using the DCC format of the international data numbering plan (Recommendation X.121), the applicable DCC plus one digit consistent with the numbering plan;

b) in the case of a network using the DNIC format of the international data numbering plan (Recommendation X.121), the applicable DNIC.

Any Administration involved in providing transit IDSE(s) for an international call should be identified at the time of the call establishment by means of "network identification" allocated to that Administration (Recommendation X.110).

*Note 1* – Exceptionally, a DNIC may need to be allocated, for this IDSE identification purpose, to an Administration that would offer transit only and no direct subscriber access.

*Note 2* – The Administration of the originating and destination networks are already identified within the calling and called DTE addresses, and therefore do not require any additional identification at the time of the call establishment.

#### 5.4.1.2 *Originating network identification*

The *originating network identification* utility identifies the originating network of a call.

In the packet-switched service, the identity of the originating network (DNIC) is transferred in the *call request* packet to the destination network as part of the international data number (Recommendation X.75). To perform the function of the *originating network identification* utility this DNIC, which is part of the international data number, is always either inserted or checked by the originating network.

Provision of *originating network identification* as an optional network utility on request by a transit or destination network on a per call basis is mandatory for the circuit-switched service.

In the case of common channel signalling (Recommendation X.61), a network requiring identification of the originating network requests such identification by returning an *originating network identification request* indication. When receiving such a request the originating network responds by sending:

a) the complete calling line identity in accordance with § 5.2.1.4 in the case where the *calling line identification* facility is provided by the originating network and such identification is also requested;

b) the originating network identity in the case where calling line identification is not provided or requested.

In the case of decentralized signalling (Recommendations X.70 and X.71), a network requiring identification of the originating network requests such identification by returning a *calling line identification* request indication. When receiving such a request, the originating network responds with the calling line identity or the originating network identity depending on whether or not the *calling line identification* facility is provided by the originating network (see § 5.2.1.4).

#### 5.4.1.3 *Destination network identification*

The destination *network identification* utility identifies the destination network of a call.

In the circuit-switched service *destination network identification* for all international calls is a mandatory network utility. Thus, for each international call the identity of the destination network is returned in accordance with the applicable signalling procedures (Recommendations X.61, X.70 and X.71).

In the packet-switched service, the identity of the destination network (DNIC) may be transferred in the *call connected* packet to the originating network as part of the international data number (Recommendation X.75). When transferred, this DNIC must either be inserted or checked by the destination network.

#### 5.4.1.4 *Transit network identification*

*The transit network identification* utility identifies the transit network(s) via which the call has been set up.

In the packet-switched service *transit network identification*, in both the forward and backward directions, is a mandatory network utility for international calls (Recommendation X.75).

In the circuit-switched service transit network identification in the backward direction is a mandatory network utility for international calls (Recommendations X.61, X.70 and X.71).

In cases where more than one transit network is identified, the identities are indicated in the order of transit networks traversed by the call following the established path from the calling user towards the called user.

### 5.4.2 *Call identifier*

The call identifier utility gives the identification of a call. When the utility is used in conjunction with the calling DTE address, it uniquely identifies the call over a period of time, the duration of this time period is for further study. This utility is standardized for packet-switched service (Recommendation X.75).

A significant call identifier may or may not be created for a given call (see also the Note 2). This is the responsibility of the originating network. Each transit network will always transfer a received significant call identifier without change. The definition of the content of the call identifier, and further specification of the associated signalling mechanisms, require further study.

*Note 1* – However, it is for further study whether a transit network can create a significant call identifier, in the case it would receive a call identifier which is not significant.

*Note 2* – On X.75 links, as stated in Recommendation X.75, a call identifier utility of 4 octets is always present in the call request packet. The value of the 3 octets call identifier parameter may or may not be significant.

In the permanent virtual circuit service, the call identifier might be systematically required. However, it is left for further study.

### 5.4.3 *Target quality of service parameters*

It is for further study whether or not a network utility(ies) is required to signal information related to the achievement of target quality of service parameters (e.g. target transit delay) for network purposes outside the control of a user (see also § 5.3.1).

## 5.5 *Arrangements for call progress signals*

This section describes the internetwork arrangements for transferring across the networks call progress signals defined in Recommendation X.96.

In the case of terminals connected to public networks via private networks, call progress signals originated in the private network are distinguished from those originated in the public data network. In CSPDN, the call progress signal "subaddress called" is sent by the destination PDN when it passes a call containing private network address information to the called DTE/DCE interface. Any subsequent call progress signals will have been originated by the private network. In PSPDN, a specific and distinct coding range is allocated for call progress signals originated in a private network.

5.5.1 *Call progress signals during call establishment*

5.5.1.1 *Call progress signals originated by the calling DTE (call request phase)*

At the time of the call request, the calling DTE is not transmitting any call progress signal.

5.5.1.2 *Call progress signals generated by the originating PDN (call request phase)*

At the time of the call request, the originating PDN (including the DCE associated with the calling DTE) may have to clear the call, due to constraints related to the DTE/DCE interface of that calling DTE.

5.5.1.2.1 *Incorrect called DTE address in a call request*

5.5.1.2.1.1 The originating PDN may receive from the calling DTE a call request with a called DTE address which is not correct. If the originating PDN detects such a difficulty, it should clear the call with NOT OBTAINABLE indication. A possible reason is that the DCC or DNIC is the one assigned to the originating PDN, but the remaining digits of the address are not assigned to any DTE on that PDN.

*Note 1* – The transmission by the calling DTE of an incorrect national prefix (see § 2.5 of Recommendation X.121) should be considered as a local procedure error.

*Note 2* – The reaction of the originating PDN to an incorrect calling DTE address received from the calling DTE is for further study.

5.5.1.2.2 *Invalid facility requested by the calling DTE*

When receiving from the calling DTE a call request that requires an optional user facility which is not offered to that DTE, the originating PDN should CLEAR the call with INVALID FACILITY REQUEST indication.

Possible reasons include:

a) request for a facility which has not been subscribed by the DTE;

b) request for a facility which is not available in the originating PDN;

c) facility request which has not been recognized as valid by the originating PDN.

The exact circumstances for such call clearing by the originating PDN with an indication of invalid facility request, are detailed in the relevant X-series Recommendations, i.e. DTE/DCE interface Recommendations, internetwork signalling Recommendations.

5.5.1.2.3 *Calling DTE procedure error related to a call request*

5.5.1.2.3.1 When receiving a call request from the calling DTE, the originating PDN (DCE) may detect a procedure error caused by the DTE. The originating PDN (DCE) should then CLEAR the call with LOCAL PROCEDURE ERROR indication. Detailed circumstances of such procedure errors in a call request are indicated in the relevant X-series DTE/DCE interface Recommendations. Possible circumstances include:

a) call request on a logical channel which is not in the ready state (in the case of an X.25 interface);

b) incorrect reference of a logical channel for the call (in the case of an X.25 interface);

c) incorrect format during call establishment.

5.5.1.3 *Call progress signals generated by an IDSE (call request phase)*

At the time of a call request, an International Data Switching Equipment (IDSE) involved in call establishment may have to clear the call.

5.5.1.3.1 *Incorrect called DTE address*

5.5.1.3.1.1 In some calls, an IDSE may receive a called DTE address which is not compatible with the numbering plan or not assigned to any DTE at that time. The IDSE should then clear the call with NOT OBTAINABLE indication. Possible reasons include: Unknown called DCG or DNIC.

5.5.1.3.1.2 However, it should also be noted that an IDSE should, if possible, not transmit to the next IDSE a call request with a called DTE address which does not correspond to a predetermined route. If an IDSE receives a called DTE address which does not conform to predetermined route, the call may be cleared with ACCESS BARRED indication.

5.5.1.3.2 *Internal network failure or congestion*

5.5.1.3.2.1 When an IDSE detects that all possible suitable routes, from the calling DTE to the called DTE via this IDSE, are temporarily unavailable, the IDSE clear the call with NETWORK CONGESTION indication.

5.5.1.3.3 *Internal network failure on the transit route(s)*

A temporary network failure may force an IDSE to clear the call request passing through it, with NETWORK CONGESTION indication.

5.5.1.3.4 *Facility not available on the transit route(s)*

When an IDSE detects a request for a facility intentionally not available on the transit route(s), the IDSE clears the call with INCOMPATIBLE DESTINATION indication or NETWORK CONGESTION indication in the case of CSPDN.

5.5.1.3.5 *Charging facility not available on the transit route(s)*

When an IDSE finds out that requested charging facilities are intentionally not available on the transit route(s) it clears the call with INCOMPATIBLE DESTINATION indication or NETWORK CONGESTION indication in the case of CSPDN.

5.5.1.3.6 *Access protection facility not available on the transit route(s)*

When an IDSE detects that requested access protection facilities are intentionally not available on the transit route(s) it clears the call with ACCESS BARRED indication.

5.5.1.4 *Call progress signals generated by the destination PDN (call request phase)*

At the time of a call request, the destination PDN (including the DCE associated with the called DTE) may have to clear the call, due to constraints related to the DTE/DCE interface of that called DTE.

5.5.1.4.1 *DTE/DCE interface not operational*

The DTE/DCE interface of the called DTE may be out of order. Possible reasons include:

a) DTE uncontrolled not ready.
b) DCE power off.
c) Network fault in the local loop.
d) Level 1 not functioning (X.25 only).
e) Level 2 not in operation (X.25 only).

5.5.1.4.1.1 If the called DTE interface is not operational, and an incoming call cannot therefore be transmitted to that DTE, the destination PDN should clear the call with OUT OF ORDER indication, or in CSPDN with either UNCONTROLLED NOT READY, DCE POWER OFF or NETWORK FAULT IN THE LOCAL LOOP indication.

*Note 1* – Special conditions may apply if a call redirection facility is subscribed to by the called DTE.

5.5.1.4.2 *Busy DTE/DCE interface*

5.5.1.4.2.1 When the called DTE is detected by the destination PDN as engaged on other call(s), and therefore as not being able to accept a new incoming call, the destination PDN should clear the call with NUMBER BUSY indication. The called DTE is not indicating the incoming call.

*Note 1* – In case of an X.25 interface, some logical channels may be reserved (e.g., for outgoing calls) and be unavailable for incoming calls (see also Annex B of Recommendation X.25). The number busy condition described in this section applies if at least one logical channel supports incoming calls.

*Note 2* – Special conditions may apply if a call redirection facility is subscribed to by the called DTE.

*Note 3* – In the case where the called DTE subscribes to the hunt group facility the busy condition occurs when all available circuits/channels are busy in all DTE/DCE interfaces in the hunt group.

5.5.1.4.2.2 When the called DTE interface is an X.25 interface, a call collision may occur on one of the logical channels. If such a collision occurs, it normally means that the X.25 interface is saturated and cannot therefore accept any additional calls at that time. The called DTE is then given priority for its call establishment, and the destination PDN should clear the incoming call with NUMBER BUSY indication. The incoming call is not transmitted to the called DTE.

5.5.1.4.3 *Non acceptance of a facility by the called DTE*

5.5.1.4.3.1 Except in the cases specified in §§ 5.5.1.4.3.2, 5.5.1.4.4 and 5.5.1.4.5, when the called DTE interface does not support a function or facility requested in the incoming call, the destination PDN should clear the call with INCOMPATIBLE DESTINATION indication (for PSPDN). The incoming call is not transmitted to the called DTE. The call progress signal used in CSPDN is for further study.

The exact circumstances for such call clearing by the destination PDN are detailed in the relevant X-series DTE/DCE interface Recommendations.

5.5.1.4.3.2 When the called DTE in PSPDN has not subscribed to the fast select acceptance facility, the destination PDN should clear a fast select call with FAST SELECT ACCEPTANCE NOT SUBSCRIBED indication. The incoming call is not transmitted to the called DTE.

5.5.1.4.4 *Specific charging facility requested by the called DTE*

5.5.1.4.4.1 When the called DTE has not subscribed to the reverse charging acceptance facility, and if an incoming call requests reverse charging, the destination PDN should clear that call with REVERSE CHARGING ACCEPTANCE NOT SUBSCRIBED indication. The incoming call is not transmitted to the called DTE.

5.5.1.4.5 *Specific access protection conditions required by the called DTE*

5.5.1.4.5.1 If an incoming call is destined for a DTE which has subscribed to the incoming calls barred facility, the destination PDN should clear the call with ACCESS BARRED indication. The incoming call is not transmitted to the called DTE.

5.5.1.4.5.2 If the destination PDN detects that the calling DTE is not permitted the connection to the called DTE, it should clear the call with ACCESS BARRED indication. The incoming call is not transmitted to the called DTE. Possible reasons include:

a) incompatible closed user group;

b) unauthorized access between the calling DTE and the called DTE. The possible exact circumstances of such restrictions are for further study.

*Note* – The fact that the calling DTE is not permitted the connection to the called DTE may be previously detected on the international part of the route where the call would then be cleared. In that case, the destination PDN is not aware of the incoming call.

5.5.1.5 *Call progress signals generated by the called DTE (call request and call confirmation phases)*

The called DTE may decide to refuse the incoming call. It will then clear the call with DTE ORIGINATED indication (in PSPDN). In CSPDN, the destination PDN may signal SUBADDRESS CALLED, following which a call progress signal may be indicated in a clearing signal from the DTE. Call progress signals generated by the called DTE are transferred to the calling DTE.

5.5.1.6 *Call progress signals generated by the destination PDN (call Confirmation phase)*

5.5.1.6.1 *Called DTE procedure error related to a call acceptance*

5.5.1.6.1.1 When expecting a CALL ACCEPTED indication from the called DTE, the destination PDN may detect a procedure error caused by the DTE. The destination PDN should then clear the call, with LOCAL PROCEDURE ERROR indication to the called DTE, and REMOTE PROCEDURE ERROR to the calling DTE. Detailed circumstances of such procedure errors in a call accepted indication are described in the relevant X-series DTE/DCE interface Recommendations. Possible circumstances include incorrect format of the CALL ACCEPTED indication.

5.5.1.7 *Call progress signals generated by an IDSE (call confirmation phase)*

For further study.

5.5.1.8 *Call progress signals generated by the originated PDN (call confirmation phase)*

For further study.

5.5.1.9 *Call progress signals resulting of call abortion (call request and call confirmation phase)*

For further study.

5.5.2 *Clearing call progress signals during data transfer*

5.5.2.1 *Clearing call progress signals generated by a DTE (data transfer phase)*

5.5.2.1.1 When a call clearing comes from an X.25 DTE, the following rules apply:

5.5.2.1.1.1 The clearing cause should be DTE ORIGINATED.

5.5.2.1.1.2 A diagnostic of one octet may be transmitted by the DTE, is passed unchanged from the clearing DTE to the other DTE.

5.5.2.1.2 In CSPDN no call progress signal is generated when initiating clearing during the data transfer phase.

5.5.2.2 *Clearing call progress signals generated by a terminating PDN (data transfer phase)*

After call establishment, either of the two terminating PDNs may have to clear the call, due to events occurring at the corresponding DTE/DCE interface.

5.5.2.2.1 *DTE/DCE interface not operational*

5.5.2.2.1.1 When a DTE/DCE interface on a PSPDN ceases to be operational, and cannot therefore convey any more signals for a call already established through that interface, the terminating PDN may clear that call with OUT OF ORDER indication. Possible reasons include:

a) level 1 not functioning;

b) level 2 not in operation.

*Note 1* – The exact circumstances, in which the terminating PDN would have to clear the virtual call because of the out of order condition of the DTE/DCE interface, are for further study.

*Note 2* – In the case of packet switched services, although the basic out of order indication is transmitted for either condition a) or b) above, the diagnostic may give more detail.

*Note 3* – When the network is ready to resume normal operation after a temporary failure or congestion, the terminating PDN may inform the DTE with a NETWORK OPERATIONAL indication. In the case of an X.25 interface, this information is passed in a restart indication packet.

5.5.2.2.2 *Procedure error at a DTE/DCE interface*

5.5.2.2.2.1 When a procedure error caused by the DTE on a PSPDN is detected that necessitates a call clearing, the terminating PDN should clear the call with LOCAL PROCEDURE ERROR indication to the local DTE, and with REMOTE PROCEDURE ERROR indication to the remote DTE. Detailed circumstances of such procedure errors are indicated in the relevant X-series DTE/DCE interface Recommendations (e.g., incorrect format, expiration of a time-out).

5.5.2.3 *Clearing call progress signals generated by an IDSE (data transfer phase)*

After call establishment, an International Data Switching Equipment (IDSE) may have to clear a call due to some constraints in the international transit part of the route.

5.5.2.3.1 *Internal network failure or congestion*

A temporary network failure or congestion may force an IDSE to clear a call passing through it, with NETWORK CONGESTION indication (PSPDN only).

5.5.2.3.2 *Facility not available on the the transit route(s)*

When an IDSE detects that it is not possible to offer a facility at a certain time it clears the call passing through it with NETWORK CONGESTION indication (PSPDN only).

5.5.2.4 *Possible collisions between clearing call progress signals (data transfer phase)*

For further study.

5.5.3 *Reset call progress signals during data transfer*

This section only applies to packet switched services, in which a virtual call or a permanent virtual circuit may be reset.

5.5.3.1 *Reset call progress signals generated by a DTE (data transfer phase)*

5.5.3.1.1 When a reset comes from an X.25 DTE, the following rules apply:

5.5.3.1.1.1 The reset cause should be DTE ORIGINATED.

5.5.3.1.1.2 A diagnostic of one octet may be transmitted by the DTE, and is passed unchanged from the resetting DTE to the other DTE.

5.5.3.2 *Reset call progress signals generated by a terminating PDN (data transfer phase)*

5.5.3.2.1 When a failure occurs at an X.25 DTE/DCE interface, without call clearing being necessary, the terminating PDN may reset the virtual call with OUT OF ORDER indication.

*Note* – The exact circumstances, in which the terminating PDN would have to reset the virtual call because of the out of order condition of the DTE/DCE interface, are for further study.

5.5.3.2.2 On an X.25 interface, certain procedure errors caused by the DTE may not necessitate a call clearing. The terminating PDN should then reset the virtual call with LOCAL PROCEDURE ERROR indication to the local DTE, and with REMOTE PROCEDURE ERROR indication to the remote DTE. Detailed circumstances of such procedure errors are indicated in Recommendation X.25.

5.5.3.2.3 When an X.25 interface is ready to resume normal data transfer on a permanent virtual circuit after a failure or out of order condition (e.g., restart), the terminating PDN should reset the permanent virtual circuit with REMOTE DTE OPERATIONAL indication.

5.5.3.3 *Reset call progress signals generated by an IDSE (data transfer phase)*

5.5.3.3.1 *Internal network failure or congestion*

In a permanent virtual circuit, a network failure or congestion may force an IDSE to send a reset packet with NETWORK OUT OF ORDER indication toward both DTEs involved. [1)]

5.5.3.4 *Possible collisions between reset call progress signals (data transfer phase)*

For further study.

## 6 Arrangements for the transfer of internetwork management information

6.1 *General conditions for transferring internetwork management information*

The transfer of internetwork management information of public data networks should be done in accordance with the reference model for OSI applications defined by CCITT, as illustrated in Figures 27/X.300 and 28/X.300.

6.2 *Detailed arrangements at the network layer for the transfer of internetwork management information*

The OSI Services considered at the network layer conform to Recommendation X.213.

To access those OSI services, protocols at the physical, link and network layers depend on the networks involved in the transfer of management information. The exact protocols to be used are as specified in the previous sections of this Recommendation.

6.3 *Detailed arrangements at the transport layer for the tansfer of internetwork management information*

The OSI Services considered at the transport layer conform to Recommendation X.214.

The protocol to be used at the transport layer conform to Recommendation X.224.

The exact characteristics of the transport layer protocol (i.e. class of transport protocol, etc.) applying to the transfer of management information, are for further study.

6.4 *Detailed arrangements at the session layer*

For further study.

The OSI services considered at the session layer conform to Recommendation X.215.

The protocol to be used at the session layer conform to Recommendation X.225.

The exact characteristics of the services and protocol at the session layer, applying to the transfer of management information, are for further study.

6.5 *Detailed arrangements at the presentation layer*

For further study.

6.6 *Detailed arrangements at the application layer*

For further study.

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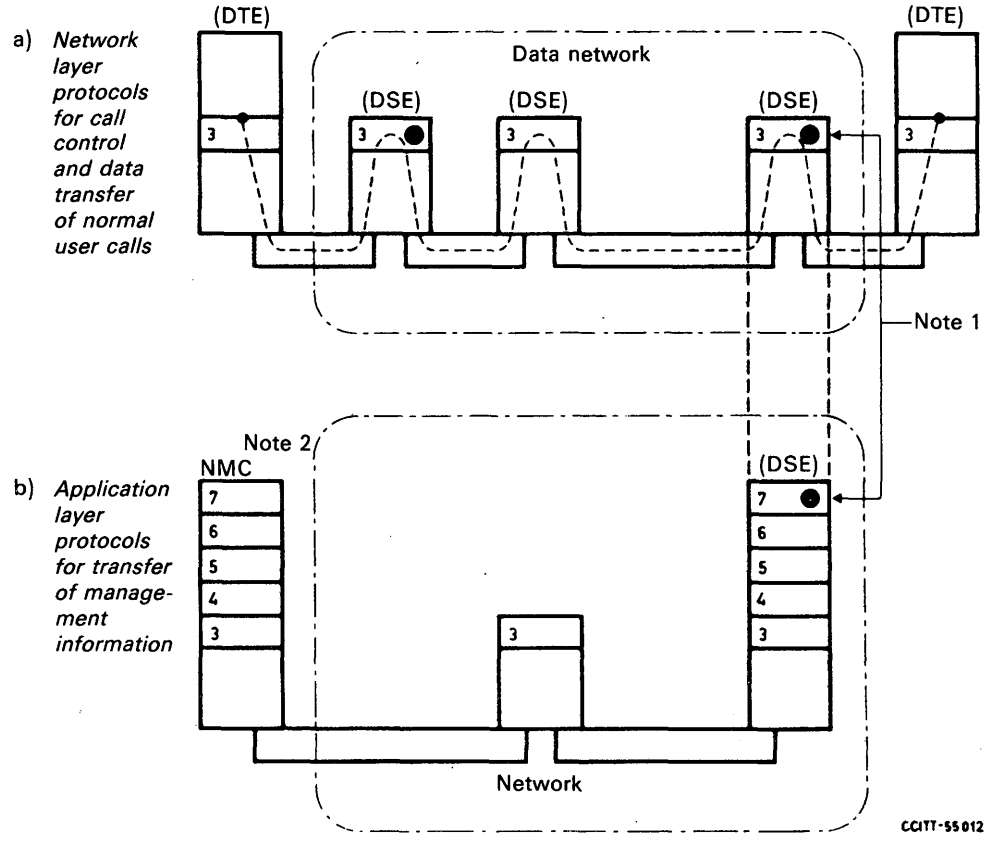
[1)] When the IDSE is ready to resume normal data transfer on the permanent virtual circuit, the IDSE will reset the permanent virtual circuit with the NETWORK OPERATIONAL indication.




*Note 1* — Two entities cooperating for call control and network management communicate for call control and data transfer on one side, and for transfer of management information on the other side. Consequently, the same two entities:

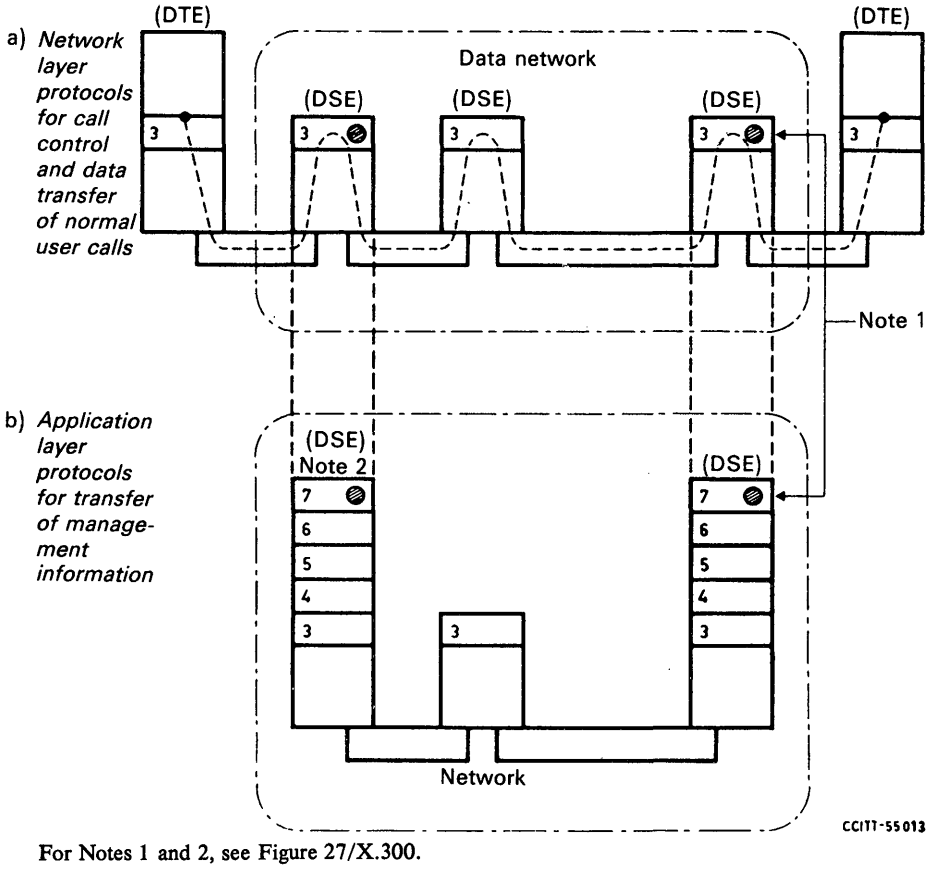
i) on one side exchange call control and data information;

ii) on another side, exchange internetwork management information; for this, specific protocols may be established at the application layer.

*Note 2* — In some cases, a Network Management Centre (NMC) may be located (reside) within a DSE.

FIGURE 27/X.300

**Transfer of management information between a DSE and an NMC**




For Notes 1 and 2, see Figure 27/X.300.

FIGURE 28/X.300

**Transfer of management information between two DSEs**

# PROCEDURES AND ARRANGEMENTS FOR DATA TERMINAL EQUIPMENTS ACCESSING CIRCUIT SWITCHED DIGITAL DATA SERVICES THROUGH ANALOGUE TELEPHONE NETWORKS

*(Malaga-Torremolinos, 1984)*

The CCITT,

*considering*

(a) that Recommendation X.1 defines the international user classes of service for PDNs and that Administrations are operating circuit switched digital data services carried over synchronous circuit switched public data networks (CSPDNs);

(b) that these CSPDNs will provide bit sequence independent full-duplex data circuits [at one or more of the user classes of service (classes 3 to 7 inclusive) defined in Recommendation X.1];

(c) that a large number of data terminal equipments (DTEs) will be connected to the analogue public switched telephone network (PSTN) for a considerable period of time;

(d) that V-series Recommendations define modems operating on the PSTN, either in the half-duplex mode or in the full-duplex mode;

(e) that Recommendations X.50 and X.51 define the multiplexing schemes used in public data networks;

(f) that Recommendation X.300 defines general principles and arrangements for interworking between public data networks and other public networks;

(g) that "categories of access for DTEs to public data transmission services provided by PDNs through terminal adaptors" are defined in Recommendation X.10,

*unanimously declares the view*

that procedures and arrangements for DTEs accessing circuit switched digital data services through analogue telephone networks be in accordance with this Recommendation.

## 1 Introduction

1.1 This Recommendation defines the functional and procedural aspects of the DTE/DCE interface for DTEs accessing a circuit switched public data network(s) (CSPDNs) through the public switched telephone network (PSTN) or leased telephone-type circuits. Both calls from a DTE on the PSTN to a DTE on the CSPDN and calls from a DTE on the CSPDN to a DTE on the PSTN are considered. Some provisions apply to calls in one of these two directions, and are indicated as such.

1.2 This Recommendation considers synchronous circuit switched data transmission (i.e. using synchronous V-series DTE/DCE interfaces). Interworking for asynchronous data transmission (i.e. using asynchronous V-series DTE/DCE interfaces) is left for further study.

*Note* – The basic service offered by such an international connection is a "bit-sequence independent" data circuit between the V-series DTE/DCE interfaces on the PSTN and the X-series DTE/DCE interfaces on the CSPDN. The communicating DTEs shall use a standard (or common) data signalling rate. For completeness, the DTEs shall also use compatible protocols (layer 2 and above).

1.3 Some of the interworking capabilities defined in this Recommendation concern specific national options which may not be provided in some national networks.

## 2 General considerations

### 2.1 *Network types*

2.1.1 In this Recommendation both switched and leased telephone-type circuits are considered for access means to/from CSPDNs.

2.1.2 In this Recommendation CSPDN may include X.21 or X.21 *bis* leased circuit services as well as circuit switched data transmission services.

### 2.2 *Network interworking configurations*

2.2.1 An interworking unit (IWU) is installed between the PSTN and the CSPDN. The IWU may consist of a modem to communicate with the modem (DCE) of PSTN DTEs, and some other facilities, such as a buffer to store a certain amount of user data.

2.2.2 Interworking between a DTE on the PSTN and a DTE on a CSPDN is a basic connection configuration. Interworking between two DTEs on the PSTN via CSPDN could be possible by regarding such a connection as a concatenation of three data circuits linked by two IWUs. This type of interworking arrangement (i.e. PSTN/CSPDN/PSTN) requires further study.

### 2.3 *DTE/DCE interfaces for DTEs connected to the PSTN*

#### 2.3.1 *V-series interfaces*

Some V-series interfaces could be used for data transmission as DTE/DCE interfaces for DTEs connected to PSTN. Examples of possible V-series interfaces are given in Appendix I.

#### 2.3.2 *Half/full-duplex mode of operation modems for PSTN DTEs*

Duplex mode of operation is preferred for the PSTN/CSPDN interworking communications. The inclusion of procedures for half-duplex (HDX) mode of operation in such interworking arrangements requires further study.

#### 2.3.3 *PSTN DTE operation types*

The following two types of PSTN DTE operation could be considered.

i) *DTEs requiring only inter-PSTN/CSPDN communications*

This type of DTE in PSTN communicates only with DTEs on the CSPDN and does not directly communicate with other DTEs within the PSTN.

ii) *DTEs requiring both inter-PSTN/CSPDN and intra-PSTN communications*

This type of DTE connected to the PSTN may communicate either with a DTE on the CSPDN or with other DTEs within the PSTN.

## 3 Timing problem

### 3.1 *General*

3.1.1 CSPDN provides DTEs with an accurate and stable timing clock for data transmission and reception. On the other hand, a clock provided by modems or DTE on the PSTN may be less accurate and stable than that provided by CSPDN. This timing clock accuracy difference could result in unacceptable bit slips in the interworking between a modem equipped DTE and CSPDN. Therefore, these unacceptable bit slips must be avoided by means of some schemes to increase the timing accuracy, which are specified in this section.

3.1.2 Different timing schemes are used between duplex and half-duplex modem operation.

3.1.3 Operation to solve the timing problem is required both in a modem equipped DTE side and within the IWU.

3.2 *Timing schemes for full-duplex modem operation*

The timing schemes used will depend on whether the DTE connected to the PSTN is required to interwork only with DTEs on the CSPDN, or whether intra-PSTN working is required in addition.

3.2.1 *Timing scheme for PSTN DTEs without direct intra-PSTN communications*

3.2.1.1 *General*

The following is a timing method for interworking with a modem equipped DTE and CSPDN. Use of receiver signal element timing (i.e. CSPDN provided timing) for sending timing avoids bit slip occurrence, because modem equipped DTE can use the same accurate timing for data transmission as that of CSPDN.

3.2.1.2 *Required operation in a modem equipped DTE side*

The receiver signal element timing (i.e. CSPDN provided timing) is looped back either in the DTE, in the modem or as an external connection of interchange circuits in the DTE/modem interface. The modem must be arranged to accept external timing.

3.2.1.3 *Required operation in the IWU*

In the direction from PSTN toward CSPDN, only a small buffer is required to compensate for timing wander and/or jitter that might be accumulated in the transmission within PSTN.

3.2.2 *Timing scheme for PSTN DTEs which require direct intra-PSTN communications as well as communications via an IWU to the CSPDN*

*Note* – The following sections (§§ 3.2.2 to 6.1 inclusive) are provisional and are intended to be a starting point for further study.

3.2.2.1 *General*

In this case, if the receiver signal element timing is always looped back for use as transmitting timing, direct intra-PSTN communications are impossible, because transmitting timing cannot be generated. Therefore, some sophisticated loop-back operation, taking account of calling and called situations, is required.

3.2.2.2 *Operation in PSTN DTE side*

3.2.2.2.1 *Operation depending on calling/called situation*

1) *Operation for calls to a DTE on the PSTN*

   Operation during a period when no call takes place is described in this section. Namely, operation required to prepare for a call to a DTE on the PSTN is as follows. The same loop-back arrangement as that of § 3.2.1.2 is applied. Both a call from a DTE on CSPDN and a call from DTE on the PSTN are possible. In the case of calls from CSPDN to the PSTN, the loop-back mechanism described in § 3.2.1 applies. Even in direct intra-PSTN communications, receiving timing is given by a remote modem equipped DTE, as described in 2) ii) below. Therefore, the timing scheme is applicable in both cases (i.e. CSPDN interworking and direct intra-PSTN communications).

2) *Operation for call request*

   i) When interworking with CSPDN, the same loop-back arrangement as that of § 3.2.1.2 is applied in order to avoid bit slips.

   ii) When direct intra-PSTN communications, self-timing generated by DTE or modem is used in order to avoid the situation that both calling and called DTEs use loop-back arrangements.

3.2.2.2.2 The same conditions as those in § 3.2.1.2 apply.

3.2.2.2.3 If a modem equipped DTE communicates with only PSTN DTEs which do not perform timing loop-back, the same operation as § 3.2.1 can be used. This is because timing clock supply by the remote DTE on PSTN can be expected.

3.2.2.3 *Operation in the IWU*

The same operation as in § 3.2.1.3 is required. The IWU need not resolve the DTE operation type difference described in §§ 3.2.1 and 3.2.2.

3.2.3 *Another alternative*

When these loop-back arrangements cannot be used, the following alternative scheme might be used.

3.2.3.1 Self-generated timing can be used for sending in any case. In order to compensate for clock timing accuracy difference, IWU has rather a larger buffer. If DTE transmits for a long period, this buffer may overflow. Transmission delay will occur if much data is stored in the buffer. Therefore, this method may limit the user's call holding time.

3.2.3.2 From the remote DTE point of view, there is no great difference between the two methods (i.e. modem loop-back and IWU large buffer methods).

3.3 *Required timing schemes for half-duplex mode operation*

3.3.1 *IWU buffer method*

3.3.1.1 *Operation in modem equipped DTE side*

In the receiving direction, DTE can use CSPDN provided timing. However, while the DTE is transmitting, this CSPDN provided timing is not available in the half-duplex mode operation. Therefore a scheme to prevent bit slips is performed in the IWU.

3.3.1.2 *Operation in IWU*

Since the normal internal modem timing with less accuracy than ± 0.01% is not synchronized with CSPDN timing, a large elastic memory buffer will be required in the IWU in order to prevent bit slips. This buffer can be cleared when send/receive turn takes place. The IWU could detect send/receive turn by checking IWU's modem carrier from PSTN DTE and status bits from CSPDN. Also, IWU must switch modem carrier (circuits 109 and 105) on/off and status bits (circuits C and I) on/off as described in Annex A of Recommendation X.21 *bis*. See § 4 for detailed procedures.

Since the buffer is cleared by every send/receive turn in the case of two way alternate communications, no such a large buffer is required. The amount of this buffer could be determined by clock accuracy difference and the time from getting send turn (start of transmission) until giving send turn to a remote DTE.

However, in the case of one way communications, a very large buffer is required, which causes long transmission delay. Therefore, call holding time would be limited. Frame or data block store-and-forward communications by the IWU might be suitable in the case of one way communications.

3.3.2 *Another alternative (long holdover clock method)*

The possible use of a long holdover clock that synchronizes with the CSPDN timing necessary to prevent bit slips in the IWU's buffer is another alternative. The possibility of this method is left for further study.

3.4 If the IWU stores and forward user's data frames/blocks because of the half/full duplex mode conversion (see § 5.2) or layer 3 protocol conversion (see § 6.1), the IWU could resolve this timing problem without specific operation in PSTN DTE sides.

## 4 Full- and half-duplex modes of operation

This section deals with the case where general V-series modems and not X.21 *bis* bearer rate modems are used for DTEs connected to the PSTN. When the X.21 or X.21 *bis* bearer rate modems are used for PSTN DTEs, existing procedures defined in Recommendations X.21 and X.21 *bis* are also applied to the DTE/DCE interface for PSTN DTEs.

4.1 *Full-duplex mode of operation*

4.1.1 *Data transfer phase*

In the data transfer phase, circuits 105 (request to send) and 109 (data channel received line signal detector) of PSTN DTEs modem are signalled to circuits I and C (for X.21) or circuits 109 and 105 (for X.21 *bis*) respectively.

4.1.2 *Ready for data indication to PSTN DTE*

Circuit 107 (data set ready) = ON of PSTN DTEs modem is used to indicate *ready for data* to the PSTN DTE.

4.2 *Half-duplex mode of operation*

4.2.1 *Send/receive turn control*

Send/receive turn control can be realized by switching CSPDN DTEs X.21 circuits C, I (X.21 *bis* circuits 105, 109) and PSTN DTEs modem circuits 109, 105 during data transfer phase in accordance with Figure A-1/X.21 *bis* in Recommendation X.21 *bis*.

4.2.2 *Circuit 106 (ready for sending) control*

4.2.2.1 Before CSPDN DTE starts sending data, it puts circuit C into the ON state. However, it must not send data immediately. It must wait for ready-for-sending signal from an IWU modem. Ready for sending indication to the CSPDN DTE is performed in the following way.

4.2.2.2 When the CSPDN puts circuit C into the ON state, circuit 105 (request to send) of the IWU modem becomes ON. Afterwards, when circuit 106 (ready for sending) of the IWU modem becomes ON, this is indicated to the CSPDN DTE by signalling I = ON for a minimum 24 bits interval and a maximum 48 bits interval. The response time of the OFF to ON transition of circuit 106 as a response to circuit 105 OFF to ON in the IWU modem could conform to the V-series Recommendation adopted for the modems.

4.2.2.3 Some networks may not provide the circuit 106 control facility described in § 4.2.2. In this case, CSPDN DTE must wait for sending data for a timing defined in V-series Recommendations before sending data.

4.2.3 *Ready for data indication to PSTN DTE*

The same procedure as in § 4.1.2 is applied.

## 5 Interworking between half- and full-duplex mode DTEs

Communications between full-duplex mode DTEs using PSTN-CSPDN interworking is described in § 4.1.

Communications between half-duplex mode DTEs using PSTN-CSPDN interworking is described in § 4.2.

Schemes for interworking between a half-duplex mode DTE on PSTN and a full-duplex mode DTE on CSPDN is specified in the following. There are two schemes as described in §§ 5.1 and 5.2, depending on the capability of the CSPDN DTE.

5.1 *Half-duplex mode of operation by full-duplex mode CSPDN DTEs*

When a full-duplex mode DTE on the CSPDN can operate also in the half-duplex mode, no specific conversion mechanism is required in IWU. However, the full-duplex DTE must know the need for the half-duplex mode operation. A possible method for this is that the CSPDN indicates such necessity to the DTE by the network provided information. This method is left for further study.

5.2 *Conversion between duplex and half-duplex modes*

When a duplex mode DTE on the CSPDN cannot operate in the half-duplex mode, duplex and half-duplex mode conversion is required in the IWU or other places in the networks. A possible mode conversion mechanism is described in the following.

5.2.1 *Data transmission in the direction from half-duplex mode DTE to duplex mode DTE*

No specific mechanism is required for the IWU in this direction.

5.2.2 *Data transmission in the direction from duplex mode DTE to half-duplex mode DTE*

5.2.2.1 *Send/receive turn around control mechanism*

The IWU recognizes frames/data blocks within user's data stream and stores them in its buffer. When the IWU gets the send turn, the IWU will send all stored frames/data blocks. When the IWU has sent all data, the IWU will give the send turn to the half-duplex mode DTE. In order to realize this mechanism, the IWU must know, in advance, some parts of layer 2 protocol, such as framing pattern or data block delimiter, between DTEs. In order to prevent buffer overflow, data amount which the duplex mode DTE sends in the absence of send turn might be limited.

5.2.3 If the IWU must store the user's frame/block because of the protocol conversion as described in § 6.1, this duplex and half-duplex mode conversion can be performed concurrently.

*Note* – The above proposed "turn around control mechanism" requires further study.

## 6 Network layer protocol considerations

6.1 *Network layer protocol differences*

Different network layer "data transfer phase" protocols are used for teletex connected to PSTN and teletex connected to CSPDN. When a PSTN DTE does not use the same network layer data transfer protocol as that of a CSPDN DTE, network layer protocol conversion must be excecuted by IWU. Detailed protocol conversion procedures are for further study.

## 7 Call control procedures for PSTN DTEs

Call control procedures for PSTN DTEs originating calls to DTEs on the CSPDN through PSTN and receiving calls from DTEs on the CSPDN through PSTN are described in this section.

7.1 *Use of PSTN procedures with existing types of modems*

7.1.1 *Manual call control*

7.1.1.1 *Calls from PSTN to CSPDN*

An end-to-end path can be established by call control information input from the telephone set of PSTN DTE. There is no need for bearer modems in this method. There are several kinds of detailed procedures to implement this method. Two examples are described in the following §§ 7.1.1.1.1 and 7.1.1.1.2.

7.1.1.1.1 Firstly, a PSTN path is established between DTE and CSPDN. The further call control information, such as the address of an actual remote DTE, is transferred from the DTE to the IWU by using in-band tone signalling (e.g. Recommendations V.19 and V.20). In this way, call control information can be informed directly from modem equipped DTE to the IWU.

7.1.1.1.2 Some enhanced PSTNs might be able to get both IWU port address and the address of an actual remote DTE from a calling DTE by using general telephone call control procedure. This information is delivered to the IWU. In this method, dial pulse signals, namely dial pulse telephone sets as well as push button telephone sets, can be used for internetworking call control.

7.1.1.2 *Calls from CSPDN to PSTN*

DTEs on the PSTN will respond to an incoming call in accordance with § 4 of Recommendation V.25.

7.1.2 *Automatic call control*

The automatic "call origination" and "call answer" procedures defined in §§ 3 and 4 (respectively) of CCITT Recommendation V.25 shall apply to DTEs on the PSTN.

7.2 *Use of X.21 (X.21 bis) with currently non-standardized modems*

7.2.1 After a PSTN path between PSTN DTE and IWU has been established by using PSTN access procedures (e.g. port access), X.21 (X.21 *bis*) call control procedure is used between the DTE and the IWU to establish end-to-end path.

7.2.2 In order to use existing X.21 call control procedures, duplex bearer rate modems, such as 3.2 kbit/s (i.e. in the 6+2 envelope scheme for the 2.4 kbit/s user rate), are required. Since call progress signals must be sent with the status bit of 0, general modems cannot be used. Specifications for the bearer rate modems require further study.

7.3 *Use of Recommendation X.32*

7.3.1 Some Administrations are supporting the use of X.25 DTEs on the PSTN (for telematic services, such as teletex, G4 facsimile, etc.

7.3.2 DTEs on the PSTN may access PSPDN functions (physically implemented either as a real PSPDN network or as part of the IWU) using applicable Recommendations, such as X.32 and X.28. An interworking function is then used to interwork between the PSPDN function and the CSPDN to reach DTEs on the CSPDN. Further study is needed.

## 8 PSTN DTE identification

The PSTN does not generally indicate a calling DTE address to a called DTE. This section describes methods for CSPDN and IWU to obtain the calling address of DTEs on PSTN.

8.1 *Two kinds of calling DTE identification*

8.1.1 There are two kinds of calling DTE identification:

a) PSTN calling line identification. This is the subscriber line ID of the calling DTE.

b) PSTN user identification. This indicates which user originated a CSPDN access call via the PSTN. When the user always uses a fixed subscriber line, the user ID is equivalent to the calling line ID.

8.1.2 A calling user ID is indicated to a called DTE as a calling address when possible. Otherwise a called line ID is indicated to a called DTE when possible.

8.2 *Calling user identification*

8.2.1 *By means of PSTN procedures*

In the call request procedure, the DTE on the PSTN gives its terminal identification with a password to the IWU. This can be achieved by the user adding the terminal identification and the password to the destination address. The IWU checks the terminal identification comparing it with the already registered ones. If they are valid, the terminal identification can be used in the CSPDN.

8.2.2 *By means of Recommendation X.25*

Some PSTN DTEs conforming to Recommendation X.25, such as in Teletex and G4 facsimile operation, can indicate their identification with a password as defined in Recommendation X.32.

8.2.3 *By means of Recommendation X.21*

When a PSTN DTE uses an X.21 (X.21 *bis*) bearer rate modem, it may be able to indicate its user identification by using the X.21 (X.21 *bis*) procedure. This is left for further study.

8.3 *Calling line identification*

8.3.1 Some enhanced PSTNs may provide calling line ID. In this case, no specific mechanism is required for the calling DTE.

## 9 Modem type selection

9.1 *Modem type selection for calls from DTEs on the PSTN*

When a DTE on the PSTN originates a call, the modem type used for the call can be indicated by the calling DTE using a port address or other information in the call request procedure.

9.2 *Modem type selection for calls from DTEs on the CSPDN*

In case of a call from a DTE on the CSPDN, it is difficult for the IWU to know the modem type of a called DTE on PSTN. Possible methods are described in the following.

9.2.1 *Automatic data rate negotiation by modems*

Recommendation V.100 specifies modems capable of automatic data rate negotiation during the call establishment phase. The use of such modems at the IWU between the PSTN and the CSPDN requires further study.

9.2.2 *Registration method*

Modem types for DTEs on PSTN are registered in the IWU or other appropriate places.

9.2.3 *Default identification method*

Any DTE on PSTN accessible from a particular CSPDN uses the same default modem type.

*Note* – This method can be used in combination with other methods, e.g. in the case where another method cannot be used.

9.2.4 *User facility method*

A calling DTE indicates the modem type by using a user facility of a call request signal. It is undesirable that the calling DTE on the CSPDN be required to know the modem characteristics of any called DTE on the PSTN. Therefore, the use of this method is restricted to national use only.

APPENDIX I

(to Recommendation X.310)

TABLE I-1/X.310

**Examples of possible V-series interfaces**

| V-series type modem | Data signalling rate(s) | Mode of operation | Type of telephone circuit | Operation with PDNs |
|---|---|---|---|---|
| V.21 | Up to 300 bit/s start/stop | Duplex | PSTN | PSPDN (X.3 PAD) |
| V.22 | *a)* 1200/600 bit/s synchronous | Duplex | PSTN (and 2-wire leased lines) | PSPDN packet mode DTE |
| | *b)* Alternative *a)* plus 1200/600 bit/s start/stop | Same | Same | PSPDN (X.3 PAD) |
| | *c)* Alternative *b)* plus asynchronous mode up to 1200 bit/s start/stop including 300 bit/s start/stop | Same | Same | PSPDN (X.3 PAD) (Videotex?) |
| V.22 *bis* | 2400/1200 bit/s | Duplex | PSTN | Teletex (see Note 1); of interest to Study Group XVII |
| V.23 | 600/1200 baud synch. or asynch. | Half-duplex or duplex | PSTN or leased lines (4-wire) (2-point or multipoint) | – |
| V.26 | 2400 bit/s | Duplex or half-duplex | Leased lines (4-wire) (2-point or multipoint) | (Note 2) |
| V.26 *bis* | 2400 bit/s | Half-duplex | PSTN | – |
| V.26 *ter* | 2400/1200 bit/s | Duplex | PSTN | Of interest to Study Group VII (see Note 1) |
| V.27 | 4800 bit/s | Duplex or half-duplex | Leased lines (4-wire) (2-point or multipoint) | – |
| V.27 *bis* | 4800/2400 bit/s | Duplex or half-duplex | Leased lines (4-wire) (2-point or multipoint) | (Note 2) |
| V.27 *ter* | 4800/2400 bit/s | Half-duplex | PSTN | – |
| V.29 | 9600 bit/s | Duplex | Leased lines (4-wire) | (Note 2) |
| V.32 | 9600/4800 bit/s | Duplex | PSTN | (Note 3) |

*Note 1* – Recommendations V.22 *bis* and V.26 *ter* provide 2400 bit/s duplex operation over the PSTN. They are proposed for use in certain countries to provide Teletex service using the PSTN. Some interest has been expressed for using them to provide synchronous data transmission (user class of service 8) for packet mode DTEs to access PSPDN.

*Note 2* – Some interest has been expressed for using these modems, on 4-wire leased circuits, to access PSPDNs.

*Note 3* – Recommendation V.32 is intended to provide both 9600 bit/s (user class of services 6 and 10) and 4800 bit/s (user class of services 5 and 9) modes of operation.

SECTION 2

# MOBILE DATA TRANSMISSION SYSTEMS

## Recommendation X.350

### GENERAL REQUIREMENTS TO BE MET FOR DATA TRANSMISSION IN THE MARITIME SATELLITE SERVICE

*(Malaga-Torremolinos, 1984)*

The CCITT,

*considering*

(a) that a Maritime Satellite Service is being operated by the International Maritime Satellite Organization (INMARSAT);

(b) that data transmission services in the INMARSAT system should meet the provisions laid down for data transmission in general;

(c) that the ship-board DTE will be connected to a PDN on a call-by-call basis;

(d) that ship board DTEs should have the capability of interfacing public data networks through all coast earth stations even though they are located in different countries and interfacing different public data networks,

*unanimously declares the view*

that the following general provisions should apply for data transmission in the maritime satellite service.

## 1 Definitions

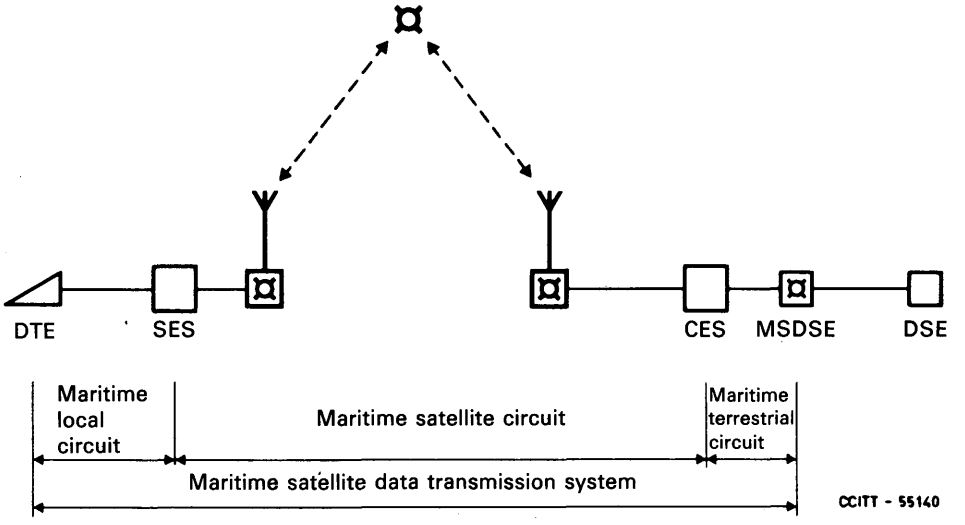
The following are definitions of terms used in relation with data transmission in the Maritime Satellite Service.

*Note* – A similar set of definitions for telephone interworking is contained in Recommendation M.1100.

1.1 **maritime satellite data transmission system** is a means for the establishment of temporary connections between a data switching exchange (DSE) in a public data network (PDN) and an on-board DTE. The maritime satellite data transmission system comprises *a maritime satellite circuit, a maritime local circuit, a maritime satellite data switching exchange (MSDSE), and a maritime terrestrial circuit.* The general configuration is shown in Figure 1/X.350.

1.2 **maritime local circuit** is a circuit between the *ship earth station* and an on-board DTE.

1.3 **maritime satellite circuit** is a circuit between the *ship earth station* nd the *coast earth station.* It comprises all elements required for establishing, maintaining and clearing the maritime satellite circuit including the *network coordination station.*




SES = Ship earth station
CES = Coast earth station
MSDSE = Maritime satellite data switching exchange
DSE = Data switching exchange

FIGURE 1/X.350

**Composition of the maritime satellite data transmission system**

1.4 **maritime terrestrial circuit** is a circuit between the *coast earth station* nd the *maritime satellite data switching exchange.*

1.5 **ship earth station** is defined in Article 1, § 4.16, of the Radio Regulations, ITU, Geneva 1982.

1.6 **coast earth station** is defined in Article 1, § 4.14, of the Radio Regulations, ITU, Geneva 1982.

1.7 **maritime satellite data switching exchange (MSDSE)** is the functional interface between the *maritime satellite data transmission system* and a public data network.

The MSDSE provides the following functions:

- interworking between the signalling systems used in the *maritime satellite data transmission system* and the PDN,
- routing and call control for calls to and from ships,
- charging.

1.8 **network coordination station** is a station in the maritime satellite system with the capability to coordinate, supervise and monitor the assignment and utilization of the maritime satellite circuits within a satellite coverage area. The network coordination station is designated and operated by the satellite system operator (INMARSAT).

## 2 Choice of interface between a ship board DTE and the MSDSE

2.1 For data signalling rates at and above 600 bit/s two types of terminal mode of operation are defined (Recommendation X.1):

i) terminals operating in the synchronous mode for user classes of service 3 through 7 interfacing circuit switched PDNs using the interfaces defined in Recommendations X.21, X.21 *bis* and X.22;

ii) terminals operating in the packet mode for user classes of service 8 through 12 interfacing packet switched PDNs using the interface defined in Recommendation X.25.

2.2 Operation in the packet mode has several advantages as compared to operation in the synchronous mode.

i) operation in the packet mode permits the interconnection of DTEs operating in different user classes of service;

ii) the interface comprises layers 1, 2 and 3 of the Open System Interconnection (OSI) protocol so that the higher layers may be built directly on top of the interface defined in Recommendation X.25;

iii) the link level protocol (level 2) provides link-by-link error protection using ARQ techniques.

*Note* – This error protection is additional to and independent of any forward error correction applied as part of level 1;

iv) the provision of PADs will also interconnect an on-board packet mode DTE with data subscribers of the public switched telephone network and with subscribers of circuit switched PDNs; the PAD may also be used for interconnection with leased lines;

v) it would be possible to operate with different data rates in the two directions of transmission over the satellite link.

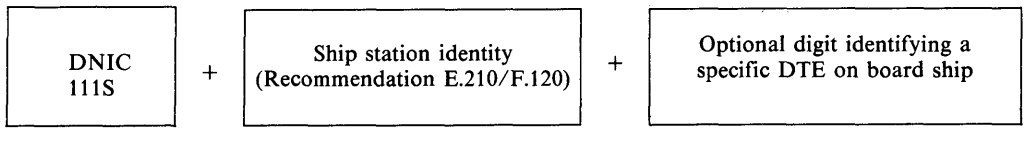
2.3 Based on the above considerations it is concluded that access to PDNs from the Maritime Satellite Service should be provided for the packet mode of operation.

Interconnection with circuit switched PDNs may be offered on an optional basis.

2.4 The procedures for interworking between packet switched data networks and the maritime satellite data transmission system are given in Recommendation X.352.

## 3 International data number for a ship board DTE

The format of the international data number for a ship board DTE is defined in Recommendation X.121, and is composed as follows:




## 4 Data transmission prefixes

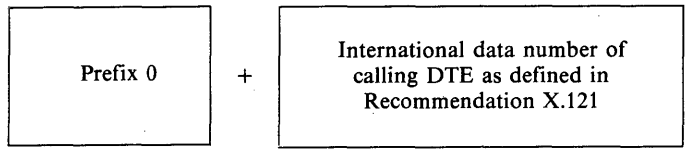
Prefixes to be used at the ship board DTE for calling a DTE of a PDN or a special termination located at the maritime satellite data switching exchange (MSDSE) or in a PDN are given in Annex A.

## 5 Transfer of address signal between the MSDSE and a ship board DTE

5.1 *Calls originating in a PDN*

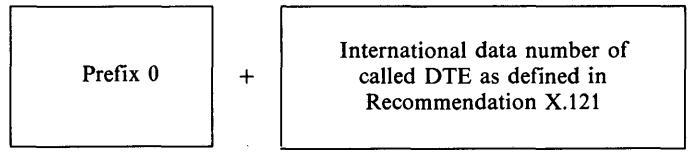
5.1.1 For an incoming call to a ship board DTE, the part of the called DTE address which includes the DNIC and the ship station identity need not be transferred across the DCE/DTE interface since the coast earth station identifies the called ship by procedures on the radio path. If present, the optional digit identifying a specific DTE on board the ship must be transferred transparently to the ship. [See also Recommendation X.352, § 2.3 ii).]

5.1.2 The calling DTE address transferred across the DCE/DTE interface should have the following format:



5.2 *Calls originating at a ship*

5.2.1 For a calling ship board DTE the called DTE address transferred across the DTE/DCE interface must have the following format irrespective of the location of the called DTE:

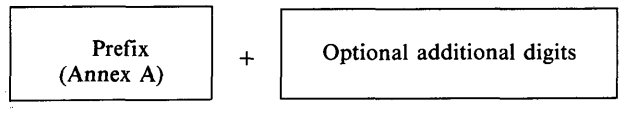



5.2.2 The calling DTE address consisting of the ship station identity optionally followed by the digit identifying the DTE on board the ship should be tranferred across the DTE/DCE interface [see also Recommendation X.352, § 2.3 i)].

*Note* – As required by Recommendation X.300, the calling DTE address, if present, should be checked by the MSDSE before the call request packet is transmitted into a PDN. The DNIC of the ocean area in which the calling ship is located should be inserted by the MSDSE. If the calling DTE address is not present, it should be inserted by the MSDSE. The inserted address should consist of the DNIC followed by the ship station identity.

5.3 *Calls to special terminations*

For a ship board DTE calling a special termination defined by one of the prefixes (other than 0) given in Annex A, the called DTE address transferred across the DTE/DCE interface must have the following format:




5.4 *Sub-addressing*

The use of the shared address method for identifying a specific DTE on board the ship is given in § 3 above.

For identifying a specific DTE on board the ship by using the extended address method in the facility field, see Recommendation X.25.

## 6 User services and facilities

6.1 User services and facilities should be offered in accordance with Recommendation X.2.

*Note* – The permanent virtual circuit service would require a leased line extended to the ship.

6.2 The realization of user facilities is given in Recommendation X.300.

6.3 Default values for certain facilities and parameters provided in all MSDSEs should be defined by INMARSAT. The default values for other facilities and parameters may be independently fixed for each MSDSE.

Methods for negotiation of facilities and parameters on a per call basis are for further study.

See also Recommendation X.32.

## 7 Routing

The general principles for routing between PDNs are given in Recommendation X.110. Special routing requirements related to the Maritime Satellite Service are given in Recommendation X.353.

## 8 Call progress signals and diagnostic codes

8.1 A subscriber of a PDN calling a ship board DTE may receive call progress signals and diagnostic codes in accordance with Recommendation X.96 and Annex E to Recommendation X.25, respectively. If the call progress signal (and diagnostic code) is returned from the MSDSE in case of unsuccessful call set-up of the maritime satellite circuit, Recommendation X.352 gives more precise information about the cause.

8.2 Call progress signals and diagnostic codes received at the on-board DTE as part of a clear indication packet will also be in accordance with Recommendation X.96 and Annex E to Recommendation X.25, respectively. Moreover, Recommendation X.352 suggests call progress signals to be returned from the ship earth station to the on-board DTE for unsuccessful call set-up of the maritime satellite circuit.

## 9 Closed user groups

9.1 In accordance with Recommendation X.2 the closed user group is considered as an essential user facility and should therefore also be made available for ships.

9.2 Because ships may set up and receive data calls through any MSDSE, a ship being part of a closed user group should be known as such on all MSDSEs in the Maritime Satellite Service.

9.3 The principles and procedures for realizing closed user groups are given in Recommendation X.300.

9.4 Administrative arrangements for closed user groups are given in Recommendation X.180. See also Recommendation F.122 regarding administrative arrangements for including ships in closed user groups.

## 10 Interface to PADs

10.1 A packet mode DTE on board a ship should access PADs on a PDN using the procedures defined in Recommendation X.29.

10.2 The procedures for an on-board DTE operating in the start-stop mode accessing a PAD should be in accordance with Recommendation X.351.

## 11 Transfer of C and I lead information

The maritime satellite circuit should include provisions for transferring the C and I leads (Recommendation X.21) between the on-board DTE/ship earth station interface and the coast earth station/MSDSE interface. If an envelope structure is used for this purpose, it must be ensured that non-standard envelopes are not passed into the PDN.

## 12 Handling of group calls (broadcast service)

12.1 The INMARSAT system provides for a communication service (maritime group calls) where a calling DTE of a PDN may forward messages simultaneously to a given group of ships. There will be no return link from the ships (i.e. a simplex service) so that no acknowledgement will be given as to whether a given ship in the called group has received the message.

Maritime group calls are identified by the following international data number (see Recommendation E.210/F.120):

| DNIC | Ship station identity for group calls |
|---|---|
| 111S | 0 $X_2X_3$ ..... $X_9$ |

where the first digit of the ship station identity has the fixed value 0. The remaining digits of the ship station identity determine which group of ships is being addressed.

12.2 If maritime group calls are required through a PDN, the calls should be forwarded through a message handling system (MHS) at the MSDSE. The procedures to be used between a DTE of a PDN and the MHS should be in accordance with rules defined by the CCITT. The procedures and formatting to be used on the maritime satellite circuit is to be defined by INMARSAT.

The MHS (or the MSDSE) must make sure that the calling DTE is authorized for maritime group calls, e.g. by use of the calling line identification facility or the closed user group facility. Calls from non-authorized DTEs must be barred.

12.3 Calls with a group address (other than those forwarded by the MHS) must be barred by the MSDSE or the coast earth station.

## ANNEX A

(to Recommendation X.350)

### Allocation of telephone prefixes, telex access codes and data transmission prefixes

Administrations should make the application for the allocation of new prefixes and access codes to the CCITT Secretariat. The application should contain a definition for the service, termination or facility to be accessed.

The CCITT Secretariat would be responsible for coordinating the allocation of new prefixes and access codes with the competent Study Groups. The allocation of new prefixes and access codes should be done in such a way as to ensure that equivalent services carried by means of telephone, telex or data circuits are given the same prefix.

The prefixes and access codes to be used for automatic calling should be as follows:

a) *Telephone:* For international calls the prefix should be 00 followed by the international telephone number of the called subscriber. For national calls the prefix should be 0 followed by the national (significant) number of the called subscriber.

*Note* – In the Maritime Satellite Service only the international format should be used (see § 2.3.1.1, Recommendation E.211).

b) *Telex:* For international calls the access code should be 00 followed by the international telex number of the called subscriber. For national calls the access code should be 0 followed by the national telex number of the called subscriber.

*Note* – In the Maritime Satellite Service only the international format should be used (see § 2.3.2.1, Recommendation F.121).

c) *Data transmission:* For data calls through a public data network the format should always consist of the prefix 0 followed by the international data number of the called subscriber (see § 5.2.1, Recommendation X.350).

Table A-1/X.350 contains a list of prefixes and access codes allocated so far for access to special destinations, services or facilities.

TABLE A-1/X.350

(Note 1)

**Allocation of telephone prefixes, telex access codes and data transmission prefixes**

| Category | Prefix or access code | | Applications (Notes 2 and 3) | Telephone | Telex | Data |
|---|---|---|---|---|---|---|
| | Digit 1 | Digit 2 | | | | |
| Operator | 1 | 0 | Spare | – | – | – |
| | 1 | 1 | International outgoing operator | A | A | NA |
| | 1 | 2 | International information service | A | A | FS |
| | 1 | 3 | National operator | A | A | NA |
| | 1 | 4 | National information service | A | A | FS |
| | 1 | 5 | Radiotelegram service | FS | A | NA |
| | 1 | 6 | Spare | – | – | – |
| | 1 | 7 | Booking of telephone calls (Note 4) | A | A | NA |
| | 1 | 8 | Spare | – | – | – |
| | 1 | 9 | Spare | – | – | – |
| Automatic facilities | 2 | 0 | Access to maritime PAD (Note 5) | A | NA | NA |
| | 2 | 1 | Store-and-forward (international) | NA | A | NA |
| | 2 | 2 | Store-and-forward (national) | NA | A | NA |
| | 2 | 3 | Abbreviated dialling (short code selection) | A | A | NA |
| | 2 | 4 | Telex letter service | NA | A | NA |
| | 2 | 5 | Spare | – | – | – |
| | 2 | 6 | | – | – | – |
| | 2 | 7 | | – | – | – |
| | 2 | 8 | | – | – | – |
| | 2 | 9 | | – | – | – |
| Specialized assistance (Notes 6 and 7) | 3 | 0 | Spare | – | – | – |
| | 3 | 1 | Maritime enquiries | A | A | A |
| | 3 | 2 | Medical advice | A | A | A |
| | 3 | 3 | Technical assistance | A | A | A |
| | 3 | 4 | Person-to-person call | A | NA | NA |
| | 3 | 5 | Collect calls | A | NA | NA |
| | 3 | 6 | Credit card calls | A | A | NA |
| | 3 | 7 | Time and charges requested at end of call | A | A | NA |
| | 3 | 8 | Medical assistance | A | A | A |
| | 3 | 9 | Maritime assistance | A | A | A |
| Ship Reporting (Note 6) | 4 | 0 | Spare | – | – | – |
| | 4 | 1 | Meteorological reports | A | A | A |
| | 4 | 2 | Navigational hazards and warnings | A | A | A |
| | 4 | 3 | Ship position reports | A | A | A |
| | 4 | 4 | Spare | – | – | – |
| | 4 | 5 | | – | – | – |
| | 4 | 6 | | – | – | – |
| | 4 | 7 | | – | – | – |
| | 4 | 8 | | – | – | – |
| | 4 | 9 | | – | – | – |

TABLE A-1/X.350 *(cont.)*

| Category | Prefix or access code | | Applications (Notes 2 and 3) | Telephone | Telex | Data |
|---|---|---|---|---|---|---|
| | Digit 1 | Digit 2 | | | | |
| Information retrieval | 5 | 0 | Spare | – | – | – |
| | 5 | 1 | Meteorological forecasts | FS | FS | FS |
| | 5 | 2 | Navigational warnings | FS | FS | FS |
| | 5 | 3 | Videotex (international) | FS | NA | FS |
| | 5 | 4 | Videotex (national) | FS | NA | FS |
| | 5 | 5 | News (international) | FS | FS | FS |
| | 5 | 6 | News (national) | FS | FS | FS |
| | 5 | 7 | Spare | – | – | – |
| | 5 | 8 | | – | – | – |
| | 5 | 9 | | – | – | – |
| Specialized use (Note 8) | 6 | | Administration specialized use, e.g. leased lines | A | A | FS |
| | 7 | | Spare | – | – | – |
| | 8 | | Spare | – | – | – |
| Test (Note 6) | 9 | 0 | Spare | – | – | – |
| | 9 | 1 | Automatic test line | A | A | FS |
| | 9 | 2 | Commissioning tests | A | A | A |
| | 9 | 3 | Spare | – | – | – |
| | 9 | 4 | Spare | – | – | – |
| | 9 | 5 | Operational coordination | A | A | A |
| | 9 | 6 | Spare | – | – | – |
| | 9 | 7 | | – | – | – |
| | 9 | 8 | | – | – | – |
| | 9 | 9 | | – | – | – |

*Note 1* – The same table is contained in Recommendations E.211, F.121 and X.350.

*Note 2* – The entries in the columns under Telephone, Telex and Data have the following meanings:

A = Applicable for access by this service
NA = Not applicable for access by this service
FS = For further study.

*Note 3* – The prefix or access code may be followed by an optional telephone country code, data country code (or data network identification code) or telex destination code, or other optional digits.

*Note 4* – Via some coast earth stations it would be possible to book telephone calls using the telex service.

*Note 5* – PAD = Packet Assembly/Disassembly facility. The prefix 20 should be followed by two digits indicating the required data rate (see Recommendation X.351).

*Note 6* – Some of the facilities under this category are defined in Annex B of Recommendation E.211.

*Note 7* – The prefixes 34, 35, 36 and 37 may be followed by the international number of the called subscriber.

*Note 8* – Digits following digit 6 will be allocated on a national basis.

## SPECIAL REQUIREMENTS TO BE MET FOR PACKET ASSEMBLY/DISASSEMBLY FACILITIES (PADs) LOCATED AT OR IN ASSOCIATION WITH COAST EARTH STATIONS IN THE MARITIME SATELLITE SERVICE

*(Malaga-Torremolinos, 1984)*

The CCITT,

*considering*

(a) that the PAD is defined in Recommendation X.3;

(b) that the DTE/DCE interface for a start-stop mode DTE accessing a PAD is defined in Recommendation X.28;

(c) that the procedures for the exchange of control information and user data between a PAD and a packet mode DTE are given in Recommendation X.29;

(d) that Recommendation X.350 gives the general requirements to be met for data transmission in the maritime satellite service;

(e) that start-stop mode DTEs are in use in the maritime satellite service;

(f) that it is desirable that such DTEs are offered access to and from packet switched public data networks via PADs located at or in association with coast earth stations or maritime satellite data switching exchanges (MSDSEs);

(g) that it is desirable to employ the same access procedures, service initiation and exchange of control information and characters in all PADs in the maritime satellite service (maritime PADs).

*Note 1* – The term *maritime PAD* is used for PADs located at or in association with coast earth station in the maritime satellite service designed in accordance with this Recommendation.

*Note 2* – This Recommendation does not specify PADs to be used on-board ships.

*unanimously declares the view*

(1) that PADs in the Maritime Satellite Service (maritime PADs) should meet the requirements of this Recommendation in order to ensure full compatibility between PADs associated with different coast earth stations or maritime satellite data switching exchanges (MSDSEs) (see Recommendation X.350 for the definition of MSDSE). The general specifications of PADs are given in Recommendations X.3, X.28 and X.29;

(2) that the maritime PAD shall accept calls from any ship participating in the Maritime Satellite Service. Optionally, the maritime PAD may also offer the capability of setting up calls to ship board start-stop mode DTEs;

(3) that maritime PADs shall offer the initial standard profile given in Table 3/X.351;

(4) that maritime PADs will in addition offer other standard profiles defined in Recommendation X.28;

(5) that the user on board the ship should be advised to place the data call through the maritime PAD which is nearest to the called subscriber in order to avoid long terrestrial routes;

(6) that the protocol should enable access to and from unattended start-stop mode DTEs on-board ships and ensure efficient disconnection of the access information path at the end of a virtual call in order to avoid undue holding of the satellite circuit;

(7) that network user identification (NUI) facility is required for all calls set up from an on-board DTE in order to avoid fraudulent calls. The format of the NUI facility request signal is defined in Annex A;

(8) that maritime PADs may be located as shown in Annex B.

## 1 Procedures for establishing the access information path for ship originated calls

### 1.1 *DTE/DCE interface*

The access information path should be provided by the use of modems standardized for use in the public switched telephone network:

i) At the rate of 300 bit/s for full duplex operation in accordance with Recommendation V.21. Channel No. 1 is to be used in the direction from the ship to the PAD and channel No. 2 in the opposite direction. Tone disabling is required for disabling of echo suppressors.

ii) At the rate of 1200 bit/s for full duplex operation in accordance with Recommendation V.22, alternative B, mode ii) with 10 bits per character (i.e. one start bit, eight information bits and one stop bit) [§ 4.2.1 b) of Recommendation V.22]. The handshake procedure should be in accordance with Figure 4/V.22. The ship board modem shall transmit in the low channel and receive in the high channel. The modem of the PAD will have the opposite channel configuration. Tone disabling is required for disabling of echo suppressors.

iii) At the rate of 75/1200 bit/s in accordance with Recommendation V.23. The rate of 75 bit/s should be used for the direction from the on-board DTE to the PAD and the rate of 1200 bit/s should be used for the other direction. Tone disabling is required for disabling of echo suppressors.

*Note 1* – The alternative given in ii) above is preferred.

*Note 2* – Administrations may offer other additional data rates at the maritime PAD.

The particular interchange circuits provided, and their operation, shall be in accordance with Recommendation V.24 and clamping of circuit 104 should be implemented in accordance with Recommendation V.24, § 4.3.

### 1.2 *Procedures for setting up the access information path by the DTE*

#### 1.2.1 *Setting up the satellite link*

The satellite link is established by using procedures defined within the INMARSAT system.

#### 1.2.2 *Dialling procedures*

The dialling procedures for setting up telephone circuits in the INMARSAT system is given in Recommendation E.211.

Table 1/X.351 gives the dialling sequences which should be used for accessing the maritime PADs using the modems given in § 1.1.

TABLE 1/X.351

**Dialling information for accessing the modems defined in § 1.1**

| Data signalling rate (bit/s) | Dialling sequence |
|---|---|
| 300 | 2002 |
| 1200 | 2003 |
| 75/1200 | 2011 |

Table 2/X.351 gives the dialling sequences for other data rates of Recommendation X.3 which can be supported in the existing INMARSAT system. These data rates may be offered on an optional basis.

TABLE 2/X.351

**Dialling information for additional data signalling rates**

| Data signalling rate (bit/s) | Dialling sequence |
|---|---|
| 50 | 2010 |
| 75 | 2005 |
| 100 | 2009 |
| 110 | 2000 |
| 134.5 | 2001 |
| 150 | 2006 |
| 200 | 2008 |
| 600 | 2004 |
| 1 800 | 2007 |
| 2 400 | 2012 |
| 4 800 | 2013 |
| 9 600 | 2014 |
| 56 000 | 2017 |

The dialling sequences 2050 through 2099 are allocated for national use, e.g. access to PADs for special services such as videotex.

For access to PADs other than maritime PADs, national access procedures and access numbers should be used. The numbering and dialling procedures will then be as defined for calling a terrestrial telephone subscriber (see § 2.3.1 of Recommendation E.211).

### 1.2.3 *Routing and digit conversion at the coast earth station*

The routing of calls from the ship earth station to the maritime PAD is as shown in Annex B.

There may be a separate input port to the maritime PAD for each data rate, or several data rates may be accepted on one port. The coast earth station will route the call automatically to the appropriate port of the PAD.

If the maritime PAD is remotely connected to the coast earth station via the public switched telephone network [corresponding to case a) of Annex B], the coast earth station will convert the digits $20X_1X_2$ into the appropriate telephone access number allocated to the required input port of the PAD.

### 1.2.4 *Disabling of echo suppressors*

Echo suppressors are normally fitted at both ends of the satellite connection. Even though the echo suppressors in some cases may be disabled by signalling means, it is advisable that the disabling tone is sent by the modems whenever the access information path is being established.

## 2 Procedures for establishing the access information path for calls originating in a PDN

This point is for further study.

## 3 Procedures for disconnecting the access information path

Procedures for disconnecting the access information path, i.e. the maritime satellite telephone circuit, are given in §§ 1.1.3.2 and 1.1.3.4 of Recommendation X.28.

*Note 1* – Since a maritime satellite telephone circuit is used for accessing the maritime PAD, charging of the call may take place until the circuit has been cleared forward (see Recommendation Q.60 for the relevant conditions). For calls set up from the on-board DTE, disconnection by the maritime PAD corresponds to clearback on the maritime satellite telephone circuit. The clearing procedures related to clearback of telephone circuits in the maritime satellite service are defined in Recommendation Q.60.

*Note 2* – The maritime PAD may be provided with control mechanisms for disconnecting the access information path during fault conditions, for example when no information has been passed between the DTE and the PAD for a given period of time.

*Note 3* – When the maritime PAD detects that a clearing condition of level 3 exists on the interface to the PDN and after the necessary control signals (e.g. the *clear indication PAD service* signal) have been passed to or received from the DTE, the PAD should disconnect the access information path.

## 4 Format of characters used in the exchange of control information

The start-stop mode DTE shall generate and be capable of receiving characters in accordance with International Alphabet No. 5 as described in Recommendation T.50. The general structure of characters should be in accordance with Recommendation X.4.

The following specific conditions should apply. The PAD will transmit and expect to receive 8-bit characters, where the 8th bit (i.e. the last bit preceding the stop element) shall be the parity bit. The maritime PAD will detect the parity from the *service request* signal.

If the transparent mode is selected during the call (see § 5.2 below), the PAD will ignore the parity bit and will pass octets transparently between the two interconnected DTEs.

The initial standard profile in Table 3/X.351 assumes that the even parity is used. However, the maritime PAD will also support the optional parameter values 1, 2 and 3 of parameter 21 (see Recommendation X.3). If the on-board start-stop mode DTE requires the use of a specific value for parameter 21, this value should be selected by a *set PAD command* (or a *set and read PAD command*) signal (e.g. SET 21:3) sent as soon as the *PAD identification PAD service* signal has been received [see § 5.2.1 ii)].

It is for further study whether specific standard profiles for maritime applications should be included in Table 3/X.351 for the purpose of parity treatment other than that provided with the initial standard profile.

## 5 Procedures for ship originated calls

### 5.1 *General*

#### 5.1.1 *Initial standard profile for maritime PADs*

The initial standard profile for maritime satellite applications which will be offered in all maritime PADs is given in Table 3/X.351.

Parameters Nos. 1 through 12 and parameter No. 21 will be implemented in all maritime PADs. The remaining parameters may be offered on a national basis.

#### 5.1.2 *Coding of PAD command signals and PAD service signals*

The coding of *PAD command* signals and *PAD service* signals are given in Recommendation X.28.

### 5.2 *Procedures*

5.2.1 Figure 1/X.351 shows the sequence of events for call establishment and call clearing for ship originated calls.

TABLE 3/X.351

**PAD parameter settings for the initial standard profile for maritime PADs**

| Parameter reference number | Parameter description | Parameter setting for standard maritime satellite profile | Parameter value |
|---|---|---|---|
| 1 | PAD recall using a character | Set to possible | 1 |
| 2 | Echo | Set to no echo | 0 |
| 3 | Selection of data forwarding signal | Set to all characters in column 0 and 1 and character DEL | 126 |
| 4 | Selection of idle timer delay | Set to no time-out | 0 |
| 5 | Ancillary device control | Set to no use of X-ON and X-OFF | 0 |
| 6 | Control of PAD service signal | Set to service signals are sent | 1 |
| 7 | Selection of operation of PAD on receipt of break signal from the start-stop mode DTE | Set to reset | 2 |
| 8 | Discard output | Set to normal data delivery | 0 |
| 9 | Padding after carriage return | Set to no padding after carriage return | 0 |
| 10 | Line folding | Set to no line folding | 0 |
| 11 | Binary speed of start-stop mode DTE | Set to speed of DTE | See Recommendation X.3 |
| 12 | Flow control of the PAD by the start-stop mode DTE | Set to use of X-ON and X-OFF | 1 |
| 13 | Linefeed insertion after carriage return | Set to no linefeed insertion | 0 |
| 14 | Linefeed padding | Set to no padding after LF | 0 |
| 15 | Editing | Set to no editing | 0 |
| 16 | Character delete | Set to character 7/15 (DEL) | 127 |
| 17 | Line delete | Set to character 1/8 (CAN) | 24 |
| 18 | Line display | Set to character 1/2 (DC2) | 18 |
| 19 | Editing PAD service signals | Set to editing PAD service signals for printing terminals" | 1 |
| 20 | Echo mask | Set to echo all characters | 0 |
| 21 | Parity treatment | Set to no parity detection or generation | 0 |
| 22 | Page wait | Set to page wait disabled | 0 |

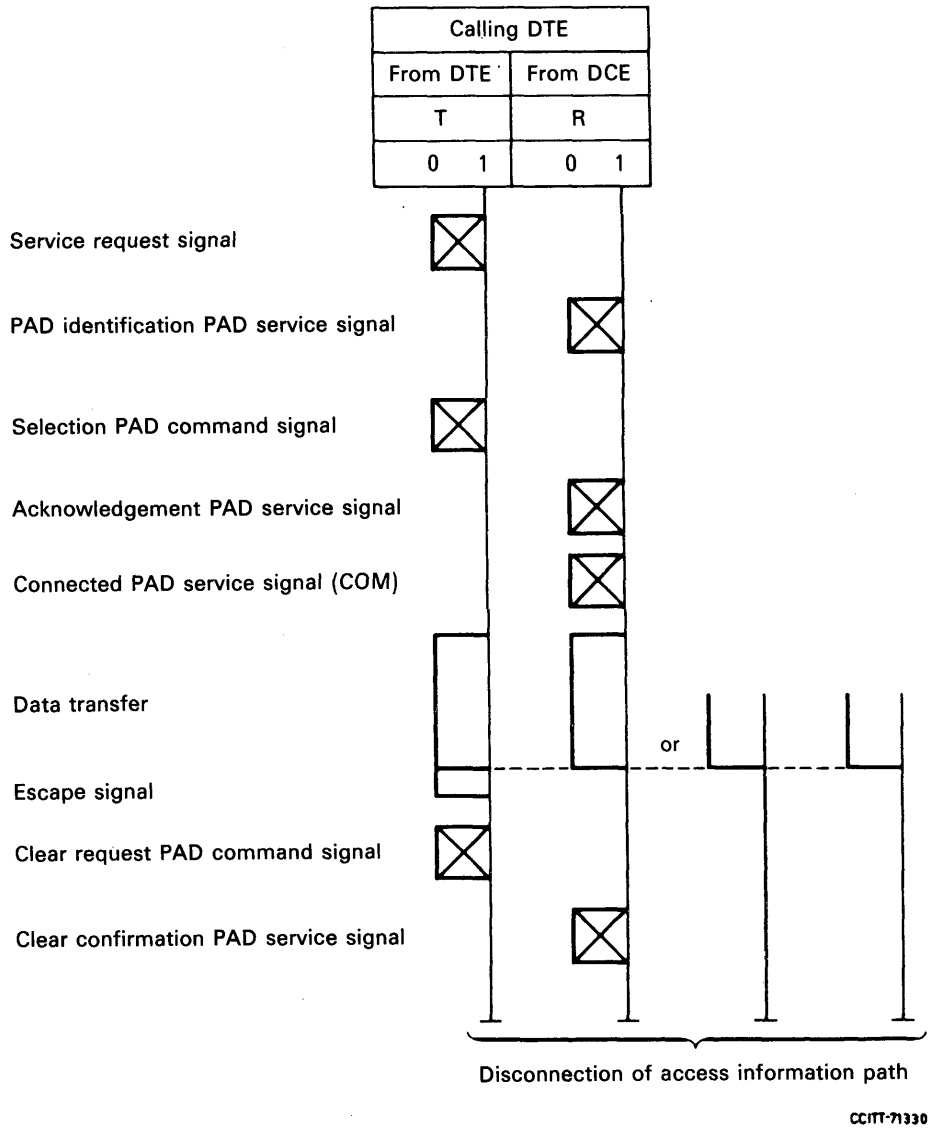



FIGURE 1/X.351

**Sequence of events for ship originated calls**

The following procedures will be supported in maritime PADs for virtual calls set up by the on-board start-stop mode DTE. These procedures are based on those given in Recommendation X.28, however, where the procedures given below deviate from those given in Recommendation X.28 or where Recommendation X.28 gives several alternative procedures, those given below should prevail.

i) The procedure should be initiated by the on-board start-stop mode DTE sending a *service request* signal consisting of the characters <2/14( · ) 0/13(CR)> to the PAD.

The PAD will detect the parity and, if required, the data rate used from this signal.

ii) The PAD will respond within 10 seconds with the *PAD identification PAD service* signal with the following format:

PAD and/or port identification <(CR) (LF)>

[The signal <(CR) (LF)> is the format effector.]

On receipt of this signal the start-stop mode DTE shall send either:

- the *selection PAD command* signal, or
- a *set PAD command* (or *set and read PAD command)* signal for setting of specific PAD parameters followed by the *selection PAD command* signal, or
- a *standard profile selection PAD command* signal followed by the *selection PAD command* signal.

The format of the *selection PAD command* signal is given in Annex A.

If the NUI facility request signal contained in the *selection PAD command* signal is not accepted by the PAD, the PAD will transmit the *clear indication PAD service* signal <CLR NA> and disconnect the access information path.

If the first character of the *selection PAD command* signal has not been received within 60 seconds or the last character within 120 seconds, the PAD will transmit the *error PAD service* signal and disconnect the access information path.

iii) The PAD will acknowledge the *selection PAD command* signal within 10 seconds with the *acknowledgement PAD service* signal composed of the characters <0/13 (CR) 0/10 (LF)>.

iv) When the virtual call has been extended to the called DTE, the PAD will return the *PAD service* signal <COM> to the start-stop mode DTE. The interface will now be in the data transfer state where characters may be transferred using International Alphabet No. 5 except for the character <1/0 (DLE)> (which would be interpreted by the PAD as an escape from the data transfer state) and the characters <1/1 (DC1)> and <1/3 (DC3)> (which are used for flow control, see also Recommendation X.28, § 4.1).

If the start-stop mode DTE would require data to be transferred transparently through the PAD, the DTE should either send the *standard profile selection PAD command* signal <PROF91> or the *set PAD command* signal <SET 1:0, 3:0, 4:20, 6:0, 12:0> as soon as the *PAD service* signal <COM> has been received.

Selection of other PAD parameter values should be done in accordance with the procedures given in Recommendation X.28.

*Note* – When the transparent profile has been selected, the start-stop mode DTE will no longer be capable of escaping from the data transfer state and, since no *PAD service* signal will be given, a call control procedure needs to exist between the two communicating DTEs. For the packet mode DTE this would require a protocol at a layer above layer 3.

5.2.2 The general conditions for clearing are given in Recommendation X.28, § 3.2.2. However, the following should be noted:

a) When parameter 6 is not set to 0, the PAD will return the *clear confirmation PAD service* signal within 10 seconds after the receipt of a *clear request PAD command* signal from the ship-board DTE without awaiting a clear confirmation packet from the packet mode DTE. The start-stop mode DTE should be responsible for disconnecting the access information path. However, if the start-stop mode DTE does not disconnect the access information path or does not send the first character of a new *PAD command* signal within 20 seconds, the PAD should disconnect the access information path.

b) If parameter 6 is not set to 0, the PAD will send a *clear indication PAD service* signal to the start-stop mode DTE when receiving a clear indication packet from the PDN. The PAD should be capable of disconnecting the access information path within 20 seconds provided that
   - the on-board start-stop mode DTE has not disconnected the access information path,
   - a new *PAD command* signal has not been received from the on-board DTE, or
   - an incoming call packet to the same ship has not been received from the PDN within this time-out period.

c) If parameter 6 has been set to 0, the on-board DTE should disconnect the access information path at the end of the virtual call. If a clear indication packet is received from the PDN and the path has not been disconnected by the on-board DTE, the PAD should be capable of disconnecting the access information path.

5.2.3 Maritime PADs may offer initial profiles and procedures additional to those given in this Recommendation on a national basis.

## 6 Procedures for PDN originated calls

These procedures are for further study.

## 7 Procedures for exchange of user data

### 7.1 *General*

The procedures given in Recommendation X.28, § 4, should be used.

7.2 *Special conditions for the Maritime Satellite Service*

The following conditions relate to the long two-way transmission delay on the satellite circuit (approximately 0.6 seconds):

i) The PAD should be capable of storing more than one packet before a flow control signal is sent to the start-stop mode DTE.

ii) The parameter M in Recommendation X.28, § 4.6, must have the minimum values given in Table 4/X.351.

iii) The echo will be delayed by approximately 0.6 seconds. Therefore parameter 2 should normally be set to 0.

TABLE 4/X.351

**Minimum values for the parameter M**

| Data signalling rate (bit/s) | Minimum value of M |
|---|---|
| 300 | 18 |
| 1200 | 72 |

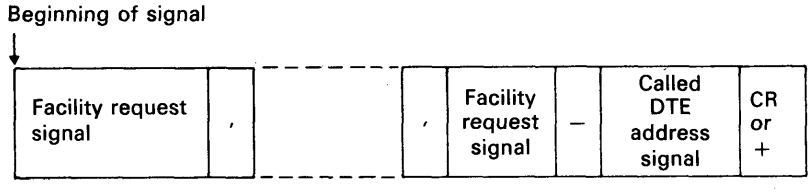
ANNEX A

(to Recommendation X.351)

**Format of selection PAD command signal for maritime satellite applications**

A.1 *General format*

The general format of the *selection PAD command* signal is given in Recommendation X.28 and is composed as follows:




The character 2/12 (,) is used as a separator between facility request signals and the character 2/13 (–) is used as a separator between the facility request block and the called DTE address signal. The *selection PAD command* signal is terminated by either of the characters 0/13 (CR) or 2/11 (+).

The facility request block must contain the NUI facility request signal. Other facility request signals are optional.

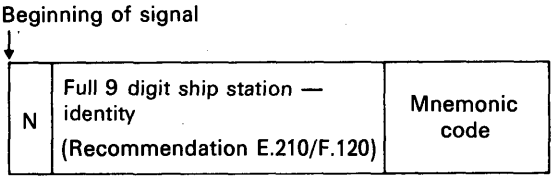
If the PAD receives a *selection PAD command* signal with a separator character 2/12 (,) followed by an empty facility request field, the signal will be accepted provided that the other fields of the signal are accepted.

The inclusion of user data in the *selection PAD command* signals is for further study.

A.2 *NUI facility request signal*

A.2.1 *Format of the NUI facility request signal*

The NUI facility request signal shall have the following format and be sent in the order shown;




N is the character 4/14 (N) of International Alphabet No. 5. The mnemonic code of the NUI facility request signal may consist of 1 to 4 characters in columns 2 to 7 of International Alphabet No. 5, except 2/0 (SP), 7/15 (DEL), 2/13 (−), 2/12 (,) and 2/11 (+).

A.2.2 *Validation of the NUI facility request signal*

The coast earth station will check the general authorization of the calling ship for access to the INMARSAT system. Therefore, validation of the NUI facility request signal may be limited to the mnemonic code. However, the possibility of fraudulent calling would be reduced if the ship station identity is also included in the validation.

The ship station identity may also be used for identifying the calling ship for charging purposes and for insertion in the calling DTE address field of the call request packet.

A.3 *Composition of the called DTE address signal*

A.3.1 *Calls to a DTE of a PDN*

The called DTE address signal shall consist of the prefix 0 followed by the full international number of the called DTE. This applies also when the called DTE is located in the same country as the maritime PAD.

A.3.2 *Calls to special destination*

Annex A of Recommendation X.350 defines two-digit prefixes for access to special destinations. For calls to such destinations the called DTE address shall consist of the two-digit prefix, optionally followed by additional digits.

A.4 *Optional facilities*

Facilities to be offered in a maritime PAD is to be determined by the Administration concerned.

The shipboard DTE may request available facilities in accordance with the procedures given in Recommendation X.28.

ANNEX B

(to Recommendation X.351)

**Possible locations of PADs in the Maritime Satellite Service**

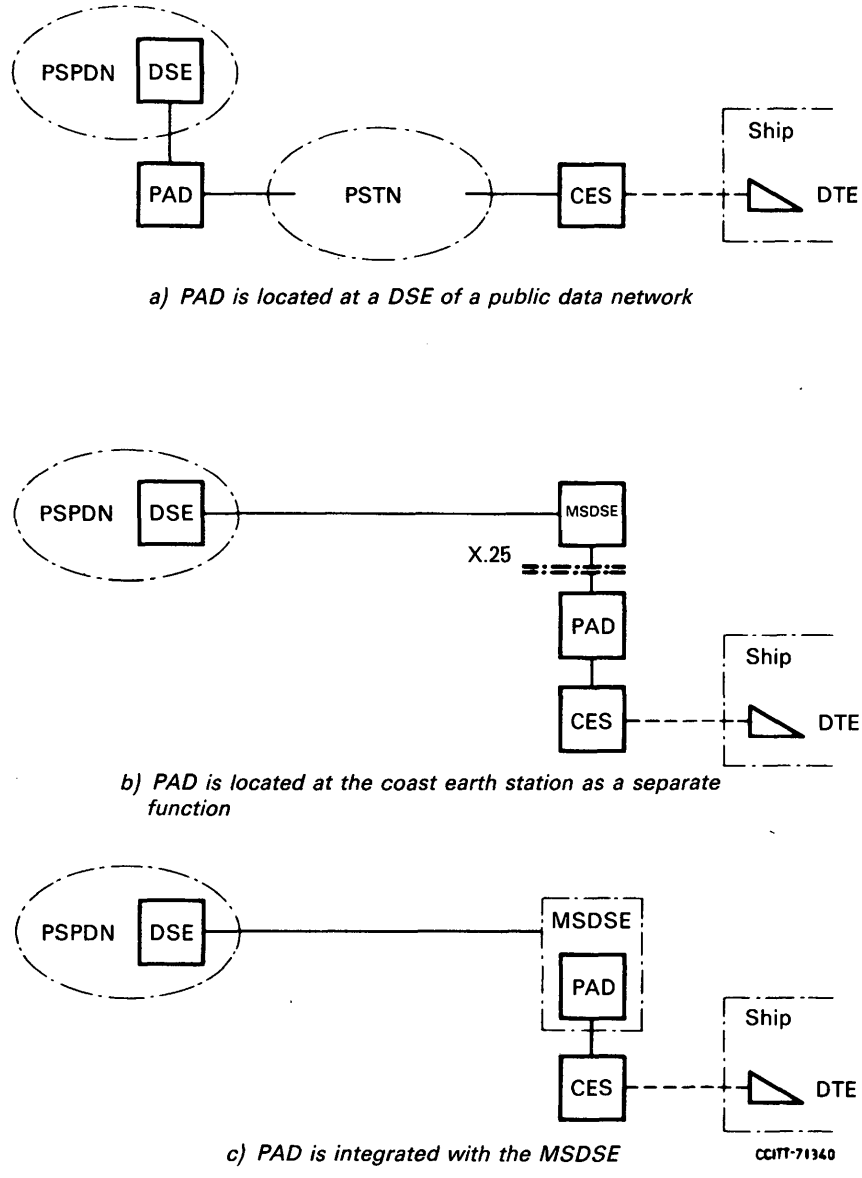
PADs in the Maritime Satellite Service may be located as shown in Figure B-1/X.351. The following cases have been identified:

a) The PAD is connected to a DSE in the country in which the coast earth station is located. In this case a call from a ship board start-stop mode DTE is routed from the maritime satellite telephone system via the telephone network to the PAD. For charging purposes a network user identification (NUI) signal must be used for identification of the calling ship.

This solution may be used irrespective of the telephone switching capabilities of the coast earth station. It is the only possible solution when the coast earth station does not incorporate a telephone switch.

b) The PAD is located at the coast earth station and is connected to the maritime satellite telephone system at the coast earth station and to the MSDSE on the interface defined in Recommendation X.25. In this case also, the NUI signal would be required.

c) The PAD is integrated with the MSDSE and the interworking procedure defined in Recommendation X.352 is used for transferring the calling line identification from the coast earth station to the MSDSE. In this case the use of the NUI signal would not be required for identification purposes.




CES = Coast earth station
DSE = Data switching exchange
PSPDN = Packet switched public data network
PSTN = Public switched telephone network
MSDSE = Maritime satellite data switching exchange

FIGURE B-1/X.351

**Possible locations of the PAD**

**Recommendation X.352**

## INTERWORKING BETWEEN PUBLIC PACKET SWITCHED DATA NETWORKS AND THE MARITIME SATELLITE DATA TRANSMISSION SYSTEM

*(Malaga-Torremolinos, 1984)*

The CCITT,

*considering*

(a) that a Maritime Satellite Service is now being operated by the International Maritime Satellite Organization (INMARSAT);

(b) that interworking between the Maritime Satellite Service and public data networks is required;

(c) that Recommendation X.350 specifies general requirements for data transmission in the Maritime Satellite Service and Recommendation X.353 outlines the routing principles for interconnecting the Maritime Satellite Service with public data networks;

(d) that Recommendation X.25 specifies the interface between data terminals and data circuit-terminating equipment for terminals operating in the packet mode on public data networks, and that Recommendation X.75 specifies terminal and transit call control procedures and data transfer system on international circuits between packet-switched data networks;

(e) that the physical link between a ship and a data switching exchange (DSE) will only exist on a temporary basis, i.e. so long as a virtual call exists between the ship and the DSE;

(f) that Recommendation X.141 provides guidance with respect to general principles for the detection and correction of errors in public data networks,

*unanimously declares the view*

that the following interworking principles and interface conditions should apply for operating in the packet mode between a ship board DTE and a public data network.

### 1 Definitions

For definitions of terms used in relation with data transmission in the maritime satellite service, see Recommendation X.350.

For the purpose of this Recommendation the **maritime satellite data switching exchange (MSDSE)** is defined as the functional interface between the maritime satellite data transmission system and a packet switched public data network.

The MSDSE provides the following functions:

- interworking between the signalling systems used in the maritime satellite data transmission system and the PSPDN;
- routing and call control for calls to and from ships;
- charging.

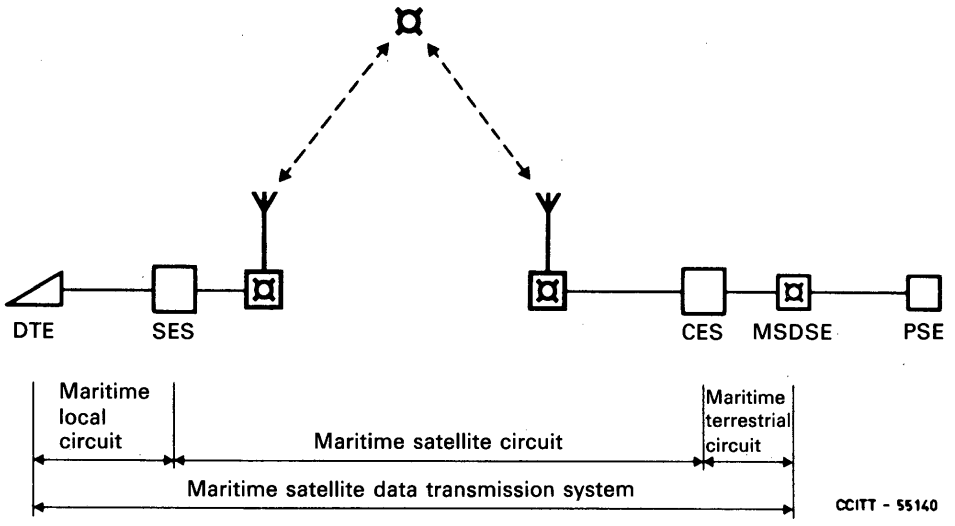
The composition of the maritime satellite data transmission system for interconnection with a packet switched PDN is shown in Figure 1/X.352.

### 2 Interface conditions

The following interfaces need to be specified for interworking and call control purposes:

- the interface between the on-board DTE and the ship earth station (maritime local circuit);
- the interface between the ship earth station and the coast earth station including the interface to the network coordination station (maritime satellite circuit);
- the interface between the coast earth station and the MSDSE (maritime terrestrial circuit);
- the interface between the MSDSE and a packet switched PDN.

The interfaces are shown for levels 1, 2 and 3 in Figure 2/X.352.

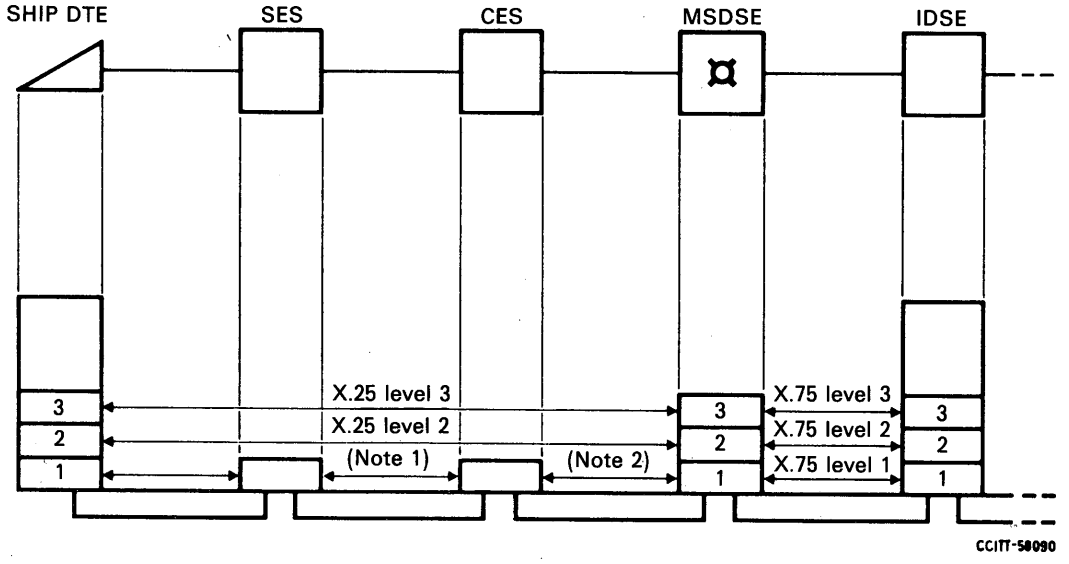



SES = Ship earth station
CES = Coast earth station
MSDSE = Maritime satellite data switching exchange
PSE = Packet switching exchange

*Note* — See Recommendation X.350 for definitions.

FIGURE 1/X.352

**Composition of the maritime satellite data transmission system for interconnection with a packet switched network**




*Note 1* – Signalling system and physical link as defined for the INMARSAT system.

*Note 2* – Interworking between the CES and level 3 of the protocol defined in Recommendation X.75.

FIGURE 2/X.352

**Interfaces to be defined in the maritime satellite system**

2.1 *Interface between the on-board DTE and the ship earth station (maritime local circuit)*

2.1.1 *Level 1* (physical level) between the on-board DTE and the ship earth station may be realised by the use of the interfaces defined in:

- Recommendation X.21;
- Recommendation X.21 *bis*;
- Recommendations V.24 and V.25.

The Recommendation X.21 interface should be included in new ship earth station designs. The Recommendation X.21 *bis* interface (or the Recommendation V.24 interface) may be used for existing stations so that the service may be operated from such stations without requiring a redesign of them.

The basic requirements of the level 1 interface are:

i) For calls originating in the ship board DTE the interface should provide for the following functions:
   - it should enable the DTE to provide the ship earth station with the address of the coast earth station through which the call is to be established.

     *Note* – The address of the called DTE is provided as part of the level 3 procedure.
   - it should enable the ship earth station to provide the DTE with *call progress* signals when the attempt to establish the maritime satellite circuit fails. The *call progress* signals to be used are given in § 6.1.

     *Note* – This may not be possible in some ship earth stations, e.g. when the DTE interfaces the ship earth station in accordance with Recommendation V.24.

ii) For calls originating in a PDN the interface should allow for automatic connection of the on board DTE to the circuit.

Interchange circuits shall be provided in order to meet these requirements. The required interchange circuits are defined in the Recommendations applicable to the interface used. The control of these interchange circuits shall be such as to ensure proper establishment and clearing of the maritime satellite circuit. It should also be observed that since the maritime satellite circuit is established on a call by call basis, it must be ensured that the on-board DTE acquires synchronism to the element timing of the PDN before the full procedure on level 2 is established. Until synchronism is obtained the DTE should send contiguous 1s.

Detailed specifications of the modems to be used at the ship earth station and the call control procedures are for further study.

See also Recommendation X.32.

2.1.2 *Level 2* should be in accordance with § 2 of Recommendation X.25. The extended control field (modulo 128) may be used if required.

*Note 1* – In order to obtain maximum throughput the extended control field and/or non-standard frame length must be used for user classes of service 10 and 11.

*Note 2* – For reasons given in Recommendation X.141 it may be advantageous to use the selective reject (SREJ) command.

The on-board DTE should start sending the flag sequence as soon as synchronism with the MSDSE has been established.

2.1.3 *Level 3* should be in accordance with §§ 3 through 7 of Recommendation X.25.

Extended packet sequence numbering, non-standard default window size and non-standard packet size may be used.

*Note* – In order to obtain maximum throughput, packet sequence numbering modulo 128 combined with non-standard default window size, or non-standard default packet size combined with non-standard default window size could be used.

Composition of the address field of the *call request* packet is given in § 4 of this Recommendation.

2.2 *Interface between the ship earth station and the coast earth station (maritime satellite circuit)*

The set-up and clearing procedures for the maritime satellite circuit are to be defined by INMARSAT in accordance with the interworking procedures defined in §§ 2.1 and 2.3.

The ship earth station and the coast earth station must be transparent for levels 2 and 3 of Recommendation X.25.

*Note* – Forward error correction may be employed on the maritime satellite circuit in order to improve the bit error performance. See Recommendation X.141.

2.3 *Interface between the coast earth station and the MSDSE (maritime terrestrial circuit)*

The maritime terrestrial circuit must be transparent for levels 2 and 3 of Recommendation X.25.

Interworking between the coast earth station and the international circuit interconnecting the MSDSE with a PDN should take place as follows:

i) For ship originated calls the coast earth station should provide the MSDSE with the full 9 digit ship station identity (see Recommendation E.210/F.120) of the calling ship for insertion in the calling DTE address field of the call request packet. This information will be provided to the coast earth station as part of the signalling procedure for setting up the maritime satellite circuit and will be available before level 3 has been established between the on-board DTE and the MSDSE.

*Note* – If it is impractical to implement this procedure, the ship station identity could be obtained from the calling DTE address in the call request packet.

The coast earth station must also given an indication to the MSDSE that the set-up of the maritime satellite circuit has been completed so that levels 2 and 3 of the protocol can be established.

ii) For incoming calls from a PDN the MSDSE must transfer the ship station identity contained in the *call request* packet to the coast earth station in order to set up the maritime satellite circuit. When the maritime satellite circuit has been set up, the coast earth station must provide the MSDSE with a signal indicating that setting up of levels 2 and 3 may commence.

In the event of unsuccessful call set-up of the maritime satellite circuit, the coast earth station must indicate to the MSDSE the reason for call set-up failure so that the MSDSE may return the appropriate call progress signal (and diagnostic code) in the *clear request* packet. The call progress signals to be used are given in § 6.2.

iii) The MSDSE should start sending the flag sequence as soon as the coast earth station has indicated that the maritime satellite circuit has been established and through-connected by the coast earth station.

If the flag sequence has not been received from the on-board DTE within a given time-out period (for further study), the MSDSE should initiate clearing of the satellite circuit.

In order to ensure full call control by the MSDSE also for ship originated calls, the MSDSE may initialize level 2 by sending the SABM command as soon as the flag sequence has been detected.

iv) If the maritime satellite circuit is interrupted (see § 7.2) or abnormally cleared (e.g. priority over-ride), an indication should be given to the MSDSE so that the terrestrial part of the virtual circuit may be cleared with an appropriate *call progress* signal.

The MSDSE must be capable at any time to receive an indication from the coast earth station that the satellite circuit has been cleared or interrupted.

v) The MSDSE must also be capable of indicating to the coast earth station that the maritime satellite circuit can be released.

2.4 *Interface between the MSDSE and a packet switched PDN*

This interface should correspond to Recommendation X.75.

## 3 Detailed call set-up and clearing procedures

Examples of call set-up and clearing procedures and interworking between various system elements are given in Annex A.

## 4 Composition of the call request packet at the on-board DTE

4.1 The general format of the *call request* packet shall be as defined in Recommendation X.25.

4.2 The called DTE address shall be composed as follows for calls to subscribers of a PDN:

- prefix 0;
- the international data number of the called DTE in accordance with Recommendation X.121.

4.3 The calling DTE address composed as defined in Recommendation X.350 should always be inserted in the *call request* packet.

4.4 The calling DTE address to be inserted by the MSDSE in the call request packet should be composed of the DNIC (111S) associated with the ocean area in which the ship is located followed by the ship station identity and, if present, the optional digit specifying a specific ship board DTE.

4.5 Some MSDSEs may offer access to special terminations using abbreviated addresses. The called DTE address shall in such cases consist only of the abbreviated address (see Recommendation X.350). All such abbreviated addresses will have a first digit different from 0 in order to distinguish them from calls to an international data number. If the required termination is in a PDN the MSDSE must perform all necessary digit conversion to the international data number associated with the required termination before the call can be forwarded into a PDN.

## 5 Clearing of the maritime satellite circuit

If more than one virtual call exists, the MSDSE must not initiate clearing of the maritime satellite circuit when detecting a clearing condition for one of the virtual calls.

If only one virtual call exists when a clear request packet is received from either of the parties, the MSDSE shall start clearing of the HDLC LAPB link as follows:

i) If the clearing was initiated by the PDN, clearing of the HDLC LAPB link should commence when either of the following conditions has been met:

   – a *DTE clear confirmation* or a *clear request* packet has been received from the on-board DTE;

   – timer T13 (Annex D to Recommendation X.25) has expired.

   *Note 1* – Before clearing of the HDLC link the MSDSE may issue a clear indication packet with diagnostic code No. 50 (timer expired for clear indication).

   *Note 2* – It is desirable to have a smaller value than 60 seconds on timer T13 for maritime satellite applications in order to reduce the traffic load on the satellite circuits. The minimum value is for further study.

ii) If the clearing was initiated by the on-board DTE, the MSDSE should forward the *clear request* packet into the PDN and immediately return a *DCE clear confirmation* packet to the on-board DTE without awaiting the return of any *clear confirmation* packet from the PDN. As soon as the *clear confirmation* packet has been sent to the ship, clearing of the HDLC link should commence.

   *Note* – In order to allow the DTE to place a new call immediately after clearing of the last existing virtual call, the clearing of the HDLC link may be delayed by a short time-out period. If the clearing was initiated from the PDN, the timer should be started when the *DTE clear confirmation* packet is received from the on-board DTE. If the clearing was initiated by the on-board DTE, the timer should be started when the *DCE clear confirmation* packet is sent to the ship. If a new *call request* packet is received from either of the parties during this time-out period, the satellite circuit should not be cleared. The time-out should be short in order to avoid undue holding of the satellite circuit in those cases where no further calling is intended.

An indication that the physical link may be cleared should be provided to the coast earth station as soon as the MSDSE has entered the disconnected phase. The actual clearing of the maritime satellite circuit would then be undertaken by the coast earth station.

*Note* – With the above procedures clearing of levels 1 and 2 is always initiated by the MSDSE and interworking between different levels would not be required in the on-board DTE. Procedures for handling clearing failures associated with the maritime satellite circuit are to be defined by INMARSAT.

## 6 Relationship between call progress signals, diagnostic codes and unsuccessful call events of the maritime satellite circuit

### 6.1 *Ship originated calls*

The ship earth station should provide *call progress* signals to the on-board DTE in accordance with Table 1/X.352.

TABLE 1/X.352

**Call progress signals to be provided by the ship earth station to the on-board DTE**

| Event (see Note) | Call progress signal (Recommendation X.96) |
|---|---|
| Out of order (e.g. continuity check fails) | Out of order |
| Congestion | Network congestion |
| Request not acceptable | Access barred |
| No response to the request message | Network congestion |

*Note* – Some of these events are detected by the ship earth station and some are signallled from the coast earth station (or the network coordination station).

6.2 *Incoming call from a PDN*

The coast earth station should indicate to the MSDSE the reason for unsuccessful call set-up of the maritime satellite circuit. The *call progress* signal and diagnostic code to be returned by the MSDSE to the PDN is given in Table 2/X.352.

For coding of the clearing cause field see Recommendation X.25.

TABLE 2/X.352

**Satellite system event to be indicated by the coast earth station to the MSDSE and associated clearing cause and diagnostic code**

| Satellite system event | Clearing cause (*call progress* signal, Recommendation X.96) | Diagnostic code |
|---|---|---|
| Ship busy | Number busy | No additional information (No. 0) |
| Out of order (e.g. continuity check failure) | Out of order | No additional information (No. 0) |
| No response from the ship | Ship absent | No additional information (No. 0) |
| No DTE at the ship | Incompatible destination | No additional information (No. 0) |
| Non-existing number | Not obtainable | Invalid called address (No. 67) |
| Insufficient number of digits | Not obtainable | Invalid called address (No. 67) |
| Wrong format of called number | Not obtainable | Invalid called address (No. 67) |
| Access barred | Access barred | No additional information (No. 0) |
| Network congestion | Network congestion | No additional information (No. 0) |
| Congestion at coast earth station | Network congestion | No additional information (No. 0) |
| Priority override (see Note) | Network congestion | No additional information (No. 0) |
| Satellite system outage | Network congestion | No additional information (No. 0) |
| Coast earth station outage | Network congestion | No additional information (No. 0) |

*Note* – Priority override indicates that the particular maritime satellite circuit has been cleared in order to service a call with distress priority.

## 7 Satellite circuit interruption supervision

### 7.1 *General*

The satellite circuit may be interrupted due to several causes, e.g. antenna blockage at the ship earth station, the ship is no longer within satellite coverage, the ship earth station is faulty. The interruption condition is to be defined by INMARSAT.

Interruption supervision should be undertaken both by the ship earth station and by the coast earth station (or by the MSDSE). The interruption supervision should be associated with each physical link and/or HDLC LAPB link.

### 7.2 *Actions to be taken by the MSDSE*

Upon detecting an interruption of the satellite circuit the MSDSE shall send *clear request* packets on each virtual circuit affected with the clearing cause "network congestion" to the PDN. The *clear indication* packet should be sent to the ship in order to facilitate clearing if the interruption only exists in one direction of transmission. However, the MSDSE should not wait for a *DTE clearing confirmation* packet from the ship.

Since the MSDSE has no means of further monitoring of the ship station (and the interruption condition), a subsequent call to that ship should be handled in the normal way. If the ship station does not respond to the call, the clearing cause indication should be "ship absent" (see Table 2/X.352).

*Note* – Because of the reasons given above, the restart procedure of Recommendation X.25 does not apply.

### 7.3 *Actions to be taken by the on-board DTE*

For further study.

## ANNEX A

(to Recommendation X.352)

## Call set-up and clearing procedures for telephone type channels

### A.1 *Introduction*

This annex describes possible procedures for call set-up and clearing of levels 1, 2 and 3 between an on-board DTE operating in the packet mode and an MSDSE using telephone type channels between the ship earth station and the coast earth station. Definition of procedures for this case is important because then packet switched data transmission may be offered with existing ship earth station designs with only minor modifications to the ship earth stations.

Since the physical link (level 1) is subdivided into three parts (see Figure 1/X.352), information equivalent to that on the C and I leads (or the corresponding leads of the interface defined in Recommendation X.21 *bis*) needs to be provided also on the maritime satellite circuit so that the coast earth station can fully control the establishment and clearing of that circuit. This can be done by using the inband continuity signals and clearing signals specified for telephony (both are single frequency tones with frequency 2600 Hz).

Even though the procedures defined below are based on telephone signalling, similar procedures would apply for data transmission on dedicated data channels (or combined digital channels for speech and data). The C and I lead information could then be provided as status bits multiplexed together with the digital data on the T and R circuits (see also Recommendation X.51). Continuity of the maritime satellite circuit could then be established before level 1 is extended to the DTE and the MSDSE. Moreover, clearing of level 1 can be done independently of the higher levels, enabling the coast earth station and the ship earth station to fully control establishment and clearing of the maritime satellite circuit.

A.2 *Ship originated call*

Figure A-1/X.352 shows the full call set-up and clearing procedures for all levels of the call control and data transfer protocol between the MSDSE and an on-board DTE for a ship originated call.

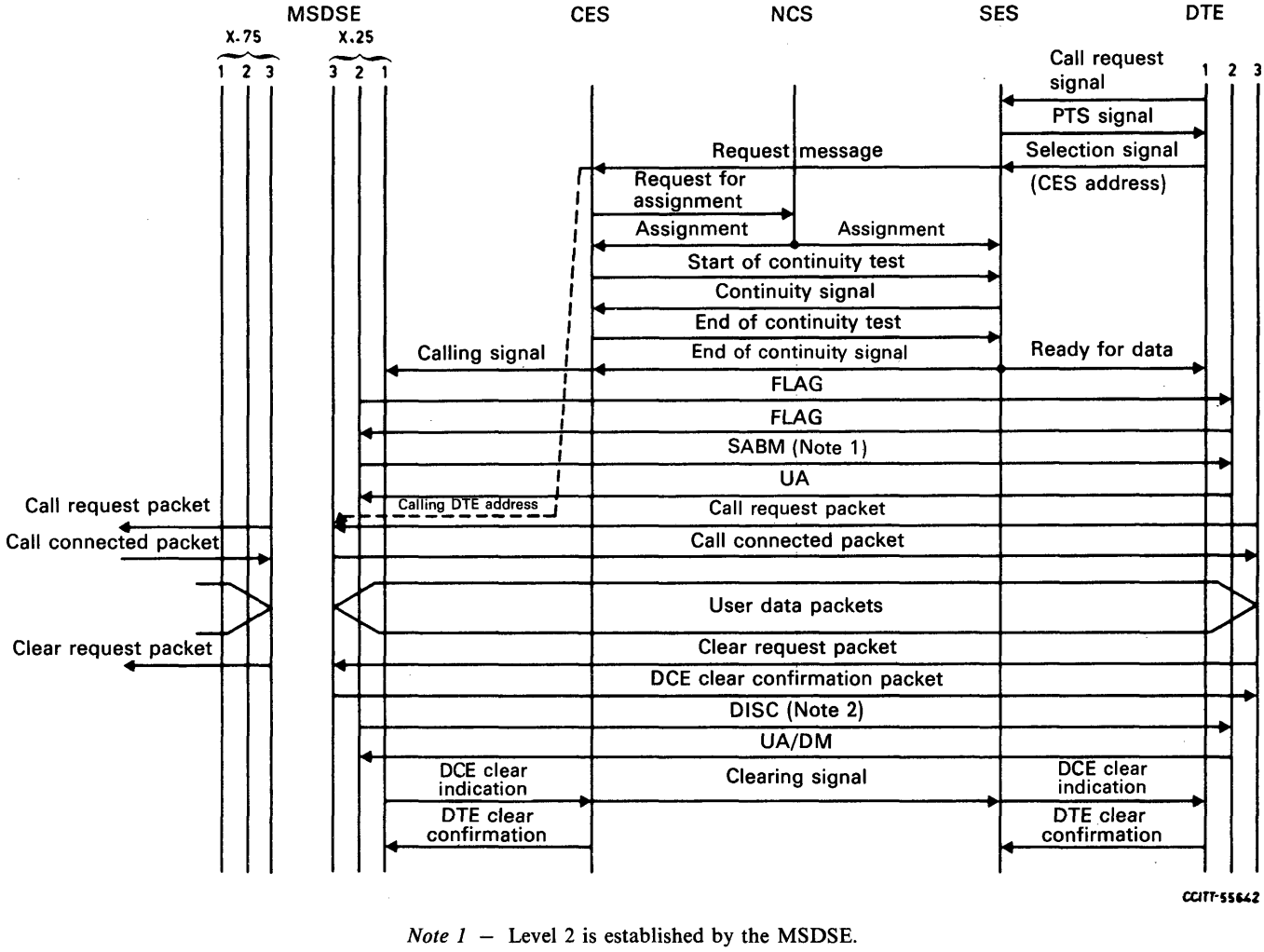
The following signals are exchanged between the coast earth station, the ship earth station and the network coordination station using the common channel signalling system defined by INMARSAT:

- *request message* (sent by the ship to the called coast earth station);
- *request for assignment* (sent by the called coast earth station to the network coordination station);
- *assignment message* (sent by the network coordination station to both the ship earth station and the coast earth station for indicating the maritime satellite circuit on which the call is to be established).

*Note* – The coast earth station and the network coordination station may send other messages in order to indicate unsuccessful call set-up (e.g. access barred, congestion).

In order to verify the maritime satellite circuit, the coast earth station initiates a continuity check of the assigned circuit. The maritime terrestrial circuit should not be set up before the continuity test has been completed. If the continuity test fails, the circuit will be cleared by the coast earth station.

For the procedure between the coast earth station and the MSDSE only those signals required for transfer of interworking information are shown.




*Note 1* – Level 2 is established by the MSDSE.

*Note 2* – Level 2 is cleared by the MSDSA.

FIGURE A-1/X.352

**Call set-up and clearing for a ship originated call**

## A.3 *Incoming call from a PDN*

Figure A-2/X.352 shows the call set-up and clearing procedures for an incoming call from a PDN.

The address (i.e. the called ship station identity) as contained in the *call request* packet is transferred to the coast earth station. The maritime satellite circuit is established by methods similar to those of § A.2. At the ship earth station the continuity signal is turned off when the call accepted signal is returned by the DTE so that the *call accepted* state (state 9 of Recommendation X.21) can be transferred to the MSDSE.

The *call connected* packet is returned to the PDN when the *call accepted* packet is received from the on-board DTE.

An unsuccessful call may be detected by the coast earth station at several stages during call set-up:

- from indications given by the network coordination station (e.g. ship busy, congestion);
- failure to establish continuity of the maritime satellite circuit (e.g. no response from the ship).

The coast earth station should in such cases provide an appropriate indication to the MSDSE so that a *clear request* packet may be returned to the PDN.

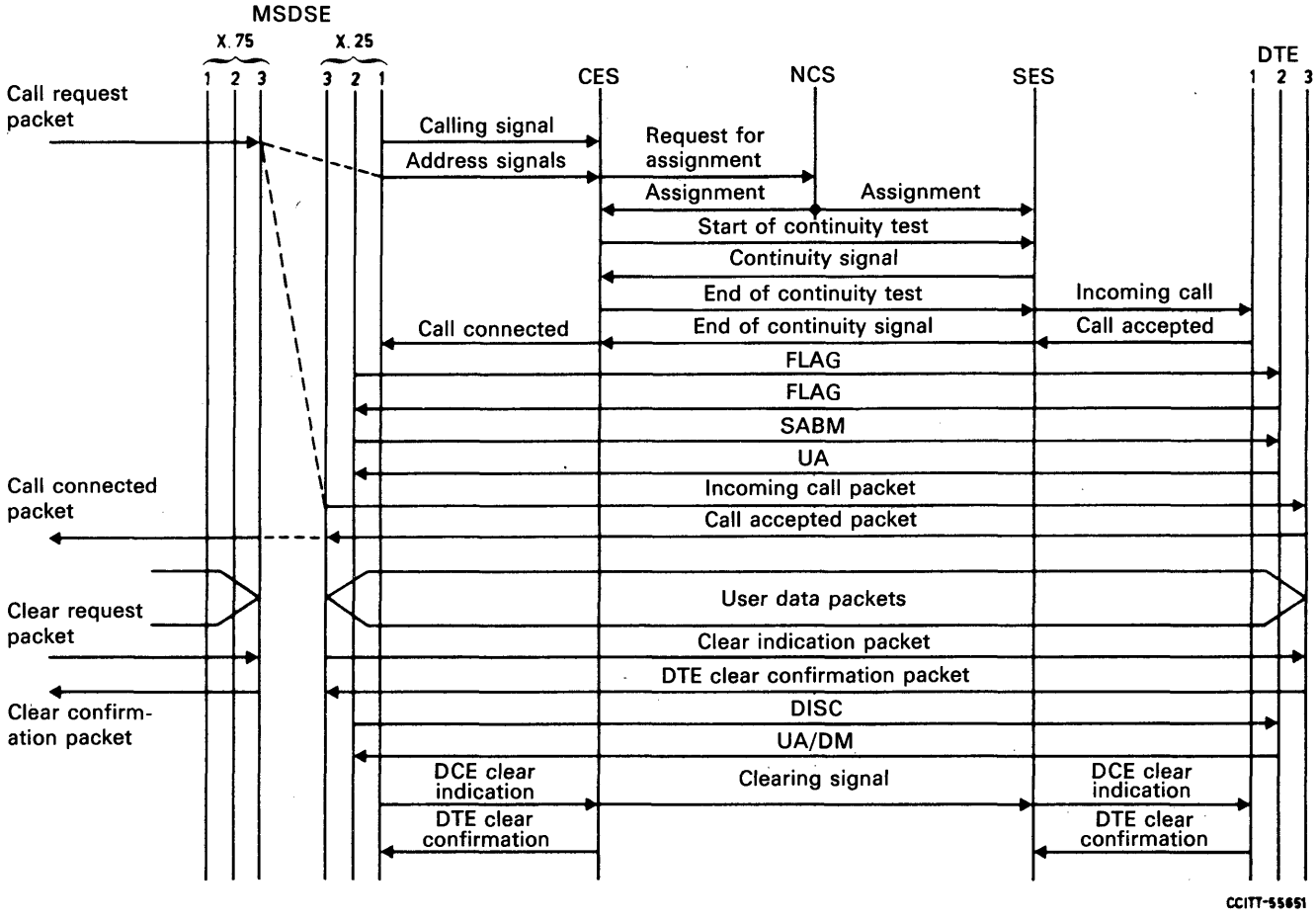



FIGURE A-2/X.352

**Call set-up and clearing for an incoming call from a PDN**

## ROUTING PRINCIPLES FOR INTERCONNECTING THE MARITIME SATELLITE DATA TRANSMISSION SYSTEM WITH PUBLIC DATA NETWORKS

*(Malaga-Torremolinos, 1984)*

The CCITT,

*considering*

(a) that a Maritime Satellite Service is now being operated by the International Maritime Satellite Organization (INMARSAT);

(b) that the mobile subscribers may have access to the service through a number of coast earth stations located in different countries;

(c) that interworking between the maritime satellite data transmission system and the public data networks is required;

(d) that Recommendation X.110 specifies routing principles for international data services, Recommendation X.121 specifies the international numbering plan for public data networks and Recommendation E.210/F.120 provides for internationally unique ship station identification;

*unanimously declares the view*

that the following routing principles should apply for setting up calls between subscribers of the public data networks and subscribers to the maritime satellite data transmission service.

### 1 General

#### 1.1 *Definitions*

Figure 1/X.353 shows the composition of systems in the Maritime Satellite Service. For definition of the various elements see Recommendation X.350.

The maritime satellite data switching exchange (MSDSE) is defined in § 1.7 of Recommendation X.350.

For the purpose of this Recommendation the term *ocean area* means an ocean area covered by one maritime satellite.

#### 1.2 *Role of the MSDSE*

A MSDSE will at the same time act as an international gateway and as an interface to the mobile subscribers. The ships participating in the service are assigned as subscribers to one MSDSE on a call by call basis. Within an ocean area covered by one satellite, a ship may set up or receive data calls from any MSDSE in that region. Each ocean area may contain a number of MSDSEs.

One MSDSE may have access to more than one satellite, and thus may serve more than one ocean area.

The MSDSE may be connected to more than one international data switching exchange (IDSE) in a PDN. The MSDSE may also be connected to IDSEs in different PDNs.

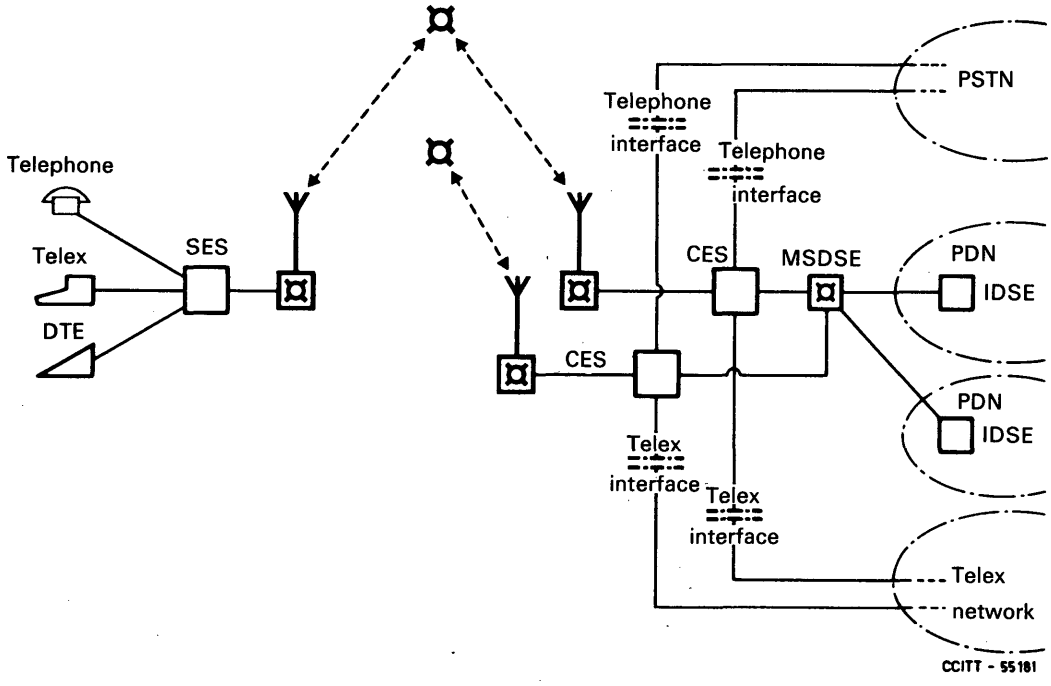
This Recommendation assumes that a PDN (i.e. a specific DNIC) does not connect to more than one MSDSE serving the same ocean area.

### 2 Routing of ship originated calls

#### 2.1 *A ship calling a land network subscriber*

The ship station selects one MSDSE in the ocean area by signalling procedures defined within the maritime satellite service. The ship should be advised to place the call through the MSDSE which is nearest to the called subscriber in order to avoid long terrestrial routes.

The ship subscriber should provide the international data number of the called subscriber to the MSDSE which will forward the call through its associated IDSE (or through the most appropriate IDSE if the MSDSE is connected to more than one IDSE).




SES = Ship earth station
CES = Coast earth station
MSDSE = Maritime satellite data switching exchange
IDSE = International data switching exchange

*Note* – In this example, the MSDSE is serving two ocean areas and is connected to two PDNs.

FIGURE 1/X.353

**Main elements of the maritime satellite system**

## 2.2 *A ship calling another ship*

If the two ships are in the same ocean area or are in different ocean areas covered by the same MSDSE, the MSDSE sets up the call directly to the called ship so that only one MSDSE will be involved in the call.

*Note* – If the MSDSE does not have full switching capability, the call will first be routed to its associated IDSE and then back again to the MSDSE.

If the two ships are in different ocean areas which are not both covered by the same MSDSE, the calling MSDSE will route the call in accordance with § 2.1 above.

## 2.3 *Routing of special service requests*

Certain services (e.g. access to data bases for navigational warnings, weather forecasts, etc.) may be accessed by use of special short number codes defined within the maritime satellite service. Such abbreviated codes require conversion to the full international data number before the call can be forwarded from the MSDSE to a PDN.

## 2.4 *Information provided to ships*

Administrations operating MSDSEs should prepare and maintain information for ships with regard to the Administration's routing capabilities towards various destinations.

## 3 Routing of land originated calls to ships

### 3.1 *Routing principles*

According to Recommendation X.121 one DNIC is allocated for each ocean area (DNIC = 111S, where S specifies the ocean area). This implies that the network of origin and transit networks can only distinguish between ocean areas and not between the different MSDSEs in that area. Therefore, each Administration has normally to route data calls to ships via one predetermined MSDSE per ocean area on bilateral agreement between the Administration of origin and the Administrations operating the MSDSEs.

Similar agreements need to be made with Administrations operating transit networks which will be involved in establishing the connection.

Situations may arise when two Administrations are using the same transit network for routing their calls to two different MSDSEs within the same ocean area, i.e. two MSDSEs with the same DNIC. This will be solved by routing the call according to the DNIC of the Administration of origin.

### 3.2 *Routing on facility field information*

If the MSDSE (or the associated transit network) does not provide for a given facility, the Administration may choose to set up calls requesting such a facility via another MSDSE or transit network than that normally used by the Administration rather than barring the call.

### 3.3 *Re-routing of calls at the MSDSE*

MSDSEs that have access to two satellites may have the capability of re-routing calls between the coverage areas of the two satellites. The re-routing of calls by the MSDSE enables a land user to have calls re-routed to another data number (but to the same ship), which only differs in ocean area, when a ship is absent from the ocean area indicated by the original data number. The re-routing of a call between the two ocean areas covered by the MSDSE should be carried out only once.

The condition for re-routing is that the ship is included in the list of ship earth stations and is not barred from incoming access.

The DNIC to be returned as part of the called line identification, or whether a called line identification should be returned in such cases, is for further study.

General re-routing of calls based on the information contained in a maritime satellite location register is desirable. This may require changes to existing X-Series Recommendations and to the INMARSAT system specifications and is therefore left for further study.

*Note* – See also § 3.1.

## 4 Barring of calls

In general, calls with a group address (as defined in Recommendation E.210/F.120) should be barred. Such addresses are ship station identities with a first digit 0. The call should preferably be barred in the network of origin. However, the MSDSE must in any case be capable of barring such calls. (See also Recommendation X.350.)

## 5 Use of satellite links

The link between the coast earth station and a ship is always a satellite link.

To provide acceptable quality of service, a limited number of satellite links should be permitted on a data connection. (See Annex B to Recommendation X.110).

Hence, for a call destined to a ship, all transit exchanges should recognise from the destination DNIC of 111S that the final link is a satellite link and perform routing so that the maximum permitted transit delay from the calling user to the called user is not exceeded.

*Note* – the mechanisms for a transit network to determine the transit delay already experienced in setting up a call is for further study.

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