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Foreword

This ETSI Technical Report (ETR) has been produced by the Terminal Equipment (TE) Technical Committee of the European Telecommunications Standards Institute (ETSI).

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

Introduction

Based on CCITT Recommendation X.32 [4], this ETR covers the minimum set of network requirements for CCITT Recommendation X.32 [4] indirect access, through a Public Switched Telephone Network (PSTN), to a Packet Switched Public Data Network (PSPDN).

CCITT Recommendation X.32 [4] covers the full functionality of CCITT Recommendation X.32 [4] indirect access to a PSPDN and contains various options and items for further study, whereas this ETR extracts a minimum set of requirements from the Recommendation.

The implementation of CCITT Recommendation X.32 [4] varies between the different countries in Europe, a brief summary of which is indicated below:

- most countries have CCITT Recommendation X.32 [4] implemented or plans for its implementation;

- most countries provide the non-identified service, many countries provide the identified service and very few countries provide the customised service;

- of the countries that provide the identified service, the majority use the Network User Identification (NUI) method, but only one country uses the eXchange IDentification (XID) method;

- all countries providing CCITT Recommendation X.32 [4] services provide dial-in-by-the-Data Terminal Equipment (DTE) operation via PSTN;

- few countries provide indirect access via the Integrated Services Digital Network (ISDN) and Circuit Switched Public Data Network (CSPDN);

- the method of link layer address assignment varies between countries;

- many countries provide dial-out-by-the-PSPDN operation;

- one country provides security grade 1 and security grade 2;

- very few countries provide CCITT Recommendation X.32 [4] optional user facilities;

- the same range of CCITT Recommendation X.25 [3] optional user facilities are not offered.

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1 Scope

This ETR defines the functional and procedural aspects of the interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for packet mode DTEs that access a PSPDN via a PSTN.

This ETR defines technical interfaces for PSPDNs providing a CCITT Recommendation X.32 [4] service.

This ETR defines:

- the PSPDN indirect access via the PSTN;
- the non-identified and identified services for the dial-in-by-the-DTE operation;
- access profiles based on a minimum set of features.

2 Normative references

For the purposes of this ETR, the following references apply.

[1] CCITT Recommendation X.1 (1988): "International user classes of service in public data networks and integrated services digital networks (ISDNs)".

[2] CCITT Recommendation X.2 (1988): "International data transmission services and optional user facilities in public data networks and ISDNs".

[3] CCITT Recommendation X.25 (1988): "Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit".

[4] CCITT Recommendation X.32 (1988): "Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for terminals operating in the packet mode and accessing a packet switched public data network through a public switched telephone network or an integrated services digital network or a circuit switched public data network".

[5] CCITT Recommendation X.121 (1988): "International numbering plan for public data networks".

[6] CCITT Recommendation X.301 (1988): "Description of the general arrangements for call control within a subnetwork and between subnetworks for the provision of data transmission services".

[7] CCITT Recommendation E.163 (1988): "Numbering plan for the international telephone service".

[8] CCITT Recommendation E.164 (1988): "Numbering plan for the ISDN era".

[9] CCITT Recommendation V.22 bis (1988): "2400 bits per second duplex modem using the frequency division technique standardized for use on the general switched telephone network and on point-to-point 2-wire leased telephone-type circuits".

[10] CCITT Recommendation V.24 (1988): "List of definitions for interchange circuits between data terminal equipment (DTE) and data-circuit terminating equipment (DCE)".

[11] CCITT Recommendation V.25 (1988): "Automatic answering equipment and/or parallel automatic calling equipment on the general switched telephone network including procedures for disabling of echo control devices for both manually and automatically established calls".

[12] CCITT Recommendation V.25 bis (1988): "Automatic calling and/or answering equipment on the general switched telephone network using the 100-series interchange circuits".

[13] CCITT Recommendation V.28 (1988): "Electrical characteristics for unbalanced double-current interchange circuits".

[14] CCITT Recommendation V.32 (1988): "A family of 2-wire, duplex modems operating at data signalling rates of up to 9600 bit/s for use on the general switched telephone network and on leased telephone-type circuits".

[15] CCITT Recommendation V.54 (1988): "Loop test devices for modems".

[16] ISO 2110 (1980): "Data Communication - 25-pin DTE/DCE interface connector and pin assignments".

[17] ETS 300 002 (1992): "Public Switched Telephone Network (PSTN); Category II attachment requirements for 9 600 or 4 800 bits per second duplex modems standardised for use on the PSTN (Candidate NET 25)".

[18] ETS 300 114 (1991): "Attachments to the Public Switched Telephone Network (PSTN); Basic attachment requirements for modem standardized for use on the PSTN (Candidate NET 20)".

[19] ETS 300 117 (1991): "Attachments to the Public Switched Telephone Network (PSTN); Category II attachment requirements for 2 400 bits per second duplex modems standardized for use on the PSTN (Candidate NET 23)".

[20] ISO/IEC 8885: "Information technology - Telecommunications and information exchange between systems - High-level data link control (HDLC) procedures - General purpose XID frame information field content and format".

3 Definitions and abbreviations

3.1 Definitions

Definitions for Data Circuit-terminating Equipment (DCE), Data Terminal Equipment (DTE), Network User Identification (NUI), Public Switched Network (PSN), Packet Switched Public Data Network (PSPDN) and Public Switched Telephone Network (PSTN) are as given in the relevant CCITT series of Recommendations.

3.2 Abbreviations

For the purpose of this ETR, the following abbreviations apply.

CAC	Commercial Action Committee of CEPT
CCITT	Comité Consultatif International Télégraphique et Téléphonique
CEPT	Comité Européen des Postes et Télécommunications
CUG	Closed User Group
DCE	Data Circuit-terminating Equipment

DIAG	DIAGnostic element
DTE	Data Terminal Equipment
ETR	ETSI Technical Report
ETS	European Telecommunication Standard
ETSI	European Telecommunications Standards Institute
ID	IDentity element
HDLC	High-level Data Link Control
ISO	International Standards Organization
LAPB	Link Access Procedure-Balanced
NTP	Network Termination Point
NUI	Network User Identification
PSN	Public Switched Network
PSPDN	Packet Switched Public Data Network
PSTN	Public Switched Telephone Network
SABM	Set Asynchronous Balanced Mode
SIG	SIGnature element
UA	User Agent
XID	eXchange IDentification

4 Functional aspects

4.1 PSPDN indirect access considerations

A packet-mode DTE should access a PSPDN by means of selection procedures on a PSTN (see figure 1). Within this ETR, this operation is termed "dial-in-by-the-DTE".

To perform this operation, the DTE should use an automatic or manual calling procedure.

All networks should provide dial-in-by-the-DTE operation.

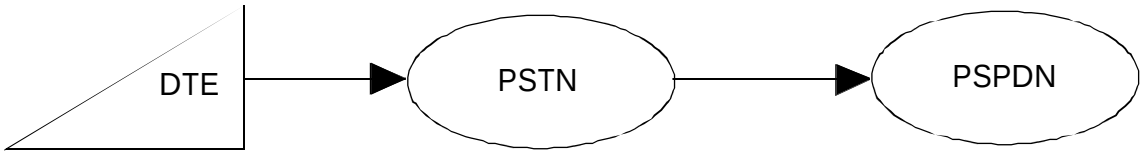


Figure 1: Dial-in-by-the-DTE operation

4.2 DTE identification

When a DTE accesses a PSPDN via a PSTN, there may be a requirement for identification of the DTE to the DCE.

The DTE "identity" is a means of referring to the DTE. The DTE identity is explicitly agreed to between the DTE and the service operator or implicitly acceptable to the service operator through agreements with other service operators, organisations or authorities. The elements composing the DTE identity and its format are network matters.

The characteristics of the service which a DTE obtains via the dial-in-by-the-DTE operation depend upon whether the PSPDN considers the DTE is identified for each particular switched access connection or virtual call. If the DTE is identified, then the PSPDN has a way to accrue charges to be paid on behalf of the DTE. This means that either the DTE or some other party can be invoiced.

Two components are required in order for a DTE to be considered identified:

a) the DTE is administratively registered either explicitly or implicitly;

b) the DTE identity is made known to the DCE during the switched access connection using one of the two methods of DTE identification described in subclause 4.4.

In any case, DTE identification is used for invoicing and accounting purposes. In addition to this basic function, DTE identification may optionally be used for enabling the PSPDN to provide a calling DTE address to a called DTE directly connected to a PSPDN.

This ETR provides for two methods of DTE identification (see subclause 4.4).

4.3 Service aspects and access profiles

The switched access service given to a DTE is dependent upon:

a) the PSPDN;

b) the use/non-use of DTE identification.

The DTE service types are the non-identified and identified DTE services, and are defined in subclause 4.3.2.

The DTE service type, the DTE identification method and the physical layer interface characteristics (see subclause 7.1) constitute an access profile. This ETR provides for six access profiles as described in subclause 5.2.

4.3.1 Service attributes

"Attributes" are defined to describe each aspect of the switched access service. However, the values of the attributes do not necessarily include all capabilities offered to PSPDN users that access the PSPDN via a leased line. The service attributes are defined and presented in detail in subclause 5.1.

For each DTE service, each attribute is either provided or not provided; if it is provided, it is set to a default value specified by the network operator (network default). Network default values should be within the limits specified by this ETR (see subclause 5.2).

4.3.2 DTE services

The service types defined in this ETR are called DTE services. These are:

a) the non-identified DTE service. All networks should offer this service to unidentified DTEs, that is, to DTEs for which no identification is provided to the DCE; and

b) the identified DTE service. All networks should offer this service to identified DTEs, that is, to DTEs for which an implicit or explicit DTE identity is provided to the DCE via one of the methods described in subclause 4.4.

Both service types are independent of the specific DTE identity.

The non-identified and identified DTE services are described in detail in subclauses 4.3.2.1 and 4.3.2.2.

4.3.2.1 Service for unidentified DTEs

The service offered to unidentified DTEs is called non-identified DTE service and is detailed in Clause 5. This DTE service should be offered by all networks as part of dial-in-by-the-DTE operation.

For a dial-in-by-the-DTE operation, the switched access path should not be disconnected for a period of time (T14) even in the absence of any virtual call. This allows users a period of time to re-establish a virtual call (see subclause 6.3).

For dial-in-by-the-DTE operation, the PSPDN may limit the number of unsuccessful attempts to establish a virtual call.

When a DTE uses the non-identified DTE service:

a) it is not required to use any optional procedures;

b) it is able to operate with different networks without having to subscribe to any of them (i.e. not administratively registered and/or assigned an identity with any PSPDN);

c) it should not be permitted to make paid calls (i.e. the local charging prevention facility is set by the network), thus allowing the service operator to guarantee collection of charges;

d) it should use one of the access profiles defined in subclause 5.2.

4.3.2.2 Service for identified DTEs

The service offered to identified DTEs is called identified DTE service and it may provide a set of capabilities different from and/or enhanced beyond the non-identified DTE service. In particular, on those networks which allow only identified DTEs to accrue charges, it is possible for DTEs to make calls for which the calling DTE assumes responsibility for the charges.

The PSPDNs should offer the identified DTE service providing one or more of the access profiles defined in subclause 5.2. In this DTE service:

a) the DTE identity should be explicitly or implicitly agreed to with the service operator;

b) the other attributes have the values set by the network as specified in subclause 5.2.1.

The effect of the identified DTE service is that this DTE is billable, but the service is otherwise similar to the non-identified DTE service.

This DTE service should be offered by all PSPDNs as part of the dial-in-by-the-DTE operation.

4.4 DTE identification methods

Networks should support one or both of the two following methods for DTE identification:

a) identification by means of a data link layer eXchange IDentification (XID) procedure;

b) identification by means of the Network User Identification (NUI) selection facility in call set-up packets.

The DTE identity becomes known to the network via one of the identification procedures at either or both of the following times:

1) prior to any virtual call establishment (see subclause 4.4.1); or

2) on a per virtual call basis (see subclause 4.4.2).

It is considered vital that a reasonable degree of protection be achieved in the DTE identification procedure so that service operators and subscribers can prevent fraudulent DTE identification. Therefore, the identification procedure includes the capabilities to verify and/or authenticate the correctness of the DTE identification. The XID method obeys an "identification protocol" that has been defined in subclauses 6.1 and 7.2.1 for conveying the information necessary for the DCE to receive the DTE identity, verify it to the proper degree of authenticity, and to report on the success of the procedure. Within the scope of this ETR, only one grade of security is defined in the identification protocol (see subclause 6.1). Identification provided by the CCITT Recommendation X.25 [3] NUI selection facility does not use an explicit identification protocol. However, the success of authentication is implicit in the reception by the DTE of a call connected packet.

4.4.1 Identification prior to virtual call establishment by means of the data link layer XID procedure

Networks providing DTE identification prior to virtual call establishment should provide the data link layer identification procedure based on the exchange of XID frames between the DTE and the DCE. The exchange of XID frames (see subclause 7.2.1) should take place before the logical link is established (disconnected phase of CCITT Recommendation X.25 [3]).

The XID frame used in this method may also be used for other data link layer functions. These functions are outside the scope of this ETR.

The service that a DTE obtains, using the XID method, is the identified DTE service. The DTE identification, determined by means of this method, remains in effect even in the absence of any virtual calls. Specifically it remains in effect until the data link layer has left the information transfer phase and has entered the disconnected phase after which the switched access path is disconnected. No new XID identification procedure is allowed before the access path is disconnected.

4.4.2 Identification per virtual call by means of Network User Identification facility

Networks providing DTE identification on a per virtual call basis should utilise the NUI selection facility.

The identification of the DTE is provided in the facility field of the call request packet via the use of the optional NUI selection facility. The identification established by this method is accomplished at the same time as virtual call set-up and remains in effect until the virtual call is cleared.

The NUI selection facility may also be used when a prior-to-virtual-call-establishment identification method has been used. In this case, the service obtained by the DTE using the NUI selection facility in a call request packet, is detailed in subclause 7.3.2 concerning operation of the NUI selection facility.

The service that a DTE obtains, using the NUI method, is the identified DTE service. Upon termination of the virtual call:

a) if no prior-to-virtual-call-establishment DTE identification had been accomplished, the logical channel is usable again for a non-identified call or a DTE-identification-via-NUI call; or

b) if a prior-to-virtual-call-establishment DTE identification had been accomplished, the logical channel is usable again under the conditions of the DTE service that the prior-to-virtual-call DTE identity had invoked.

5 DTE service description

The switched access services of DTEs are described by the service "attributes".

5.1 DTE service attributes for non-identified and identified services

Two service types should be provided by the network operators: the non-identified service and the identified service. They are detailed in the subclauses 5.2.2 and 5.2.3.

The non-identified and the identified DTE service types are independent of the specific DTE identity.

The service attributes related to the non-identified and identified service types which are included in this ETR are:

a) DTE identity;

b) DTE identification method;

c) DTE address;

d) CCITT Recommendation X.25 [3] subscription set;

e) logical channels assignment;

f) data link layer address assignment.

For each of the two DTE service types, each attribute is either provided or not.

Tables 3, 4 and 5 summarise the set of values of the physical interface characteristics and the attributes for the non-identified and identified services, as recommended for the access profiles.

5.1.1 DTE identity

The DTE identity attribute, when provided, defines the identity of the DTE. Its format is a network matter.

5.1.2 DTE identification method

The DTE identification method attribute, when provided, defines the DTE identification method used for establishing the DTE identity (see subclause 4.4).

5.1.3 DTE address

When this attribute is provided, a DTE address is assigned by the network for a given DTE identity. The DTE address can be derived and validated from the identification method.

The DTE identity is represented in the call set-up packet by a number called a "DTE address", assigned by the network.

The DTE address may be defined as one of the network options:

- a number in CCITT Recommendation X.121 [5] format from the PSPDN numbering plan, according to paragraph 2.3 of CCITT Recommendation X.121 [5].

- a number in CCITT Recommendation X.121 [5] format from the PSTN numbering plan, according to the paragraphs 2.2.1.3 or 2.6 of the CCITT Recommendation X.121 [5].

CCITT Recommendation X.301 [6] gives the possible formats of the DTE address.

5.1.3.1 DTE address not provided

In the dial-in-by-the-DTE, when the DTE makes a call request, the contents of the calling address field in the corresponding incoming call packet are either:

a) incomplete CCITT Recommendation X.121 [5] PSTN format; this means that the contents of the calling address field are not valid with respect to the definition of a "valid number" in the CCITT Recommendations X.121 [5], E.163 [7] and E.164 [8]; or

b) temporary number from the PSPDN numbering plan; this corresponds to the address of the dial-in port used for a particular call.

NOTE: It is a network option whether the incomplete CCITT Recommendation X.121 [5] PSN format or the temporary number is used; however, only incomplete CCITT Recommendation X.121 [5] format is permitted at internetwork interfaces.

5.1.3.2 DTE address provided

When an identified DTE makes a call request, the contents of the calling DTE address field in the incoming call packet given to the called DTE is the DTE address.

The provision of the DTE address is considered to be a network option.

5.1.4 CCITT Recommendation X.25 subscription set

The CCITT Recommendation X.25 [3] subscription set attribute defines the values for:

- the CCITT Recommendation X.25 [3] data link layer options and system parameters;

- the CCITT Recommendation X.25 [3] packet layer subscription-time optional user facilities, which apply to switched access operation.

The list of data link layer options and system parameters and packet layer optional user facilities required are given in table 4 (see subclause 5.2.4).

5.1.5 Logical channel assignment

The logical channel assignment attribute defines the number of logical channels assigned for a particular DTE.

There is a default value, assigned by the PSPDN, which should be in alignment with the values given in table 3 (see subclause 5.2.1).

Logical channel assignment is specified as network default and there should be one or more virtual call logical channels with dial-in-by-the-DTE operation, the specific number being a network option. The DTE that utilizes the dial-in-by-the-DTE operation can initialise outgoing virtual calls, as presented in table 1 below.

Table 1: Virtual call placement allowed

Dial operation	DTE capability	Equivalent CCITT Recommendation X.25 [3] optional user facilities
Dial-in-by-the DTE	Originating virtual calls	Incoming calls barred 1-way logical channel outgoing

5.1.6 Data link layer address assignment

The data link layer address assignment attribute defines the mechanism used to determine the data link layer addresses.

CCITT Recommendation X.25 [3] and T.70 data link layer address assignment mechanism are equivalent for the dial-in-by-the-DTE operation.

5.2 Access profiles

The access profiles are defined by the type of the V-series interface, the service type and the identification method, as described in table 2 below.

This ETR defines six access profiles.

Network operators should implement at least one of these access profiles for the non-identified service and at least one for the identified service.

Table 2: Access profiles for dial-in-by-the-DTE operation via PSTN access network

Profile	1	2	3	4	5	6
Service	Non-identified	Non-identified	Identified	Identified	Identified	Identified
V-series	V.22 bis	V.32	V.22 bis	V.32	V.22 bis	V.32
DTE identification method	-	-	NUI	NUI	XID	XID

5.2.1 Summary of the DTE services

The DTE attributes for both non-identified and identified types of service are summarized in the following table 3.

Table 3: Summary of DTE services and attributes

\\\\\\\\\\ Service Attribute \\\\\\\	Non-identified	Identified
DTE identity	-	YES
DTE identification method	-	NUI or XID
DTE address	-	Network option
CCITT Recommendation X.25 [3] subscription set	Network default	Network default
Logical channel assignment	Network default	Network default
Data link layer address assignment (NOTE)	Network default (cf. CCITT Recommendation X.25 [3]) (NOTE)	Network default (cf. CCITT Recommendation X.25 [3]) (NOTE)
NOTE: This attribute in the case of the dial-in-by-the-DTE operation is redundant since the two methods are equivalent.		

5.2.2 Non-identified DTE service

The non-identified DTE service is defined by the values of the attributes, summarized in table 3:

- no DTE identity is established;

- no DTE identification method is used.

No optional user facilities are available except:

a) the user facilities governing virtual call:

   - incoming calls barred;

   - one-way logical channel outgoing;

b) the user facilities that can be used on a per-virtual-call basis, without prior subscription, as defined by table 5 (see subclause 5.2.5).

Table 4 defines the CCITT Recommendation X.25 [3] subscription set for CCITT Recommendation X.32 [4] service requirements.

5.2.3 Identified DTE service

The values of the attributes for the identified DTE service are shown in table 3:

- the DTE identity has been agreed to, explicitly or implicitly, and is provided to the network;

- the CCITT Recommendation X.25 [3] subscription set, as presented in table 4 is the same as for the non-identified DTE service, except:

   a) the local charging prevention facility is not in effect;

   b) the NUI subscription is in effect if the per-call NUI DTE identification method is provided;

   c) the CUG selection facility may be utilized by DTEs if it is provided by the networks.

It is recommended that for each user a unique NUI should be valid over the whole network (network-wide NUI).

5.2.4 CCITT Recommendation X.25 subscription time parameters

Link level options and system parameters and packet level CCITT Recommendation X.25 [3] subscription time facilities in the non-identified and identified DTE services are available as defined in table 4.

Table 4: Availability of link level options and system parameters and packet layer optional user facilities applicable to all assigned logical channels with dial-in-by-the-DTE operation

Option, parameter or facility	Available with dial-in-by-the-PSPDN operation	
	Non-identified	Identified
Data link layer		
K	≥ 3	≥ 3
T1 [s]	≥ 2	≥ 2
T3 [s]	≥ 15	≥ 15
N1	≥ 1 080	≥ 1 080
N2	10	10
Packet layer		
Logical channel assignment	1 outgoing or more (NOTE 1)	1 outgoing or more (NOTE 1)
Packet size	128	128
Window size	2	2
Local charging prevention	Yes	No
Default throughput class	≥ 2,4	≥ 2,4
NUI subscription	-	(NOTE 2)
Closed user group	-	User option (NOTE 3)
Incoming calls barred	Yes	Yes
One-way logical channel outgoing	Yes	Yes

NOTE 1: The first outgoing logical channel should be number 1.

NOTE 2: NUI subscription is in effect if the per-call NUI DTE identification method is provided.

NOTE 3: This user option may not be offered by some networks.

5.2.5 CCITT Recommendation X.25 per call user facilities

Networks providing CCITT Recommendation X.32 [4] PSPDN access should implement, as a minimum set of per call user facilities, all the facilities listed in table 5. The availability of the facilities in the call request and/or call connected packets is shown in table 5.

Table 5: Optional user facilities on a per-call basis

Packet type \\\\\\\\ Service Facility \\\\\\\\	Call Request Packet		Call Connected Packet	
	Non-identified	Identified	Non-identified	Identified
Reserve charge	Yes	Yes	N/A	N/A
Fast selectYes	Yes	N/A	N/A	
CUG selection	No	Yes (NOTE 1)	N/A	N/A
NUI selection	No	Yes (NOTE 2)	N/A	N/A
DTE facility marker	Yes	Yes	Yes	Yes
Called line address modified notification	N/A	N/A	Yes	Yes
NOTE 1: This user option may not be offered by some networks.				
NOTE 2: Only if NUI is used. This facility is not mandatory if XID identification procedure is used.				

6 CCITT Recommendation X.32 procedures

6.1 Identification protocol procedures

This identification protocol applies only to access profiles 5 and 6, as defined in subclause 5.2.

Implementation of this protocol is achieved using XID frames at the data link layer, which is described in subclause 7.2.

6.1.1 Protocol elements

The purpose of the identification protocol is to exchange identification information between the two communicating parties. The two parties involved in this protocol are called the questioning party and the challenged party.

Within the scope of this ETR, the DCE acts as the questioning party and the DTE acts as the challenged party.

The basic security option is described as security grade 1. The identification information are encoded in the following protocol elements:

a) the IDentity element (ID) is a string of octets representing the DTE's identity. The size of the ID is a network matter;

b) the SIGnature element (SIG) of the identity is a string of octets associated with the identity and used for authentication of the identity. It is assigned for a period of time by the authority that assigns the identity and may be changed from time to time. Therefore, the SIG may also contain information concerning validity dates, etc. The size and format of the SIG is network dependent. Depending on the network, the SIG may be a password or the result of an encryption process applied to the IDentity element (ID) of the DTE;

c) the DIAGnostic element (DIAG) is the result of the identification process and is transmitted by the questioning DCE at the end of the identification process.

The formats of these elements are described in subclause 6.2.

6.1.2 Identification protocol procedure

In security grade 1, the first message containing the ID element and possibly the SIG element, is transmitted by the challenged DTE. The SIG element may be omitted if not required by the DCE, while its presence is not considered as an error.

The DTE should send its identity at the earliest opportunity and as soon as the physical access is established.

The second message containing the DIAG element is transmitted by the questioning DCE. This should indicate whether the DCE accepts the challenged DTE's identity or has detected an error. Specific values for the DIAG element are outlined in subclause 6.2.

The identification protocol elements are passed between the challenged DTE and questioning DCE in XID command frames only, see subclause 7.2.1.1.

When the identification protocol is unsuccessful, the DCE should refuse the DTE's identification by transmitting an error diagnostic. The DTE could then reattempt the XID identification procedure. The DTE is not allowed, and the DCE will refuse, to set up the link after an unsuccessful XID identification procedure, unless followed by a successful XID identification procedure. The network should allow up to (n) retries of the identification protocol by a challenged DTE before the switched access path is disconnected, where n µ 3. The DCE should then disconnect the switched access path. Some networks may not allow any retries.

If the identification is successful, the identification established applies for the duration of the switched access. If the challenged DTE wishes to re-identify itself, the switched access path must be disconnected before the identification protocol is permitted to take place.

Security grade 1 exchange of identification messages is described in figure 2.

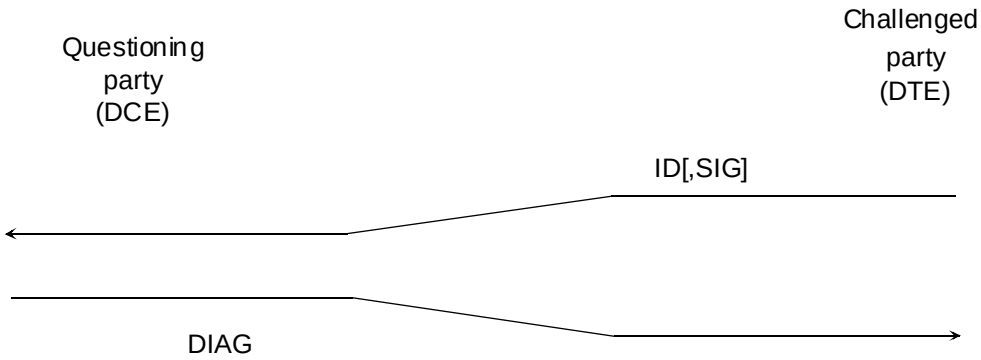


Figure 2: Exchange of identification messages for security grade 1

The procedures and actions of the DCE as a questioning party are outlined by a state diagram (see figure 3) and an actions table (see table 6).

Four states are defined for describing the procedures the DCE uses:

1) q11 - waiting for ID [,SIG]

This is the initial state of the identification process for the DCE. It is entered after the switched connection is established, and before the data link set-up procedure is performed. The DCE expects to receive the ID (and possibly SIG) element(s) from the challenged DTE. This state is also entered when a DTE identification attempt has failed and the limit of retries has not been exhausted.

2) q12 - evaluating ID [,SIG]

In this state, the DCE determines whether or not the challenged DTE's identity (and possibly SIG) element(s) is acceptable. The result is the transmission by the DCE to the challenged DTE of the DIAG element. The value of the DIAG element indicates whether identification was successful or not.

Table 6: Action taken by the questioning DCE for security grade 1

State of the DCE Protocol element received by the DCE or decision by the DCE	q11 Waiting for ID [,SIG] (grade 1)	q12 Evaluating ID [,SIG] (grade 1)	q13 DTE identification successful (grade 1)	q14 DTE identification unsuccessful (grade 1) (see NOTE 1)
ID [,SIG]	Normal -> q12	Discard -> q12	Discard -> q13	Discard -> q14
DCE checking of the ID [,SIG] is complete	//////////////////// //////////////////// //////////////////// //////////////////// ////////////////////	Positive DIAG -> q13 OR negative DIAG -> q14 OR negative DIAG -> q11 (see NOTE 2)	//////////////// //////////////// //////////////// //////////////// ////////////////	//////////////////////// //////////////////////// //////////////////////// //////////////////////// ////////////////////////

NOTE 1: When in this state, the DCE should disconnect the switched access path when it is sure that the DIAG element has been received by the DTE or the DTE is out of order.

NOTE 2: Depending on whether or not ID and/or SIG are recognized as correct by the DCE. When negative DIAG, go to q11 until the retry limit has been reached at which case go to q14.

3) q13 - DTE identification successful

In this state, the challenged DTE has completed its identification successfully. The DCE remains in this state until the switched connection is disconnected.

4) q14 - DTE identification unsuccessful

The DCE enters this state when the last DTE identification attempt allowed by the retry limit has failed. The DCE remains in this state until the switched connection is disconnected.

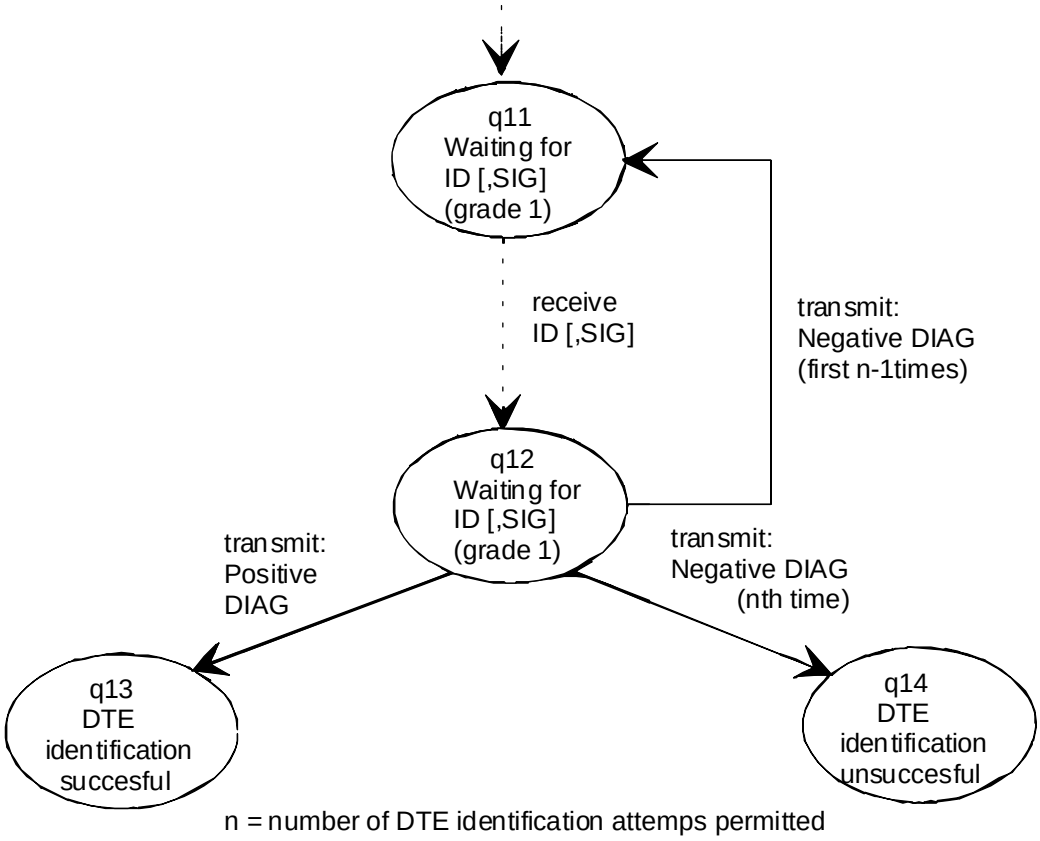


Figure 3: Diagram of states for DCE acting as questioning party for grade 1 identification

6.2 Identification protocol element codes and formats

Codes and formats of the identification protocol elements, as outlined in subclause 6.1.1, are described in detail below.

6.2.1 Coding of the identification protocol element code fields

Table 7 contains a list of the identification protocol elements, as defined in subclause 6.1.1, and their corresponding codes

Table 7: Identification protocol elements and codes

Identification element	Bits							
	8	7	6	5	4	3	2	1
Identity element (ID)	1	1	0	0	1	1	0	0
Signature element (SIG)	1	1	0	0	1	1	0	1
Diagnostic element (DIAG)	0	0	0	0	0	1	1	1

6.2.2 Coding of the identification protocol element parameters fields

6.2.2.1 Identity element

The octet following the code field indicates the length, in octets, of the parameter field. The following octets contain the string of octets composing the identity.

Identity size and format is a network matter.

6.2.2.2 Signature element

The octet following the code field indicates the length, in octets, of the parameter field. The following octets contain the string of octets composing the signature.

Signature size and format is a network matter.

6.2.2.3 Diagnostic element

The coding of the parameter field for the diagnostic element is as shown in table 8 below.

Table 8: Coding for the parameter field for the diagnostic element

Diagnostic element	Bits 8	7	6	5	4	3	2	1
Identification confirmed	0	1	1	1	1	1	1	1
Identification failed								
- general	1	0	0	0	0	0	0	0
- additional	1	X	X	X	X	X	X	X
Network congestion	0	0	0	0	0	1	0	1

6.3 Timer T14

The DCE may support a timer T14 whose value should be made known to the DTE. At the expiration of timer T14, the DCE will disconnect the link, if connected, and then the switched access path.

Timer T14 is started whenever a switched access path is established and stopped when the DTE identity is established or when a virtual call, which is not to be charged to the local DTE, is established. In the latter case, timer T14 is restarted when no assigned logical channels are active.

The period of timer T14 should be 60 seconds.

The relationship between timer T14 and DTE identification methods is outlined in figure 4, as follows.

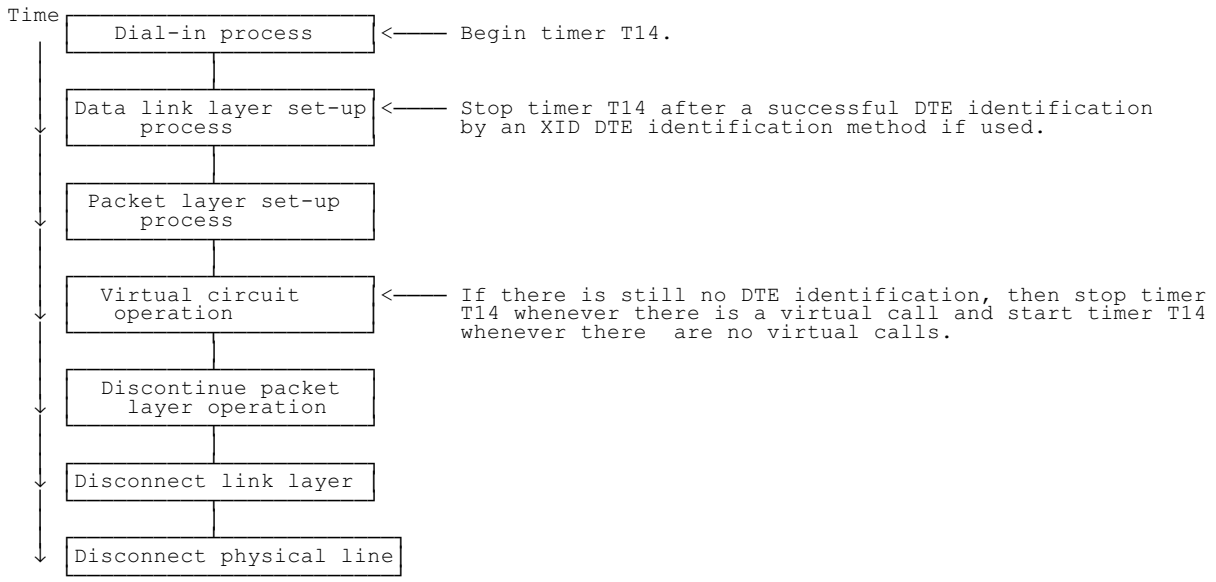


Figure 4: The relationship between timer T14 and DTE identification methods

7 Interface characteristics

7.1 Physical layer

7.1.1 Network termination points

There are two Network Terminations Points (NTPs) defined: NTP1 and NTP2.

NTP1 is located at the interface between the DTE and the modem, if the modem is provided by the service operator (see figure 5).

NTP2 is located at the interface between the modem and the PSTN, if the modem is not provided by the service operator or if the modem is internal (see figure 6).

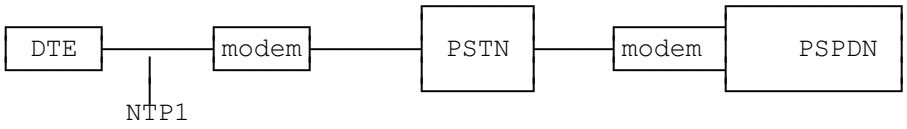


Figure 5: NTP1 interface

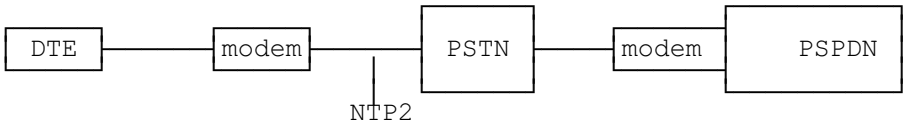


Figure 6: NTP2 interface

7.1.2 DTE/modem interface requirements

DTE/modem interface requirements are specified in case of NTP1. Only the requirements on the modem side are relevant for this ETR.

The interchange circuits are defined in CCITT Recommendation V.24 [10]. The essential interchange circuits to be provided by the modem are specified in ETS 300 117 [19], CCITT Recommendation V.22 bis [9], ETS 300 002 [17] and CCITT Recommendation V.32 [14] depending on the bit rate at the interface.

The electrical characteristics of the interchange circuits should conform to CCITT Recommendation V.28 [13].

The connector and pin assignment plan should conform to ISO 2110 [16].

The modem in these CCITT Recommendations is referred to as a "DCE".

The bit rate is either 2 400, 4 800 or 9 600 bit/s. The operation is full duplex.

7.1.3 Modem requirements

Requirements for the modem close to the PSPDN are specified in the case of NTP2. Only the analogue characteristics of the modem close to the PSPDN, as seen from the DTE side through the PSTN, are relevant to this ETR.

The modem close to the PSPDN should conform to at least one of the following requirements (according to the profile supported):

- ETS 300 117 [19] as far as all of the following modes of operation/use are concerned:
  - 2 400 bit/s, synchronous, answer mode;
  - 1 200 bit/s, synchronous, answer mode.
- ETS 300 002 [17] as far as all for the following modes of operation/use are concerned:
  - 9 600 bit/s, trelliscoded, synchronous, answer;
  - 9 600 bit/s, uncoded, synchronous, answer;
  - 4 800 bit/s, uncoded, synchronous, answer.

When the CCITT Recommendation X.32 [4] service operator decides to use an identical PSTN number for both the CCITT Recommendations V.32 [14] and V.22 bis [9] accesses the modem should be - in addition to the above mentioned requirements - conforming to the CCITT Recommendation V.32 [14], Annex A.

7.1.4 Setting up the access information path

7.1.4.1 PSTN numbering

The service operator should arrange that the access information path to the PSPDN can be established using the numbering and call set-up procedures required by the PSTN service operator. For general guidelines to PSPDNs access numbers, see Annex A.

7.1.4.2 DTE/modem operation

The modems should allow for establishing the access information path in accordance with CCITT Recommendation V.25 [11] for a manual data station calling an automatic answering station.

In the case of NTP1, the modem should allow for an automatic calling mode operation according to CCITT Recommendation V.25 bis [12] procedures.

Subsequent to the completion of the above, data exchanged on circuits 103 and 104 or on the equivalent internal circuits will be as described in the Clauses of this ETR related to link and packet layer operation.

Circuits 106 and 109 may enter OFF condition due to momentary transmission failures of modem retraining. Higher layers should delay for several seconds before considering the interface to be non-operational.

7.1.5 Disconnecting the access information path

7.1.5.1 Disconnecting by the DTE

In the case of NTP1 the access information path should be disconnected by:

a) reversion of the data circuit to the voice mode; or

b) the DTE turning circuit 108/1 or 108/2 OFF for a period greater than Z. The value of Z is 50 ms.

In the case of NTP2 the access information path should be disconnected by clearing the PSTN communication.

7.1.5.2 Disconnecting by the network

Networks should use the disconnection procedures specified in section 4.4.3 of CCITT Recommendation V.24 [10].

7.1.6 Loops

The definitions of test loops and the principles of maintenance testing using test loops are provided in ETS 300 114 [18] and CCITT Recommendation V.54 [15].

Additional information on loops 2 and 3 can be found in ETS 300 117 [19], ETS 300 002 [17] and CCITT Recommendations V.22 bis [9] and V.32 [14].

In the case of NTP1, the modem should provide for manual activation of loop 3 but the modem may also allow for automatic activation of loop 3.

In the case of NTP2 manual or automatic activation of loop 2 in the modem close to the PSPDN may be possible.

7.2 Data link layer

Switched access data interchange between a DTE and a DCE at the data link layer conforms to the Link Access Procedure-Balanced (LAPB), as described in sections 2.2, 2.3 and 2.4 of CCITT Recommendation CCITT Recommendation X.25 [3], but with the following limitations:

- basic LAPB (modulo 8) operation;

- single link operation.

The data link layer procedures adhere to the principles and terminology of the High-level Data Link Control (HDLC) procedures specified by ISO.

DCE operation should be compatible with the ISO balanced asynchronous class of procedure with optional functions 1,2 and 8 (Class BA 1,2,8). (Option 1 is necessary for usage of the Exchange Identification, XID frame. Options 2 and 8 are required for modulo 8 operation).

7.2.1 XID operation

Access profiles 5 and 6, as described in subclause 5.2, utilise XID frames for performing the DTE identification protocol.

See Clause 6 for general procedures and formats of the identification protocol.

7.2.1.1 XID frame usage

CCITT Recommendation X.32 [4] utilisation of the XID frame is compatible with the ISO/IEC 8885 [20] (general purpose XID frame information field content and format).

The XID command frame is issued by the DTE, using the XID information field to present its identity (ID) to the DCE. The signature (SIG) should follow the ID, if its presence is required by the DCE. The DCE transmits an XID response, with no information field present. The DCE should then transmit an XID command, with the XID information field containing the DIAG. The DTE returns an XID response with no information field present.

The XID information field is used to transport the ID and DIAG elements, the formats of which are described in subclause 6.2.

XID command/response interchange is as follows:

DTE		DCE
XID command (ID,[SIG])	------>	
	<------	XID response
	<------	XID command (DIAG)
XID response	------>	

See subclause 7.2.1.4 for a description of XID procedures.

7.2.1.2 XID frame structure

The general structure of the XID frame is as follows:

F	A	C	FI	DLL	.....	DLL	UD	FCS	F

<-- XID identification field-->

The following fields are general HDLC (non-specific XID frame) fields :

F Flag

A Address

FCS Frame check sequence

These fields are described in section 2.2 of CCITT Recommendation X.25 [3].

The addressing procedure used in the address field is described in subclause 7.2.3 of this ETR.

The following fields are specific XID frame fields :

C Control field

FI Format Identifier subfield

DLL Data link layer subfield

UD User data subfield

These fields are described in the following subclauses, a) to d).

The FI, DLL and UD subfields constitute the XID information field.

a) Control field

The Control field format is the unnumbered modulo 8 format and its encoding is as follows :

Bits							
8	7	6	5	4	3	2	1
1	0	1	P/F	1	1	1	1

P/F : Poll/Final bit.

The XID command and response have the same Control field format. The poll bit should be set to 1 in the XID command and, likewise, the final bit should be set to 1 in the XID response.

b) Format Identifier (FI) subfield

The FI subfield is a one octet field and has the capability of designating 128 different standardised formats and 128 different user-defined formats. The Format Identifier field for the XID frame is encoded :

Bits							
8	7	6	5	4	3	2	1
1	0	0	0	0	0	1	0

The FI subfield should be present in the XID frame only if a DLL subfield or UD subfield follows.

c) Data link layer (DLL) subfield

Multiple DLL subfields may exist in the XID frame and they provide a means of specifying various DLL characteristics and parameters, such as address resolution and parameter negotiation.

The encoding of the DLL subfield is under further study by ISO, so this field should be absent from the XID command and XID response.

d) User data (UD) subfield

The UD subfield contains data link user information to be transported transparently during the interchange of XID frames and is passed to the user of the data link. The length of the user data field is arbitrary but is restricted by the maximum length restrictions of the HDLC frame information field, taking into account the length of the FI and DLL subfields.

The UD subfield is valid only in the disconnected phase.

The UD subfield is encoded :

User data identifier	User data field

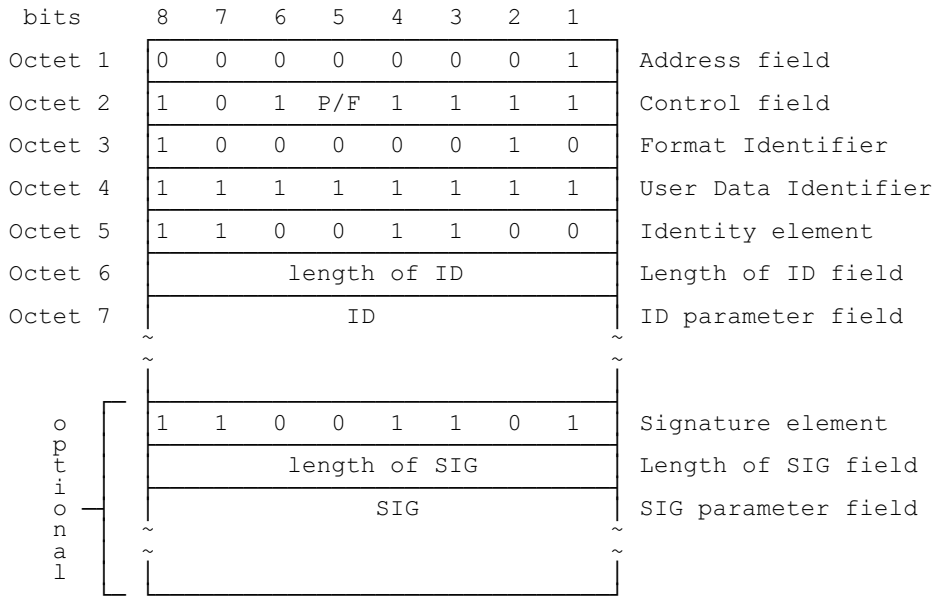
The user data identifier is encoded:

Bits							
8	7	6	5	4	3	2	1
1	1	1	1	1	1	1	1

The user data field is used for transporting the identification data across the link, the formats of which are described in subclause 6.2.

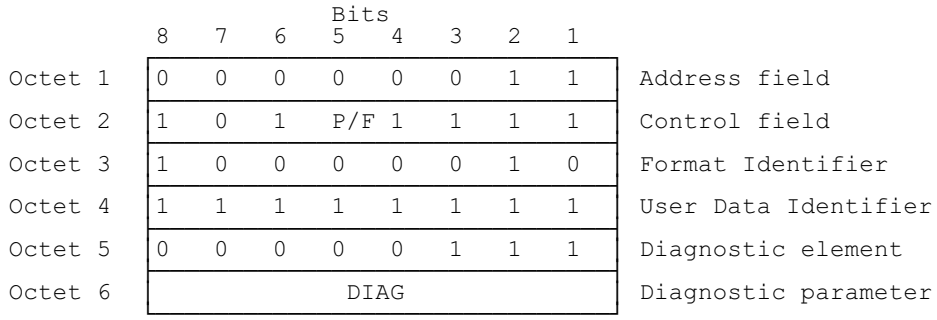
7.2.1.3 XID command frame format

The format of the XID command frame of the DTE presenting its identity is as follows :



The signature related fields (SIG element field, signature length field and signature parameter field) may be omitted if not required by the DCE.

The format of the XID command frame of the DCE returning the diagnostic result is as follows:



All fields composing the XID command frame are described in subclauses 6.2 and 7.2.1.2.

7.2.1.4 XID procedures

When a DTE/DCE determines that it is not able to act upon a received XID command, it should consider that the XID command is not implemented and should act as specified in § 2.4.4.4.1 of CCITT Recommendation X.25 [3].

When a DTE/DCE determines that it is able to act upon a received XID command, it should process the command and acknowledge it by transmitting an XID response. In the case where duplication of an XID command frame occurs, it is acknowledged by means of an XID response, but the contents of the information field are ignored.

The link must be in the disconnected phase for the identification protocol to take place.

If identification is successful, the data link is established under normal LAPB procedures. If these procedures are not successful, the switched access path is disconnected by the network.

The identification of the DTE remains in effect until the data link layer or the switched access path is disconnected.

The DTE/DCE should start timer T1 (described in subclause 7.2.2.1), once it transmits an XID command. Timer T1 is stopped upon reception of the XID response from the DCE/DTE.

If timer T1 expires before the DTE/DCE receives an XID response, the DTE/DCE retransmits the XID command and restarts the timer T1. The maximum number of attempts made by the DTE/DCE is determined by the parameter N2 (described in subclause 7.2.2.4).

7.2.1.5 Link set-up

The initiative of the link set-up is in the charge of the DTE in the dial-in-by-the-DTE operation, but may be done by the DCE.

If the DCE receives a Set Asynchronous Balanced Mode (SABM) command from the DTE during the identification procedure with XID frames, one of the following situations occurs:

a) if the DCE has not already transmitted the XID command containing the DIAG element and non-identified service is supported, the DCE should accept the link set-up initiation and offer the non-identified service to the DTE;

b) if the DCE has already transmitted the XID command containing the positive DIAG element, the DCE should accept the link set-up initiation and provide the identified service to the DTE;

c) if the DCE has already transmitted the XID command containing the negative DIAG element, the DCE should ignore the SABM frame and should await an XID command frame containing the identity element, providing that the retry count is not exhausted. If the count has been exhausted, the DCE disconnects the switched access path.

During the period between transmitting a SABM command and receiving the User Agent (UA) response, the DCE should discard any XID frames received. Acceptable frames are as described in § 2.4.4.1 of CCITT Recommendation X.25 [3].

7.2.1.6 Disconnection

Whenever the DCE needs to disconnect the switched access path and the link is not already in the disconnected phase, it should first disconnect the link.

7.2.2 Default data link layer parameters

Listed below are the CCITT Recommendation X.25 [3] data link layer options that should be supported. Proposals for these values are outlined in subclause 5.2.

7.2.2.1 Timer T1

Timer T1 indicates the length of time a DTE/DCE should await a response to a transmitted frame, after which time it may retransmit the frame.

7.2.2.2 Timer T2

Timer T2 indicates the amount of time available at the DCE or DTE before the acknowledging frame must be transmitted, to ensure that it is received by the DTE or DCE before timer T1 expires at that DTE or DCE.

7.2.2.3 Timer T3

If the DCE observes that the line is idle for the length of timer T3 (from when T3 timer was set), it assumes that data link set-up is required before data link operation may resume.

7.2.2.4 N2 parameter

The value of N2 indicates the maximum number of attempts that may be made by the DTE/DCE to complete the successful transmission of a frame.

7.2.2.5 N1 parameter

The value of N1 indicates the maximum number of bits in an I frame that will be accepted by the DTE/DCE.

7.2.2.6 K parameter

The value of k indicates the maximum number of sequentially numbered I frames that the DTE/DCE may have outstanding at any one time.

7.2.3 Address assignment technique

Data link layer address assignment is an attribute contained in the DTE service attributes, as described in subclause 5.1.

Link level address assignment is in accordance with of CCITT Recommendation X.25 [3], § 2.4.2. This method assigns data link layer addresses depending on the role of the equipment as DTE or DCE.

Table 9 shows the data link layer address assignments for dial-in-by-the-DTE operation.

Table 9

	DTE	DCE
Command	B	A
Response	A	B

The DCE transmits address A in command frames and address B in response frames to the DTE. The DTE transmits address B in command frames and address A in response frames to the DCE.

7.3 Packet layer procedures

7.3.1 Scope and field of application

The formats and the procedures at the packet layer should be in accordance with sections 3, 4, 5, 6 and 7 of CCITT Recommendation X.25 [3]. Networks should provide as a minimum:

- one outgoing logical channel;

- the optional user facilities per contractual period or per virtual call that are presented in tables 4 and 5.

Networks may provide optionally other CCITT Recommendation X.25 [3] packet layer facilities as well.

The disconnected condition of the data link layer on CCITT Recommendation X.32 [4] protocol is recognized as the same condition as out of order condition defined in CCITT Recommendation X.25 [3] (§ 4.6.2). Therefore, after the data link layer establishment, the DCE will send a restart indication packet with cause "Network operational" to the local DTE.

If identification and authentication are done at the packet layer, using the NUI facility, identification and authentication of the identity of the DTE will cease to apply when a failure on the physical layer and/or data link layer is detected.

7.3.2 Identification and authentication of the DTE using the NUI selection facility in call set-up packets

The NUI selection facility in call set-up packets should be used for DTE identification on a per virtual call basis. The NUI selection facility may be used, if the NUI subscription facility is already set by the network.

It can also be used in addition to the prior-to-virtual-call DTE identification method based on the exchange of data link layer XID frames. This NUI identification remains in effect for the lifetime of the virtual call and is independent of any previous identification on the interface. Subsequent call requests on the switched access path, when no NUI facility is used, revert to the prior DTE service established by the XID identification method, whilst when NUI facility is used, the DTE will receive a DTE service associated with the NUI used.

The NUI selection facility will be used according to the procedures described in CCITT Recommendation X.25 [3] (see § 6.2.1, NUI override facility and NUI selection facility in call accepted packets are not applicable under the scope of this ETR).

A call without NUI that follows a call with NUI and there is no prior-to-virtual call DTE identification will receive the non-identified DTE service.

The NUI selection facility parameter may contain, as the DTE identity, either a user identifier plus a password assigned by the network to the DTE, or only a password assigned by the network to the DTE. The formats of the user identifier and the password are network dependent.

Annex A (informative): General guidelines to PSPDN access numbers

The PSTN number for accessing the PSPDN will be published by the service operator.

Service operators are recommended to use PSTN numbers which as far as possible accord to the following guide-lines:

- PSTN numbers should be independent of the geographical location of the user;

- PSTN numbers should be identical for the different bit rates;

- PSTN numbers should be short and easy to remember;

- PSTN numbers should be independent of service characteristics e.g. access profiles (see subclause 5.2).

History

Document history	
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