

The drawings contained in this Recommendation have been done in AUTOCAD

Recommendation X.32

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

(Malaga–Torremolinos, 1984, amended at Melbourne, 1988)

Preface

The establishment in various countries of packet switched public data networks (PSPDN) providing data services creates the need to produce Recommendations to facilitate access to the PSPDN through a public switched telephone network (PSTN) or an integrated services digital network (ISDN) or a circuit switched public data network (CSPDN).

The CCITT,

considering:

(a) that Recommendation X.1 specifies the user classes of service for DTEs operating in the packet mode, that Recommendation X.2 defines user facilities provided by public data networks, that Recommendation X.10 defines categories of access, that Recommendations X.21 and X.21 *bis* define DTE/DCE physical level interface characteristics, that Recommendation X.25 defines the interface between the DTE and the DCE for terminals operating in the packet mode and connected to public data networks by dedicated lines, that Recommendation X.31 defines the support of packet mode terminal equipment by an ISDN, that Recommendation X.121 defines the international numbering plan for public data networks (PDNs), that Recommendation X.300 defines the principles and arrangements for interworking between PDNs and other public networks;

(b) that the V-Series Recommendations define modem and interface characteristics for use of data services on the PSTN;

(c) that Recommendation T.70 defines the procedures and interfaces to be used by telematic terminals, that Recommendation T.71 defines the extension of Link Access Procedure Balanced (LAPB) procedure to be used in half-duplex transmission facilities (LAPX);

(d) that a need has been identified to access a PSPDN through a PSTN, or an ISDN, or CSPDN, because a dedicated circuit to the PSPDN is not justified, or because global service availability is required with back-up network access via public switched networks; however permanent virtual circuits are not available in the types of access covered in this Recommendation;

(e) that some Administrations have considered the provision of Telematic services in different types of networks, e.g. PSPDN, PSTN, ISDN and CSPDN;

(f) that, when this Recommendation is used to provide the Network Service defined in Recommendation X.213, the physical, link and packet layers correspond to the Physical, Data link and Network layers respectively, as defined in Recommendation X.200,

(unanimously) recommends

that the functional and procedural aspects of packet mode DTEs accessing a PSPDN through a PSTN or an ISDN circuit switched bearer service, or CSPDN, are as specified in this

Recommendation.

Note – Packet mode terminal (TE 1 or TE 2) conforming to the I-Series Recommendations may access a PSPDN through an ISDN circuit switched bearer service. In this case the functional and procedural aspects related to layer 2 and layer 3 in the B-channel are as specified in this Recommendation.

CONTENTS

1	<i>Scope</i>
2	<i>Functional aspects</i>
	2.1 Dial-in and dial-out considerations
	2.2 Identification
	2.3 Service aspects
	2.4 DTE identification methods
	2.5 DCE identification methods
	2.6 Dial-in-by-the-DTE and dial-out-by-the-PSPDN operation
	2.7 DTE service requirement
	2.8 Duplex and half-duplex operation
	2.9 Identification protocol
	2.10 Negotiation of values
3	<i>DTE service descriptions</i>
	3.1 DTE service attributes
	3.2 Summary of DTE services
	3.3 Nonidentified DTE service
	3.4 Identified DTE service
	3.5 Customized DTE service
4	<i>Interface characteristics (physical layer)</i>
	4.1 X.21 interface
	4.2 X.21 bis interface
	4.3 V-Series interface
5	<i>Link access procedure across the DTE/DCE interface</i>
	5.1 Introduction
	5.2 Link layer address assignment
	5.3 Use of XID frames
	5.4 Link set-up and disconnection
	5.5 Multilink
	5.6 Half-duplex operation
6	<i>Packet layer</i>
	6.1 Scope and field of application
	6.2 Use of registration packets for identification of DTE and/or DCE and for conveyance of X.32 optional user facilities
	6.3 Identification and authentication of the DTE using the <i>NUI selection</i> facility in call set-up packets
7	<i>X.32 procedures, formats, and facilities</i>
	7.1 Identification protocol

7.2 Procedures for X.32 optional user facilities

7.3 Coding of the identification protocol elements and X.32 facilities

7.4 Security grade 2 method

7.5 DCE timer T14

7.6 DCE timer T15

Annex A – Actions taken by the DCE in the roles of questioning and challenged parties for security grade 1 and security grade 2 identifications

Annex B – Abbreviations

Appendix I – Implementation of LAPX

Appendix II – RSA public key algorithm

Appendix III – Relationship of T14 to the different methods of DTE identification

1 Scope

This Recommendation defines the functional and procedural aspects of the DTE/DCE interface for packet mode user classes of service DTEs as defined in Recommendations X.1 and X.10, for DTEs that access a PSPDN via public switched networks. In this Recommendation, a public switched network (PSN) is either a public switched telephone network (PSTN) or an integrated services digital network (ISDN) providing circuit switched bearer service or a circuit switched public data network (CSPDN).

Note – The ISDN interface specification for transparent circuit connection is described in Recommendation X.31. In this Recommendation only the DTE functionalities for the access to a PSPDN service through an ISDN are considered.

In the PSTN case, the X.32 DTE/DCE interface coincides with the interface between the DTE and the modem. In the ISDN case, the X.32 interface coincides with the R reference point (see Figure 1/X.32). In the CSPDN case, the X.32 DTE/DCE interface coincides with the X.21 or X.21 *bis* interface. This definition applies whether or not the Administration provides the DCE and regardless of how the interface is physically realized (e.g., whether or not the DTE and DCE are contained within the same enclosure). In either case the PSN is involved only:

- a) in the establishment of the switched access path;
- b) to provide a transmission medium; and
- c) optionally, to provide a PSN number for purposes of identification and addressing.

Administrations may offer one or more of the following physical layer interfaces:

- 1) for access by way of a CSPDN, either Recommendation X.21 or Recommendation X.21 *bis* will be used, as described in §§ 4.1 or 4.2, respectively;
- 2) for access by way of a PSTN, appropriate V-Series Recommendations will be used as described in § 4.3;
- 3) for access by way of an ISDN, refer to Recommendation X.31.

The exact use of the relevant points in these Recommendations is given in § 4.

The transmission facility is duplex or, optionally, half-duplex. Specific procedures are defined in § 5.6 of this Recommendation for operation over a half-duplex transmission facility.

At the link layer, the LAPB link access procedure of Recommendation X.25 is used over a

single switched physical circuit. The LAPB formats and procedures shall be in accordance with §§ 2.2, 2.3 and 2.4 of Recommendation X.25, with additions as noted in § 5 of this Recommendation.

The formats and the procedures at the packet layer shall be in accordance with §§ 3, 4, 5, 6 and 7 of Recommendation X.25 with the additions noted in § 6 of this Recommendation.

Fig. 1/X.32 T0704910-88

2 Functional aspects

2.1 *Dial-in and dial-out considerations*

Dial-in operation allows a packet-mode DTE to access a PSPDN by means of selection procedures on a PSTN or CSPDN or ISDN (see Figure 2/X.32). This operation is termed “dial-in-by-the-DTE” within this Recommendation.

Fig. 2/X.32 T0704920-88

For performing this operation, the DTE may use an automatic or manual calling procedure.

Dial-out operation allows a PSPDN to access a packet-mode DTE by means of selection procedures on a PSTN or CSPDN or ISDN (see Figure 3/X.32). This operation is termed “dial-out-by-the-PSPDN” within this Recommendation.

Figure 3/X.32 T0704930-88

For dial-out-by-the-PSPDN operation, the DTE should use the automatic answering procedure but may use manual answering.

Virtual call origination is independent of dial-in-by-the-DTE and dial-out-by-the-PSPDN operations. That is, a DTE that has been involved in a dial-in-by-the-DTE or dial-out-by-the-PSPDN operation may then initiate or receive virtual calls, subject to the limitations in specific situations as described in § 3.

2.2 *Identification*

2.2.1 *DTE identity*

When a DTE accesses a PSPDN through a PSN (dial-in-by-the-DTE) or when a DTE is accessed by a PSPDN through a PSN (dial-out-by-the-PSPDN), 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 either explicitly agreed to between the DTE and the Administration or is implicitly acceptable to the Administration through agreements with other Administrations, organizations or authorities. It may be composed of different elements such as a number from a numbering plan, identification of the DTE service and authority, validity dates and period, public keys used for authentication, etc.

The characteristics of the service which a DTE obtains via dial-in-by-the-DTE or dial-out-by-the-PSPDN access depend upon whether the PSPDN considers the DTE 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. That is, either the DTE or some other party is billable.

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

- a) the DTE is administratively registered either:
 - 1) through direct arrangement with the PSPDN (i.e. explicitly), or
 - 2) through pre-arrangement between the PSPDN and a PSN or another authority, and direct arrangement between the DTE and that authority (i.e. not explicitly),
- b) the DTE identity is made known to the DCE during the switched access connection using one of the methods described in § 2.4.

A DTE may incur charges even if not identified because some Administrations collect charges via the PSTN, ISDN or CSPDN.

In any case, DTE identification is used for billing and accounting purposes. In addition to this basic function, DTE identification may optionally be used for one or both of the following purposes:

- a) enabling the PSPDN to provide a calling DTE address to a called DTE, or
- b) enabling the DTE to obtain a different service than that offered to DTEs which do not establish an identity (see § 2.3).

2.2.2 DCE identity

When a network supports dial-out-by-the-PSPDN access to DTEs, there may be a requirement for identification of the network (i.e. DCE) to the DTE. In the case of dial-in-by-the-DTE access, although the identity of the DCE may already be known by the DTE (as the DTE originated the switched access connection), there may also be a DTE requirement for identification of the network. The identification of the DCE to the DTE may be used for different purposes, such as:

- a) to enable the DTE to select the specific security related information (e.g. encrypted key, password, etc.) appropriate to that network for use in exchanges with the DCE;
- b) to enable the DTE to select different parameters, procedures or profiles appropriate to that network;
- c) to enable a DTE to ascertain by which PSPDN the switched access has been established, thus enabling proper operation of the optional *closed user group* facility and of the conveyance of the appropriate calling DTE address provided by the PSPDN, if applicable.

For each dial-in-by-the-DTE or dial-out-by-the-PSPDN access, the DCE may establish its identity by successfully completing one of the methods for DCE identification described in § 2.5. The DCE identity is composed of the network's Data Network Identification Code (DNIC), and optionally, a DTE profile designator (see § 3.1.11), except when the identity is provided by the PSN (see § 2.5.1.1); in the latter case the identity is a number of the PSN numbering plan.

2.3 Service aspects

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

- a) the PSPDN;
- b) the use/non-use of DTE identification, and
- c) the DTE service available to and chosen by the DTE.

Three DTE service types are defined in this Recommendation (see § 2.3.2). One of the DTE service types (*nonidentified*) is independent of the specific DTE identity. One service type (*identified*) may or may not be independent of the specific DTE identity. The third type (*customized*) is related to the specific DTE identity in order to provide customization of some service aspects.

The types of DTE service are further distinguished by whether there is a number assigned by the network to be used to represent the DTE identity in the address fields of *call set-up* packets. This number is called a “DTE address” and is defined in § 3.1.3.

2.3.1 Service attributes

“Attributes” are defined to describe each aspect of 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 attributes are:

- a) DTE identity;
- b) DTE identification method;
- c) DTE address;
- d) registered address;
- e) registered PSN number;
- f) X.25 subscription set;
- g) logical channels assignment;
- h) dial-out-by-the-PSPDN availability;
- i) dial-out access type;
- j) X.32 optional user facilities;
- k) DCE identity presentation, and
- l) link layer address assignment.

For each DTE service, each attribute is either provided or not provided; if it is provided it is either:

- 1) set to a default value specified by the network (Network Default) or
- 2) set to a value selected by the user from a set of values provided by the network (User Selectable). (*Note* - A network may define a default value for the attribute).

A *DTE profile* is the set of values of the Network Default and User Selectable attributes that have been selected for a particular DTE identity.

Note – The *DTE profile* need not be stored in the PSPDN.

Some networks may allow a subscriber to arrange for more than one *DTE profile* to meet different requirements for switched access service. Each *DTE profile* is independent. A “DTE profile designator” is used to differentiate the multiple profiles of the DTE.

2.3.2 DTE services

Some networks may offer service to unidentified DTEs, that is, to DTEs for which no identification is provided to the DCE.

Some networks may offer 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 specified in § 2.4. Different types of service are defined for use in different situations. The network may offer one or more of these services.

The three types of service defined in this Recommendation are called DTE services. One is a service for unidentified DTEs. The other two are services for identified DTEs. The three DTE services are:

- a) nonidentified,
- b) identified, and
- c) customized.

2.3.2.1 Service for unidentified DTEs

The service offered to unidentified DTEs is called *nonidentified* DTE service and is detailed in § 3.3. This DTE service may be offered as part of dial-in-by-the-DTE or dial-out-by-the-PSPDN operation or both.

For a dial-out-by-the-PSPDN operation, the lifetime of a switched access path corresponds to the lifetime of the virtual call. That is, at the completion of the clearing procedures for the virtual call, the DCE initiates those procedures necessary to disconnect the switched access path.

For a dial-in-by-the-DTE operation, the switched access path shall not be disconnected for a period of time (T14) even in the absence of any virtual calls. This allows users a period of time to reestablish a virtual call (see § 7.5).

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 *nonidentified* 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); and
- c) it should not be permitted to make paid calls or receive reverse-charged calls (i.e. the *local charging prevention* facility is set by the network), thus allowing the Administration to guarantee collection of charges. However, some Administrations may permit nonidentified DTEs to make free calls or may use other methods to collect charges (e.g. via the PSTN, ISDN or CSPDN).

2.3.2.2 Services for identified DTEs

The services offered to identified DTEs provide a set of capabilities/facilities different from and/or enhanced beyond the *nonidentified* DTE service. In particular, on those networks which allow only identified DTEs to accrue charges, it is possible for DTEs to:

- a) make calls for which the calling DTE assumes responsibility for the charges, and/or
- b) receive reverse-charged calls.

2.3.2.2.1 *Identified DTE service*

The PSPDN may offer the *identified* DTE service in which:

- a) the *DTE identity* has not been explicitly agreed to with the Administration, or the *DTE identity* has been explicitly agreed to. In this case, allocation of *registered addresses*, to some DTEs, by the Administration is a network option;
- b) the other attributes have the values set by the network as specified in § 3.4.

The effect of the *identified* DTE service is that this DTE is billable but the service is otherwise similar to the *nonidentified* DTE service. Note that the use of the *network user identification* (NUI) *subscription* facility provides a *DTE identity* used for billing purposes and may, in conjunction with the *NUI override* facility (§ 6.3), override, for the specific virtual call, the default set of X.25 subscription facilities. However, when using the *NUI override* facility feature, overriding the facilities is performed only when a Call Request is made by the switched access DTE and not for an Incoming Call to the switched access DTE.

The *identified* DTE service may be offered as part of dial-in-by-the-DTE or dial-out-by-the-PSPDN operation or both.

2.3.2.2.2 *Customized DTE service*

The PSPDN may offer the *customized* DTE service in which the *DTE identity* has been explicitly agreed to with the Administration, a *registered address* has been allocated and the other attributes are set according to the DTE profile which has been customized for the DTE according to the capabilities supported by the network as permitted within the specification given in § 3.5. The effect is that this DTE is billable, has an X.121 address registered with the PSPDN, and is provided a service tailored in many aspects to its requirements. This DTE service may be offered as part of dial-in-by-the-DTE or dial-out-by-the-PSPDN operation or both.

2.4 *DTE identification methods*

This Recommendation provides four distinct methods for DTE identification. These methods are:

- a) identification provided by the public switched network,
- b) identification by means of a link layer Exchange Identification (XID) procedure,
- c) identification by means of a packet layer registration procedure,
- d) identification by means of the *NUI selection* facility in *call set-up* packets.

(Note – For an interim period, support of the use of a DTE identification method by means of the calling address field in *call request* packets is a national matter. It should be remembered that the use of the calling address field for conveying identification conflicts with the use of this field for addressing, and problems can arise if both uses are needed.)

A network may support any, all or none of these methods in conjunction with the DTE services offered (see § 2.7).

The mechanisms in b), c) and d) may be used by some networks to offer functions other than, or in addition to, DTE identification.

The identity of the DTE 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 § 2.4.1), or
- 2) on a per virtual call basis (see § 2.4.2).

It is considered vital that a reasonable degree of protection be achieved in the DTE identification procedure so that Administrations 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 and registration methods obey an “identification protocol” that has been defined in §§ 2.9 and 7.1 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. Two grades of security are defined in the identification protocol. Identification provided by the public switched network and the X.25 *NUI selection* facility do not use an explicit identification protocol. However, the success of authentication is implicit in the reception by the DTE of a *call connected* packet.

DCE identification may be achieved by using the identification protocol while it is simultaneously being used for DTE identification, but as an independent invocation of the protocol.

Networks may choose to offer “secure dial-back” as an additional means for authentication of the DTE identity. Secure dial-back, as specified in § 7.2.1, uses physical location as a basis for DTE authentication by combining dial-in-by-the-DTE, dial-out-by-the-PSPDN, and DTE identification prior to virtual call establishment.

2.4.1 *Identification prior to virtual call establishment*

There are three methods by which the identity of the DTE can be determined by the DCE prior to the establishment of any virtual call. These methods are described in the following three subsections. All three methods apply to both dial-in-by-the-DTE and dial-out-by-the-PSPDN operation.

The service that a DTE which is identified prior to virtual call establishment obtains is either the *identified* or the *customized* DTE service.

If the service obtained is the *customized* DTE service and includes customized values for link layer options and system parameters, the DTE identification must be performed at the link level (see § 2.4.1.2) or be provided by the public switched network (see § 2.4.1.1).

The DTE identification that is determined by any of the prior-to-virtual-call-establishment methods remains in effect even in the absence of any virtual calls.

2.4.1.1 *Identity provided by the public switched network*

In the case of dial-in-by-the-DTE operation, the *DTE identity* may be provided by the public switched network (i.e. PSTN, ISDN or CSPDN) to the PSPDN during the PSN connection establishment stage.

Note – The administrative arrangements described in § 2.2.1 are necessary for the calling line identification to be used by the PSPDN as a *DTE identity*.

The DTE is a subscriber of the PSTN, ISDN or CSPDN network, and, therefore, the PSTN number, the ISDN number or the CSPDN number (as well as some additional management information in some circumstances) may be available and will be signalled to the PSPDN.

In the case of dial-out-by-the-PSPDN, the PSPDN uses, as the DTE identification, the information which has been provided to the PSN in order to do the dial-out-by-the-PSPDN operation.

Note – This method of identification may be used in the case of dial-out-by-the-PSPDN operation even when the PSN does not provide calling line identification.

As the PSN is providing the identification information, the DTE is not required to use any optional user procedures in order to accomplish DTE identification.

The DTE identification determined by means of this method remains in effect until the switched access path is disconnected.

Note – Although the operational requirements for a DTE which is not identified or which is identified via the “provided-by-public-switched-network” method are the same, the capabilities/facilities available to DTEs using these methods can be very different. This may result in differences in general DTE operation, especially in regard to reverse charging. In particular, the differences are those between the *nonidentified* DTE service and the *identified* or *customized* DTE services.

2.4.1.2 *Identity provided by means of the link layer XID procedure*

Identification of the DTE may be provided by a link layer procedure, as described in §§ 5 and 7, based on exchanges of XID frames between the DTE and the DCE before the logical link is established (*disconnected* phase of Recommendation X.25).

This procedure may be optionally offered by networks depending, in part, on the offering by the network of the optional frames that this procedure uses. When it is offered by the network, use of this identification procedure by DTEs is optional.

The XID frame used in this method may also be used for other link layer functions.

The DTE identification determined by means of this method remains in effect until the switched access path is disconnected or the link layer has left the information transfer phase and has entered the *disconnected* phase.

2.4.1.3 *Identity provided by means of the packet layer registration procedure*

Identification of the DTE may be provided by means of a packet layer procedure described in §§ 6 and 7. This procedure is based on one or more exchanges of *registration request* packets (from DTE to DCE) and *registration confirmation* packets (from DCE to DTE) and is always initiated by the DTE. (These packets are described in § 5.7.2 of Recommendation X.25). The DTE may initiate this procedure (for purposes of identification) once at the beginning of the existence of the switched access path, i.e. before any virtual calls are made in which the *nonidentified* DTE service is obtained or in which a per-virtual-call-DTE identification method is used. The DTE identification determined by means of this method remains in effect until the switched access path is disconnected or the link layer has entered the *disconnected* phase. Also, the receipt of a *restart indication* packet by the DTE may mean that DTE identification has been lost (see § 6.1 of Recommendation X.25 and §§ 6 and 7 of this Recommendation).

This procedure may be optionally offered by networks depending, in part, on the offering by the network of the optional *registration* packets that this procedure uses. When it is offered by the network, use of this identification procedure by DTEs is optional.

The *registration* packets used in this method are also used by those networks which offer the optional *on-line facility registration* facility.

2.4.2 Identification per virtual call by means of network user identification facility

There is a method, using the *network user identification selection* facility, by which the identity of the DTE can be determined on a per-virtual-call basis.

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. Use of NUI in the facility field in a *call accepted* packet allows a modification of billing (e.g. subaccount billing) to be carried out and has no effect on the values of the *DTE profile* in use for this DTE.

This procedure may be optionally offered by networks depending, in part, on the offering by the network of the optional *NUI selection* facility that this procedure uses. When it is offered by the network, use of this identification procedure by DTEs is optional.

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 § 6.3 concerning operation of the *NUI selection* facility.

The service that a DTE using the NUI method obtains 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 *nonidentified* 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.

2.5 DCE identification methods

This Recommendation provides three distinct methods for DCE identification. These methods are:

- a) identification provided by the public switched network,
- b) identification by means of a link layer XID procedure, and
- c) identification by means of a packet layer registration procedure.

When a network provides dial-in-by-the-DTE access and/or dial-out-by-the-PSPDN access, it need not provide the DCE identification to the DTE. Some networks may not provide the DCE identification to the DTE regardless of the approach used for the DTE identification.

However, for the networks that choose to provide the DCE identification to the DTE using one of the optional identification procedures, it is possible that the DTE may not use that optional identification procedure and, therefore, may not recognize the DCE identification. Additionally, networks are not required to provide DCE identification on dial-in-by-the-DTE operation.

There is a need to provide a reasonable degree of protection in the identification procedure so that Administrations and subscribers can prevent inaccurate DCE identification. Therefore, the identification procedure incorporates the functions of authentication and verification of the DCE's identity. The XID and registration methods of DCE identification obey an "identification protocol"

that has been defined in §§ 2.9 and 7.1 for conveying the information necessary for the DTE to recognize the DCE identity, including verifying the identity to the proper degree of authenticity and reporting on the success of the procedure.

When no DCE identification is received by the DTE, it is the responsibility of the DTE to decide if the level of security is sufficient to continue operation.

DTE identification may be achieved by using the identification protocol while it is simultaneously being used for DCE identification, but as an independent invocation of the protocol.

2.5.1 *Identification prior to virtual call establishment*

2.5.1.1 *Identity provided by the public switched network*

In the case of dial-out-by-the-PSPDN, the PSTN number, the ISDN number or the CSPDN number identifying the DCE may be provided by the public switched network (as well as some additional network management information from the PSPDN in some circumstances).

When identification is provided by the PSN, the DCE is not required to use any optional packet/frame types or any optional packet/frame fields defined in §§ 5, 6 or 7 or in Recommendation X.25.

2.5.1.2 *Identity provided by means of the link layer XID procedure*

DCE identification can be optionally provided to the DTE by means of the exchange of XID frames prior to the link set-up. The detailed procedure to provide such information is the identification protocol given in §§ 2.9 and 7.1.

2.5.1.3 *Identity provided by means of the packet layer registration*

DCE identification can be optionally provided to the DTE using the *registration* packets. The exact process is the identification protocol given in §§ 2.9 and 7.1.

2.5.2 *Identification per virtual call*

Identification of the DCE to the DTE on a per-virtual-call basis is currently not provided. The need for such a capability has been left for further study.

2.6 *Dial-in-by-the-DTE and dial-out-by-the-PSPDN operation*

All PSPDNs conforming to this Recommendation shall provide dial-in-by-the-DTE operation. Provision of dial-out-by-the-PSPDN operation is optional.

2.7 *DTE service requirement*

To provide a switched access service to DTEs, without introducing additional procedures, all PSPDNs conforming to this Recommendation shall offer the *nonidentified* DTE service and/or support use of the provided-by-the-PSN DTE identification method.

Networks may also provide access to and/or from DTEs through a PSN, with the DTE being identified to the network using one of the optional identification procedures (see §§ 2.4.1.2, 2.4.1.3 and 2.4.2).

2.8 *Duplex and half-duplex operation*

If CSPDN access is used, the transmission facility is duplex. If PSTN access is used, the transmission facility operation is duplex, or, optionally, some networks may also provide for half-duplex operation. The additional procedures necessary for half-duplex operation are described in § 5.6. If an ISDN transparent circuit connection is used, the transmission facility is duplex.

2.9 *Identification protocol*

The elements of protocol which are used in performing DTE or DCE identification by either the XID or registration methods are independent of the procedure (the vehicle) used to transfer these elements between DTE and DCE (i.e. either XID frames or *registration* packets).

The “identification protocol” consists of exchanges between the “challenged” party and the “questioning” party. The “challenged” party provides and, optionally, certifies its identity and the “questioning” party checks and authenticates this identity.

The DTE and DCE, either calling or called, may be questioning, challenged, or both questioning and challenged. This is the result of the identification protocol being used independently for DTE identification and DCE identification, possibly simultaneously.

The identification protocol provides two grades of security characterized by how many operations are needed and which elements are needed in each direction.

The operational details of the identification protocol are given in § 7.1.

2.10 *Negotiation of values*

Negotiation of link layer parameters is left for further study. Presently, DCE parameters are set to specific values according to the *DTE profile* as outlined in §§ 2.3 and 3.

Some networks may provide the capability for negotiation of packet layer facilities by means of the *on-line facility registration* facility. When provided, this negotiation takes as a starting point the values established in the *DTE profile* and, as a result, may override them.

Packet layer facilities may also be overridden by using the *NUI selection* facility when the *NUI override* facility is in effect.

3 **DTE service descriptions**

3.1 *DTE service attributes*

3.1.1 *DTE identity*

The *DTE identity* attribute, when provided, defines the identity of the DTE.

3.1.2 *DTE identification method*

The *DTE identification method* attribute, when provided, defines the DTE identification method used for establishing the *DTE identity* (see § 2.4). The method is the same for dial-in-by-the-DTE and dial-out-by-the-PSPDN operation unless the provided-by-PSN method is selected for one operation, in which case the methods may be different.

3.1.3 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.

This *DTE address* may be, as a network option, either an X.121 number from the PSPDN numbering plan (see § 2.3 of Recommendation X.121) or a number in the X.121 format from the PSN numbering plan. The number in the X.121 format from the PSN numbering plan for CSPDN is according to § 2.3 of Recommendation X.121. The number in the X.121 format from the PSN numbering for PSTN and for ISDN is either according to § 2.2.1.3 of Recommendation X.121 or to § 2.6 of Recommendation X.121. The possible formats of the DTE address are given in § 6.6 of Recommendation X.301.

Note – The inclusion or application of the TOA/NP1 address format to Recommendation X.32 as defined in Recommendation X.25 requires further study.

3.1.3.1 DTE address not provided

In the case of 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 X.121 PSN format; this means the contents of the calling address field are not valid with respect to the definition of a “valid number” in the various Recommendations (e.g. a four digit number representing a DNIC that is assigned to a PSN; a number in the form 0 + CC; and a number in the form 9 + TCC are not valid numbers as defined in Recommendations X.121, E.164 and E.163 respectively); or
- b) temporary number from the PSPDN numbering plan; this means the contents of the calling address field, although valid with respect to the definition of a “valid number” in the various Recommendations, is not a number permanently attributed to the DTE. It may be, as an example, attributed to the dial-in part used for a particular call.

Note – If the temporary number is used, the called DTE must be made aware that the contents of the calling address field is not a DTE address. The means to convey this information are for further study. Pending the results of such a study, this option may be used nationally, but such a temporary number shall not be carried on international interconnections.

Moreover, when the PSN implements calling line identification but there is no arrangement between the PSN and PSPDN to use the number provided by the PSN as DTE identification and when no other DTE identification method is used, the PSPDN may include the PSN-provided number in the calling address field of the *incoming call* packet.

3.1.3.2 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*. This applies even if the *temporary location* facility has been used to change the *registered PSN number* (see § 7.2).

3.1.4 Registered address

This attribute, when provided, permits the DCE to be aware of a possible already established PSN connection with the DTE. The value of the *registered address* is always identical to the value of the *DTE address*.

3.1.4.1 *Registered address not provided*

If the called DTE address field in a *call request* packet contains an X.121 number from the PSN numbering plan which is not a registered address, then a dial-out-by-the-PSPDN call is made to that PSN number without checking if a switched connection already exists with the DTE. If a switched connection already exists, a subsequent dial-out-by-the-PSPDN operation will result in a busy signal. Therefore, the incoming virtual call is cleared.

3.1.4.2 *Registered address provided*

Upon receiving a call request with a called DTE address, that is the *registered address*, the PSPDN needs to determine whether or not to perform a dial-out-by-the-PSPDN operation. If there is a switched connection in existence on which the *DTE identity* that corresponds to the *registered address* has been established, that switched connection will be used by the PSPDN. Otherwise, the PSPDN will perform the dial-out-by-the-PSPDN operation.

Note – This dial-out-by-the-PSPDN will not be successful if there is already a switched connection to the DTE when there has not been an establishment of a *DTE identity* or there has been a *DTE identity* established that does not correspond to the *registered address*.

The PSN number used for the dial-out-by-PSPDN is the *registered PSN number*.

Note – In some networks, if the called address used in a Call Request packet to call a switched access DTE is not the *registered address* for a *DTE identity* but is a *registered PSN number*, the PSPDN will not recognize this as a *registered address* and may treat the call according to the *nonidentified* DTE service (see §§ 3.5 and 3.3).

3.1.5 *Registered PSN number*

When the *registered PSN number* attribute is provided, its value is used by the PSPDN for dialing out to that DTE. If a *call request* packet contains a *registered address* which is not X.121 PSN number, the PSPDN uses the *registered PSN number* in order to perform the dial-out-by-the-PSPDN operation. If the *registered address* is an X.121 PSN number, then it is considered to be the *registered PSN number*.

If a DTE does not have a *registered address*, then the *registered PSN number* attribute does not apply.

3.1.6 *X.25 subscription set*

The *X.25 subscription set* attribute defines values for the X.25 link layer options and system parameters and the X.25 packet layer subscription-time optional user facilities which apply to switched access operation. Networks are not required to support all of the link layer options and packet layer subscription-time facilities, except as required in Recommendation X.2. The list of link layer options and system parameters and packet layer optional user facilities in the *X.25 subscription set* is given in Table 3/X.32 (see § 3.3).

Note – As defined in Recommendation X.25, the throughput class value is, at most, the speed of the access line (see the *dial-out access type* attribute, § 3.1.9). However, in the case of a modem with automatic fall-back capability, the DCE shall set the default throughput class value to the maximum signalling rate of the modem used, unless the user has selected a lower value for the *default throughput classes assignment* facility. Some networks may take into account the signalling rate selected by the modems in fixing the default throughput class.

3.1.6.1 Network default

When the *X.25 subscription set* is specified as network default, the value of each of the options, parameters and facilities is a default value that is set by the PSPDN. Different defaults may apply according to the DTE service invoked.

The value of the *local charging prevention* facility is closely related to the policy of the PSPDN regarding accrual of charges by a nonidentified DTE (see § 3.3).

3.1.6.2 User selectable

When the *X.25 subscription set* is specified as user selectable, the value of each of the options, parameters, and facilities is available for customization by the user to a value from the set of values offered by the PSPDN.

3.1.7 Logical channels assignment

The *logical channels assignment* attribute defines the number of logical channels of each type assigned for a particular DTE.

There is a default value assigned by the PSPDN for nonidentified DTEs (see below). A different default value may be set by the PSPDN for use in cases where the *DTE identity* is established.

3.1.7.1 Network default

When the *logical channels assignment* is specified as network default, there is one virtual call logical channel with dial-out-by-the-PSPDN operation and there may be one or more virtual call logical channels with dial-in-by-the-DTE operation; the specific number is a network option. The direction of virtual call placement that is allowed on the logical channel(s) is governed by the direction of the dial operation as shown in Table 1/X.32.

TABLE 1/X.32

Direction of virtual call placement allowed as related to direction of the dial operation when logical channels assignment is by network default

Dial operation	Capabilities for DTE originating/receiving virtual calls	Equivalent X.25 optional user facilities (see Note)
Dial-in-by-the-DTE	Originating virtual calls	– Incoming calls barred – 1-way logical channel outgoing
Dial-out-by-the-PSPDN	Receiving virtual calls	– Outgoing calls barred – 1-way logical channel incoming

--	--

Note – The association of the dial operation with one or both of the optional user facilities is network-dependent.

3.1.7.2 *User selectable*

When the *logical channels assignment* is specified as user selectable, the number of logical channels of each type is set by the user, for the particular *DTE identity*, from the values supported by the network. This may include the assignment of channels for permanent virtual circuits.

3.1.8 *Dial-out-by-the-PSPDN availability*

The *dial-out-by-the-PSPDN availability* attribute allows the use of dial-out-by-the-PSPDN operation.

3.1.8.1 *Network default*

When the *dial-out-by-the-PSPDN availability* is specified as network default, the network chooses whether or not to offer dial-out-by-the-PSPDN operation. When dial-out-by-the-PSPDN operation is offered, the PSPDN attempts to establish a switched access path to the PSN number given in a *call request* packet.

3.1.8.2 *User selectable*

When the *dial-out-by-the-PSPDN availability* is specified as user selectable, the capability to have dial-out-by-the-PSPDN availability operation with a particular DTE is chosen by the user. When the *dial-out-by-the-PSPDN availability* is selected, the *registered PSN number* attribute must also be selected. Then the network dials out to the DTE whenever the *registered address* is used in a *call request* packet and there is not already a switched access path.

3.1.9 *Dial-out access type*

The *dial-out access type* attribute applies to dial-out-by-the-PSPDN operation and allows a DTE to choose modem characteristics or a user class of service or characteristics of an ISDN connection, possibly other than the national default, from those offered by the network. *Dial-out access type* refers to the modem characteristics (in the case of the PSTN) or the X.1 user class (in the case of the CSPDN) or the characteristics of an ISDN connection (in the case of ISDN) that are used for switched access line operation at the physical layer, see § 4. A national default dial-out access type is made by the PSPDN for each PSN through which access is permitted.

Note that for dial-in-by-the-DTE through the PSTN, the modem characteristics of the PSPDN port dialled into are used. For dial-in-by-the-DTE through the CSPDN, the X.1 user class of the PSPDN port called is used.

Note 1 – Some networks may use the procedures of Recommendation V.100 to perform modem selection.

Note 2 – The modem used determines whether the transmission facility is full or half duplex. Therefore, there is no attribute for the type of transmission facility operation.

3.1.9.1 *Network default*

When the *dial-out access type* is specified as network default, the national default modem characteristics are used for dial-out-by-the-PSPDN through the PSTN. For dial-out-by-the-PSPDN through the CSPDN, the national default X.1 user class is used. For dial-out-by-the-PSPDN through an ISDN, the national default for rate adaption method is used, see Recommendation X.31 for the applicable method.

3.1.9.2 *User selectable*

When the *dial-out access type* is specified as user selectable, the modem characteristics selected for this *DTE identity*, from those offered by the network, are used for dial-out-by-the-PSPDN through the PSTN. For dial-out-by-the-PSPDN through the CSPDN, the X.1 user class, selected for this *DTE identity* from those offered by the network, is used. For dial-out-by-the-PSPDN through an ISDN, the X.1 user class, selected for this *DTE identity* from those offered by the network, is used.

3.1.10X.32 *optional user facilities*

Two X.32 optional user facilities, *temporary location* and *secure dial-back* are included within this attribute. Both of these optional user facilities are defined in § 7.2. It is optional for the PSPDN to offer these facilities.

3.1.11DCE *identity presentation*

The PSPDN chooses whether or not to offer DCE identity presentation. When DCE identity presentation is offered, the *DCE identity presentation* attribute defines the DCE identification method used by the PSPDN. The PSPDN may choose to use a DCE identification method for both dial-in-by-the-DTE operation and dial-out-by-the-PSPDN operation or for only dial-out-by-the-DTE operation. When the DCE identification is done for both operations, the method is the same for dial-in-by-the-DTE operation and dial-out-by-the-PSPDN operation. The PSPDN selects one of the DCE identification methods given in § 2.5.

Some networks may include a DTE profile designator as part of the DCE identity in order to inform the DTE of the *DTE profile* applicable to the DTE/DCE interface during this instance of switched access. The DTE profile designator is a string of octets that may be assigned by the PSPDN to the *DTE identity* as a name for the specific *DTE profile*.

3.1.12Link *layer address assignment*

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

Note – Other methods of link layer address assignment than those described below are for further study.

3.1.12.1 *Network default*

When the *link layer address assignment* is specified as network default, the link level addresses are assigned depending on the direction of the switched access call as defined in § 5.2 (same as Recommendation T.70).

Alternatively, *link layer address assignment* that is dependent on the roles of the equipment

as DTE and DCE, as defined in § 5.2 (same as § 2.4.2 of Recommendation X.25), may be provided by some networks.

Note 1 – The dial-out-by-the-PSPDN operation will only operate properly when the DTE and the PSPDN implement the same *link layer address assignment* method.

Note 2 – Assigning the link layer addresses according to the roles of the equipment as DTE and DCE does not allow for two DTEs to interoperate directly without an intervening PSPDN.

3.1.12.2 *User selectable*

When the *link layer address assignment* is specified as user selectable, the user designates whether the link level addresses are assigned depending on the direction of the switched access call or depending on the roles of the equipment as DTE and DCE (see § 5.2).

3.2 *Summary of DTE services*

The type of each attribute is given for the three DTE services in Table 2/X.32.

TABLE 2/X.32

Summary of DTE services

Summary of DTE services				
Attributes	Services	Nonidentified	Identified	Customized
DTE identity		—	Yes	Yes
DTE identification method		—	Any (ND)	Prior to virtual circuit establishment (ND)
DTE address		—	Note 4	Yes
Registered address		—	Note 1	Yes

Registered PSN number	—	—	User selectable
X.25 subscription set	ND	Note 2	User selectable
Logical channel assignment	ND	ND	User selectable
Dial-out-by-the-PSPDN availability	ND	Note 1	User selectable
Dial-out access type	ND	ND	User selectable
X.32 optional user facilities	—	—	User selectable
DCE identity presentation	ND	ND	ND
Link layer address assignment	ND	ND	User selection Note 3

--	--	--	--

— not provided

ND network default

Yes provided

Note 1 – In this DTE service, the use of *registered addresses* for some DTEs is a network option. When the DTE is assigned a *registered address*, the value of the *dial-out-by-the-PSPDN availability* attribute is user selectable. Otherwise, (if no *registered address* is assigned to the DTE), the availability of dial-out-by-the-PSPDN operation is by network default.

Note 2 – ND or, if *NUI override* is in effect, user selectable packet layer facility values (Annex H/X.25).

Note 3 – In the case of dial-in-by-the-DTE operation, the link layer address values assigned are the same for both assignment methods and, therefore, the values are not dependent on the assignment method selected by the user.

Note 4 – In this DTE service, the use of *DTE addresses* for some DTEs is a network option.

3.3 *Nonidentified DTE service*

The values of the attributes for the *nonidentified* DTE service defined in § 2.3.2.1 are shown in the “nonidentified” column of Table 2/X.32:

- no *DTE identity* is established;
- no *DTE identification* method is used.

Generally, no optional user facilities are available except those governing the direction of virtual call placement (i.e. incoming calls barred, outgoing calls barred, one-way logical channel outgoing, and one-way logical channel incoming) and those that can be used on a per-virtual-call basis without prior subscription. In addition, some networks may allow the use of:

- a) some subscription-time optional user facilities without prior subscription. (The network may make these known by publication or through the use of the *on-line facility registration* facility; in such cases, a PSPDN should consider making its identity known nonidentified DTEs), and
- b) some subscription-time optional user facilities that must be requested by the DTE through the use of the *on-line facility registration* facility.

The X.25 link layer options and system parameters and the X.25 subscription-time optional user facilities are categorized for dial-in-by-the-DTE and dial-out-by-the-PSPDN operation in Table 3/X.32 as:

- an “AVAIL-NS” link layer system parameter, which is set by the network on all networks offering *nonidentified* DTE service;
- an “AVAIL-BAS” optional user facility or link layer option, which is available on all networks offering *nonidentified* DTE service. This facility is in effect even if not requested;
- an “AVAIL-OPT” optional user facility, which is available on some networks offering the *nonidentified* DTE service and the availability of which is made known through either publication or use of the *on-line facility registration* facility. These facilities can be used without further request when operating on these networks;
- an “AVAIL-RQ” optional user facility, which is available on some networks offering the *nonidentified* DTE service and the use of which must be requested through the *on-line facility registration* facility; or
- a “NO” optional user facility or line level option, which is not available on any network offering *nonidentified* DTE service.

The DTE may use any per-call X.25 facility that is supported by the PSPDN and that does not require prior subscription.

3.4 *Identified DTE service*

The values of the attributes for the *identified* DTE service (defined in § 2.3.2.2) are shown in the “identified” column of Table 2/X.32.

- A *DTE identity* that has been agreed to explicitly or implicitly is provided to the network.
- The *X.25 subscription* set is the same as in the *nonidentified* DTE service except that:
 - a) for dial-in-by-the-DTE operation, in which the *NUI override* facility is in effect at the DTE/DCE interface, the *NUI selection* facility, as defined in Recommendation X.25, can be used to invoke user selected packet layer facility

values (see § 6.3 and Annex H/X.25), and

b) the *local charging prevention* facility is not in effect.

The DTE may use any per-call X.25 facility which is supported by the PSPDN and which does not require prior subscription.

TABLE 3/X.32

Availability of link level options and system parameters and packet level subscription-time facilities in the nonidentified DTE service

Option, parameter or facility (applicable to all assigned logical channels)	Available with Dial-in- by-the-DTE operation	Available with Dial-out-by- the-PSPDN operation
Link layer		
K	AVAIL-NS	AVAIL-NS
T1	AVAIL-NS	AVAIL-NS
T2	AVAIL-NS	AVAIL-NS
T3	AVAIL-NS	AVAIL-NS
N1	AVAIL-NS	AVAIL-NS
N2	AVAIL-NS	AVAIL-NS
Multilink	NO	NO
MT1	NO	NO
MT2	NO	NO
MT3	NO	NO

Extended frame sequence numbering	NO	NO
Packet layer		
On-line facility registration	AVAIL-OPT	AVAIL-OPT
Extended packet sequence numbering	AVAIL-RQ (Note 1)	AVAIL-RQ
D-bit Modification	AVAIL-RQ	AVAIL-RQ
Packet retransmission	AVAIL-OPT	AVAIL-OPT
Incoming calls barred	AVAIL-BAS	NO
Outgoing calls barred	NO	AVAIL-BAS
One-way logical channel outgoing	AVAIL-BAS	NO
One-way logical channel incoming	NO	AVAIL-BAS
Nonstandard default packet sizes	AVAIL-RQ	AVAIL-RQ

Nonstandard default window sizes	AVAIL-RQ (Note 2)	AVAIL-RQ (Note 2)
Default throughput classes assignment	AVAIL-RQ	AVAIL-RQ
Flow control parameter negotiation	AVAIL-RQ (Note 1)	AVAIL-RQ
Throughput class negotiation	AVAIL-RQ (Note 1)	AVAIL-RQ

TABLE 3/X.32 (cont.)

Availability of link level options and system parameters and packet level subscription-time facilities in the nonidentified DTE service

Option, parameter or facility (applicable to all assigned logical channels)	Available with Dial-in-by-the-DTE operation	Available with Dial-out-by-the-PSPDN operation
---	---	--

Packet layer (cont.)

Closed user group related facilities		
– Closed user group	NO	NO
– Closed user group with outgoing access	NO	NO
– Closed user group with incoming access	NO	NO
– Incoming calls barred within a closed user group	NO	NO
– Outgoing calls barred within a closed user group	NO	NO
Bilateral closed user group related facilities		
– Bilateral closed user group	NO	NO

– Bilateral closed user group with outgoing access	NO	NO
Fast select acceptance	NO	AVAIL-RQ
Reverse charging acceptance	NO	NO
Local charging prevention (Note 3)	Yes	Yes
Network user identification subscription	NO	NO
NUI override	NO	NO
Charging information subscription	NO	NO
RPOA subscription	NO	NO
Hunt group	NO	NO
Call redirection	NO	NO

Call deflection subscription	NO	NO

Note 1 – Further study is required to determine whether subscription should be equivalent to use in a *call set-up* packet (either in the general format identifier for the *extended packet sequence numbering* facility or in the facility field for other facilities) under the *nonidentified* DTE service.

Note 2 – Some networks offering half-duplex operation as part of the *nonidentified* DTE service may set the default window size to a single nonstandard default window size value.

Note 3 – The *local charging prevention* facility is in effect unless the PSPDN permits unidentified DTEs to accrue charges.

3.5 Customized DTE service

The values of the attributes for the *customized* DTE service (defined in § 2.3.2.2) are shown in the “customized” column in Table 2/X.32.

Note – If a public port is used, the values in the *customized DTE profile* may not all be supported. (The characteristics available may vary from public port to public port). The result may be service according to network default values or refusal of service.

A *DTE identity* that has been explicitly agreed to with the PSPDN for obtaining the *customized* DTE service is provided to the PSPDN.

The availability for customization of each X.25 link layer option and system parameter and X.25 packet layer subscription–time facility is given in Table 4/X.32.

The DTE may use any per–call X.25 facility which is supported by the PSPDN and which does not require prior subscription.

The DTE may use any per–call X.25 facility which is supported by the PSPDN and which requires a corresponding subscription–time facility to be selected, provided that the corresponding subscription–time facility has been selected.

4 Interface characteristics (physical layer)

Administrations may offer one or more of the physical layer interfaces specified below.

For a description of the physical layer interface for the case of ISDN transparent circuit connection, see Recommendation X.31.

4.1 X.21 interface

For establishment, maintenance, and disestablishment of a switched access path between a DTE and a PSPDN by way of a CSPDN, the interface at the physical layer shall be in accordance with Recommendation X.21, as described in the following sections.

4.1.1 DTE/DCE physical interface elements

The DTE/DCE physical interface elements shall be according to §§ 2.1 through 2.5 of Recommendation X.21.

4.1.2 Alignment of call control characters and error checking

Alignment of call control characters and error checking shall be in accordance with § 3 of Recommendation X.21.

4.1.3 Procedures for entering operational phases

The *call control* phase shall be required prior to entering the operational phases and shall be in accordance with § 4 of Recommendation X.21.

After a call is established within the CSPDN, the physical layer interface will enter the *data transfer* phase, as described in § 5.1 of Recommendation X.21. While in the *data transfer* phase (state 13), data exchanged on circuits T and R will be as described in subsequent sections of this

Recommendation.

The *Not ready* states given in § 2.5 of Recommendation X.21 are considered to be non-operational states, and may be considered by higher layers to be out-of-order states.

4.1.4 *Clearing procedures*

Clearing procedures shall be according to § 6 of Recommendation X.21.

TABLE 4/X.32

Availability for customization in the customized DTE service of the X.25 link level options and system parameters and the X.25 subscription–time facilities

Option, parameter or facility	Customization available
Link layer	

K	CUSTOM
T1	CUSTOM
T2	CUSTOM
T3	CUSTOM
N1	CUSTOM
N2	CUSTOM
Multilink	(Note 1)
MT1	(Note 1)
MT2	(Note 1)
MT3	(Note 1)

Extended frame sequence numbering	CUSTOM

Packet layer

On-line facility registration	CUSTOM
Extended packet sequence numbering	CUSTOM
D-bit modification	CUSTOM
Packet retransmission	CUSTOM
Incoming calls barred	CUSTOM
Outgoing calls barred	CUSTOM
One-way logical channel outgoing	CUSTOM
One-way logical channel incoming	CUSTOM
Nonstandard default packet sizes	CUSTOM
Nonstandard default window sizes	CUSTOM

Default throughput classes assignment	CUSTOM
Flow control parameter negotiation	CUSTOM
Throughput class negotiation	CUSTOM

TABLE 4/X.32 (cont.)

Availability for customization in the customized DTE service of the X.25 link level options and system parameters and the X.25 subscription-time facilities

Option, parameter or facility	Customization available
-------------------------------	-------------------------

Packet layer (cont.)

Closed user group related facilities	
– Closed user group	CUSTOM
– Closed user group with outgoing access	CUSTOM
– Closed user group with incoming access	CUSTOM
– Incoming calls barred within a closed user group	CUSTOM
– Outgoing calls barred within a closed user group	CUSTOM
Bilateral closed user group related facilities	

– Bilateral closed user group	CUSTOM
– Bilateral closed user group with outgoing access	CUSTOM
Fast select acceptance	CUSTOM
Reverse charging acceptance	CUSTOM
Local charging prevention	CUSTOM
Network user identification subscription	CUSTOM
NUI override	CUSTOM
Charging information subscription	CUSTOM
RPOA subscription	CUSTOM

Hunt group	CUSTOM
Call redirection	CUSTOM (see Note 2)
Call deflection subscriptions	

CUSTOM can be chosen or set to a nondefault value by the DTE, if supported by the PSPDN

Note 1 – The need for multilink procedures over switched access paths is left for further study.

Note 2 – The criteria for determining that the DTE is out of order (for the purposes of call redirection) have been left for further study.

4.1.5 *Failure detection principles and test loops*

Failure detection principles shall be according to §§ 2.6.1 and 2.6.2 of Recommendation X.21.

The definitions of test loops and the principles of maintenance testing using test loops are provided in Recommendation X.150.

A description of the test loops and the procedures for their use are given in § 7 of Recommendation X.21.

Automatic activation by a DTE of test loop 2 in the DCE at the remote terminal is not possible. However, some Administrations may permit the DTE to control the equivalent of a test loop 2 at the local data switching exchange (DSE) to verify the operation of the subscriber line, the switched access path and all or part of the DCE or line terminating equipment. Subscriber control of the loop, if provided, may be manual or automatic as described in Recommendations X.150 and X.21, respectively.

4.1.6 *Signal element timing*

The signal element timing shall be in accordance with § 2.6.3 of Recommendation X.21.

4.2 *X.21 bis interface*

For establishment, maintenance, and disestablishment of a switched access path between a DTE and a PSPDN by way of a CSPDN, the interface at the physical layer shall be in accordance with Recommendation X.21 *bis*, as described in the following sections.

4.2.1 *DTE/DCE physical interface elements*

The DTE/DCE physical interface elements shall be in accordance with § 1.2 of Recommendation X.21 *bis*.

4.2.2 *Procedures for entering operational phases*

The procedures for entering operational phases shall be in accordance with § 2 of Recommendation X.21 *bis*. When circuit 107 is in the ON condition, and when circuits 105, 106, 108, and 109, if provided, are in the ON condition, data exchange on circuits 103 and 104 will be as described in subsequent sections of this Recommendation.

When circuit 107 is in the OFF condition, or any of circuits 105, 106, 108 or 109, if provided, is in the OFF condition, the interface is considered to be in a non-operational state and may be considered by the higher layers to be in an out-of-order state.

4.2.3 *Failure detection and test loops*

Failure detection principles, the description of the test loops and the procedures for their use are given in §§ 3.1 through 3.3 of Recommendation X.21 *bis*.

Automatic activation by a DTE of test loop 2 in the DCE at the remote terminal is not possible. However, some Administrations may permit the DTE to control the equivalent of a test loop 2 at the local DSE to verify the operation of the subscriber line, the switched access path, and all or part of the DCE or line terminating equipment. Subscriber control of the loop, if provided, may be manual or automatic as described in Recommendations X.150 and X.21 *bis*, respectively.

4.2.4 *Signal element timing*

Signal element timing shall be in accordance with § 3.4 of Recommendation X.21 *bis*.

4.3 *V-series interface*

For establishment, maintenance, and disestablishment of a switched access path between a DTE and a PSPDN by way of a PSTN, the physical layer interface shall be as described in the following sections.

4.3.1 *Modem characteristics*

Administrations may choose to offer modem characteristics in accordance with any or all of the following:

- a) 1200 bit/s V.22, Alternatives A, B or C, Mode i)
- b) 2400/1200 bit/s V.22 *bis*, Modes i) or iii), or
V.26 *ter*, Mode i) or iii)
- c) 9600/4800 bit/s V.32

In addition, those Administrations which offer half-duplex operation may choose to offer modem characteristics in accordance with any or all of the following:

- d) 2400 bit/s V.26 *bis*, Alternative B
- e) 4800/2400 bit/s V.27 *ter*

Note – In the future it is desirable that one modem characteristic should be available in all network implementations of this Recommendation. However, for the time being, it has not been possible to select a single modem type.

Other modem characteristics are left for further study or are a national matter.

Use of the backward channel, if allowed, is outside the scope of this Recommendation.

4.3.2 *Procedures for full duplex operational phases*

When circuit 107 is in the ON condition, and when circuits 105, 106, 108 and 109, if provided, are in the ON condition, data exchanged on circuits 103 and 104 will be as described in subsequent sections of this Recommendation.

Circuits 106 and 109 may enter the 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.

4.3.3 *Procedures for half duplex operational phases*

The states of circuits 103, 104, 105, 106 and 107 shall be according to § 5.6.8, below.

4.3.4 *Origination procedures*

DTEs may use either:

- a) the automatic origination procedures described in § 3 of Recommendation V.25;
- b) the automatic origination procedures described in §§ 4 or 5 of Recommendation V.25 *bis*;

c) the manual origination procedures of § 6 of Recommendation V.25.

Networks will use automatic origination procedures only.

Note – Other origination procedures may be used provided that no special requirements are placed on DTEs (including DTEs having integral modems and diallers) using only V.25 or V.25 *bis* procedures.

4.3.5 *Answering procedures*

For dial-out-by-the-PSPDN procedures, DTEs should use the automatic answering procedures of Recommendations V.25 and V.25 *bis*. Some Administrations may also allow use of manual answering procedures, provided that doing so does not affect DTEs using automatic answering procedures.

For dial-in-by-the-DTE, networks will use automatic answering procedures only.

4.3.6 *Disconnection procedures*

DTEs and networks shall use the disconnection procedures specified in Recommendation V.24.

4.3.7 *Test loops*

The definitions of test loops and the principles of maintenance testing using test loops are provided in Recommendation V.54.

Descriptions of the test loops and the procedures for their use are given in the appropriate modem Recommendations. It should be noted that the procedures for loop testing vary among the several modem Recommendations.

Automatic activation by a DTE of test loops 2 and 4 in the DCE at the remote terminal is not possible. However, some Administrations may permit the DTE to control the equivalent of a test loop 2 or 4 at the local DSE to verify the operation of the subscriber line, the switched access path, and all or part of the DCE or line terminating equipment. Subscriber control of the loop, if provided, may be manual or automatic as described in Recommendation V.54 and the appropriate modem Recommendations, respectively.