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6 Packet communication procedures

This clause is intended to explain the role of the D-channel signalling procedures in the support of packet communications in an ISDN. A complete description of terminal adaptor functions can be found in Recommendation X.31 [14].
According to Recommendation X.31, the user may access packet facilities by means of one of the following alternatives:

a) *Circuit-switched access to PSPDN services (Case A)* by establishing a transparent circuit-switched access connection through the ISDN to the access port of a public network (e.g. PSPDN) referred to as "access unit (AU)" in the following sections. This connection may be initiated by the user or the AU. From the ISDN point of view, the circuit-switched call control procedures of 5 apply. Only the B-channel is used in this case.

b) *Packet switched access to an ISDN virtual circuit service (Case B)* by establishing a packet-mode access connection to the packet handler (PH) of an ISDN. This connection may be initiated by the user or the ISDN. Both B- and D-channels may be used in this case.

Telecom supports Case B only.
The protocol and the text of 6.1-6.5 and Appendix II, and 6.1-6.5 and Appendix III/X.31, are identical.
The term "user" refers to the user equipment which may consist of an ISDN packet-mode terminal (TE1) or a combination of an existing data terminating equipment (DTE/TE2) attached to a terminal adaptor (TA). A DTE may not receive all of the information provided in Q.931 signalling messages at the user-network interface.
The ISDN TA/TE1 presents an S/T-interface towards the network and therefore the TA/TE1 implementation should embody the procedures described in Recommendation Q.921 and this Specification for B- and D-channel connection establishment and control.
For demand access connections, 6.1 through 6.4 apply. Example message flows for demand access connections are shown in Appendix II.
Two physical types of semi-permanent connections on B- and D-channels are covered in this clause:

1) physical layer semi-permanently established between the terminal and the PH/AU, i.e. the I.430 and I.431 physical layer remains activated and the physical path through the ISDN is connected semi-permanently; and

2) X.25 data link and physical layers semi-permanently established between the terminal and the PH/AU (in this type, both the user and the network shall keep the X.25 data link layer in the established state).

When a PVC is used, there must exist a type 2) semi-permanent connection.
In semi-permanent connection type 1), the procedures of 6.3 are followed for X.25 call establishment and release.
In semi-permanent connection type 2), only the procedures of 6.3.2 are followed for X.25 call establishment and release.
When semi-permanent connection type 2) is used for PVCs, none of the following procedures apply.
Semi-permanent connections are established via a provisioning process without Q.931 procedures. Telecom does not currently support semi-permanent connections for packet access.

6.1 Outgoing access

If the user selects an already established channel for the outgoing X.25 virtual call, then the procedures described in 6.3 apply. If the selected channel is not established to the AU/PH, then the procedures for activating a channel described in the following subsections are to be used before establishing the virtual call using the procedures of 6.3.
For outgoing X.25 data calls, the user first must decide whether circuit-switched (Case A) or packet-switched services (Case B) are desired from the network. For outgoing circuit calls, the user follows the procedures of 6.1.1. For outgoing packet calls, the user decides whether the B-channel or D-channel is to be used for the packet call. If the user decides to use the B-channel, then the procedures described in 6.1.2.1 are used. If the user decides to use the D-channel, then the procedures described in 6.1.2.2 are used.

NOTE – Some networks may not support every type of access. In the case of B-channel access, the network will clear a request for unsupported services by sending a RELEASE COMPLETE message with cause No. 65, *bearer capability not implemented*. In the case of a request for D-channel access (an SABME with SAPI=16), on a network port which does not support the service, no response is required of the network.

6.1.1 Circuit-switched access to PSPDN services (Case A)

Case A is not currently supported. Therefore, this clause has not been reproduced.

6.1.2 Access to the ISDN virtual circuit service (Case B)

6.1.2.1 B-channel

Demand access B-channel connections are controlled using the D-channel signalling procedures for call establishment described in 5.1 using the messages defined in 3.2 with the following exceptions:

a) the procedures for overlap sending specified in 5.1.3 do not apply;

b) the procedures for call proceeding and overlap sending specified in 5.1.5.2 do not apply;

c) the procedures for notification of interworking at the origination interface specified in 5.1.6 do not apply;

d) the procedures for call confirmation indication specified in 5.1.7 do not apply;

e) the procedures for call connection specified in 5.1.8 apply as follows:

- upon accepting the access connection, the network shall send a CONNECT message across the user-network interface to the calling user and enter the Active state;
- this message indicates to the calling user that an access connection to the packet handler has been established;
- on receipt of the CONNECT message, the calling user shall stop timer T310, if running, may optionally send a CONNECT ACKNOWLEDGE message, and shall enter the Active state;

f) the procedures for call rejection specified in 5.1.9 apply as follows:

- when unable to accept the access connection, the network shall initiate ISDN access connection clearing at the originating user-network interface as described in 5.3;

g) the procedures for transit network selection specified in 5.1.10 do not apply.

The specific B-channel to be used as a demand connection is selected using the channel selection procedures described in 5.1.2 and summarized in Table 6-1/B.

TABLE 6-1/B

User requested channel and network response,
Outgoing access to either an AU or PH

Channel indicated in the SETUP message user to network direction			Allowable network response (network-user)
Information channel selection	Preferred or exclusive	D-channel indicator (Note 1)	
Bi	Exclusive	No	Bi
	Preferred	No	Bi, Bi′
Any	(Ignore)	No	Bi′
(Absent)			Bi′

Bi The indicated (idle) B-channel

Bi′ Any (other) idle B-channel

NOTES

1 D-channel indicator shall be encoded “0” to indicate No and “1” to indicate Yes.

2 All other encodings are invalid.

3 All columns under the heading “Channel indicated in the SETUP message” indicate possible user codings of the Channel identification information element contained in the SETUP message sent by the user to the network requesting a connection to an AU or PH (see 4.5.13). The column under “Allowable network response” refers to the allowable responses by the network to the user.

For a demand connection to an ISDN PH, the Bearer capability information element included in the SETUP message shall be coded with:

- information transfer capability set to *unrestricted digital information*;

– transfer mode set to *packet mode*;

– information transfer rate set to 00000;

– user information layer 2 protocol set to *Recommendation X.25, link layer*;

– user information layer 3 protocol set to *Recommendation X.25, packet layer*.

NOTE – Octets 5a, 5b, 5c and 5d shall not be included.

The demand access connection can then be used to support packet communications according to X.25 link layer and X.25 packet layer procedures as specified in 6.3.

Some ISDNs may require the Calling party number and the Calling party subaddress information elements to be included in the SETUP message to select a specific user profile.

6.1.2.2 D-channel

D-channel access is currently supported on basic rate access only.

The D-channel provides a connection which enables the ISDN user terminal to access a PH function within the ISDN by establishing a link layer connection (SAPI=16) to that function which can then be used to support packet communications according to X.25 layer 3 procedures as defined in 6.3. The X.25 packet layer uses the acknowledged information transfer service (i.e. I-frames) provided by LAPD (see Recommendation Q.920 [45]). Consequently, Q.931 procedures are not required to provide D-channel access.

A number of packet mode user equipment can operate simultaneously over the D-channel, each using a separate ISDN layer 2 data link identified by an appropriate address (see Recommendation Q.921) in frames transferred between the user and the PH.

6.2 Incoming access

6.2.1 Access from PSPDN services (Case A)

Case A access is not currently supported. Therefore, this clause has not been reproduced.

6.2.2 Access from the ISDN virtual circuit service (Case B)

To offer an incoming X.25 call, the network must perform the following steps in sequence:

1) *Channel selection* – The physical channel/logical link to be used for the incoming call must be identified. The network may use customer profile information, network resources, etc., to choose the channel or the procedures of Step 2 below.

2) *Physical channel/logical link establishment* – If the physical B-channel or the logical link of the D-channel have not been determined by Step 1, the network may use the procedures in 6.2.2.3. The network may then proceed with Step 3.

3) *X.25 virtual call establishment* – The network establishes the virtual call using the procedures described in 6.3.

In the configuration for the ISDN virtual circuit bearer service, the choice of channel type to be used for the delivery of a new *incoming call* packet shall be made by the network as described below.

a) A new *incoming call* packet may be indicated to the ISDN customer by a call offering procedure between the network and all user packet-mode terminals (see 3.2.3.2/X.31 and 3.2.3.3/X.31 [14]).

b) An incoming virtual call directed to a terminal with an established connection to the PH may be offered directly to the terminal over the established access connection without the use of Q.931 call offering procedures (see 3.2.3.1/X.31 and 3.2.3.2/X.31 [14]).

On a primary rate access all calls will be indicated by call offering. On a basic rate access, mandatory call offering, conditional call offering and no call offering, as described in clause 3 of ITU-T Recommendation X.31 [53], can be set by subscription option.

6.2.2.1 B-channel

When X.25 calls are to be offered on the B-channels without channel negotiation, the procedures described in 5.2 using the messages of 3.2 apply with the following exceptions:

a) The procedures for overlap receiving specified in 5.2.4 do not apply.

b) The procedures for receipt of CALL PROCEEDING and ALERTING specified in 5.2.5.2 apply with the following exception:

– The receipt of an ALERTING message shall not cause the network to send a corresponding ALERTING message to the calling user.

c) The procedures for call failure specified in 5.2.5.3 apply with the following remark:

– The network clears the incoming X.25 virtual call towards the calling X.25 DTE using the appropriate cause from Table 6-4/B.

d) The procedures for notification of interworking at the terminating interface specified in 5.2.6 apply with the following exceptions:

– The case of the call entering an ISDN environment during call establishment is not applicable.

– In the case of a call leaving the ISDN environment within the called user's premises, no notification is sent to the calling party.

– The case of in-band information/patterns is not applicable.

e) The procedures for active indication specified in 5.2.8 apply with the following exception:

– The network shall not initiate procedures to send a CONNECT message towards the calling user.

f) The procedures for user notification specified in 5.9 do not apply.

Where an established B-channel connection is to be used, the *incoming call* packet will be delivered in accordance with 6.3.

Where a new B-channel connection is to be established, the identity of the selected user will be associated with the Connection Endpoint Suffix (CES) from which the first CONNECT message has been received.

6.2.2.2 D-channel

The D-channel provides a connection which enables the ISDN PH to access an ISDN user terminal or vice versa. This access is accomplished by establishing an ISDN link layer connection (SAPI=16) to the terminal or network which can then be used to support packet communications according to X.25 [5] layer 3 procedures as defined in 6.3.

The layer 2 procedures shall be in accordance with Recommendation Q.921 [3]. The D-channel provides a semipermanent connection for packet access since all D-channel layer 2 frames containing a packet-mode SAPI (16) are routed automatically between the user and the PH function.

When an incoming call is offered to packet-mode user equipment at the user interface, the channel selection procedures described in 6.2.2.3 shall be used.

A number of packet mode terminals can operate simultaneously over the D-channel, each using a separate layer 2 link identified by an appropriate TEI (see Recommendation Q.921) in frames transferred between the terminal and the network.

6.2.2.3 Call offering

6.2.2.3.1 Channel selection through call offering

The call offering procedure is performed using the layer 3 messages and procedures of clause 5. The call offering procedure is integrated into the circuit-switched call control procedures, signalled on the D-channel, with the channel selection being accomplished by means of the channel selection procedure if offered as a network option. Channel selection by call offering is available by subscription option for basic rate access.

As described in clause 5, the network selects the first user which responds to the call offering with a CONNECT message. When the selected user has requested that the X.25 call be set up over a new B-channel, the network will indicate that the channel is acceptable by returning a CONNECT ACKNOWLEDGE message to the user. If multiple terminals have responded positively to the SETUP message, the network shall clear each of the non-selected terminals with a RELEASE message containing cause No. 26, *non-selected user clearing*.

When the selected user has requested that the X.25 call be set up over an established B-channel or the D-channel, the network shall respond to the CONNECT message with a RELEASE message containing cause No. 7, *call awarded and being delivered in an established channel*. The network shall also return a RELEASE message containing cause No. 26, *non-selected user clearing* to any other positively responding terminals. The network will then deliver the X.25 virtual call over the selected channel.

NOTE 1 – There is no time significance between the delivery of the RELEASE message and the incoming call packet, i.e. either may occur first.

NOTE 2 – The network shall send the RELEASE message(s) and the user(s) shall respond with RELEASE COMPLETE. If the channel indicated by the first positively responding user is not available, the network will use Q.931 call clearing procedures to clear the call with cause No. 6, *channel unacceptable*. If the channel indicated in the SETUP message is not

acceptable to the user, the user will clear the call with a RELEASE COMPLETE message containing cause No. 34, *no circuit/Bhannel available* or cause No. 44, *requested circuit/Bhannel not available*.

On the basis of a network option or subscription agreement, the network may choose the access channel or access channel type (e.g. B or D) for a particular incoming packet call.

When the Channel indication information element indicates *Channel indication = No channel, Exclusive,* and *D-channel indication – Yes*, then the Bearer capability information element should be coded as follows:

- information transfer capability set to *unrestricted digital information*;
- transfer mode set to *packet mode*;
- information rate set to *packet mode (00000)*;
- layer 2 protocol set to *Recommendation Q.921*;
- layer 3 protocol set to Recommendation X.25, packet layer.

In all other cases, the Bearer capability information element should be encoded as follows:

- information transfer capability set to either
  a) *unrestricted digital information*; or
  b) *restricted digital information*;
- transfer mode set to *packet mode*;
- information rate set to *packet mode (00000)*;
- layer 2 protocol set to *Recommendation* X.25, *link layer*;
- layer 3 protocol set to *Recommendation* X.25, *Packet layer*.

There exists an understanding that if the terminal responds with D-channel indication set (see Table 6-2/B), the Layer 2 protocol to be used is Recommendation Q.921 (LAPD).

TABLE 6-2/B

Network requested channel and user response
Incoming access for packet-mode

Channel indicated in the SETUP message network to user direction			Allowable network response (network-user)
Information channel selection	Preferred or exclusive	D-channel indicator (Note 1)	

Bi	Exclusive	No	Bi
		Yes	Bi, D
Bi	Preferred	No	Bi, Bi′, Bj
		Yes	Bi, Bi′, Bj, D
No channel	Preferred	No	Bj
		Yes	BJ, D
	Exclusive	Yes	D

Bi Indicated (idle) B-channel

Bi′ Any other idle B-channel (not permitted in response to broadcast call offering)

Bj An established B-channel under the user's control (a semi-permanent B-channel which is allocated to the user may be indicated if the user subscribes to the unconditional notification class)

D The D-channel

NOTES

1 D-channel indicator shall be encoded "0" to indicate No and "1" to indicate Yes. 2 All other encodings are invalid.

The channel selection procedure for incoming calls is independent of the type of channel selected at the calling end. In this respect, any combination of channel type used at each end is possible, provided the user rates and available bandwidth are compatible.

The channel selection principle to be used in the procedure is shown in Table 6-2/B.

NOTE 3 – When the incoming SETUP message is sent on a broadcast data link with a Channel identification information element which indicates an idle B-channel and *preferred*, the called user is not permitted to respond with a different idle B-channel in the response. The option to respond with a different idle channel is restricted to point-to-point call offerings.

NOTE 4 – Networks providing packet-mode call offering shall provide Q.931 signalling procedures for packet-mode calls on SAPI=0. For an interim period, some networks, by subscription agreement, may offer SAPI=16 broadcast call offering procedures for providing Q.931 signalling. This option shall use all Q.931 procedures for packet-mode calls with the following restriction: All calls will be offered as *D-channel exclusive* and will not provide channel selection procedures. Terminals implementing SAPI=16 procedures should also implement SAPI=0 procedures for portability. Telecom does not support call offering on SAPI=16.

6.2.2.3.2 Information element mapping

Some networks may choose to provide a service of mapping some or all of the information from the *incoming call* packet into the SETUP message (see 3.2.3/X.31). Table 6-3/B shows the mapping of the X.25 incoming call elements to Q.931 information elements. The *incoming call* packet will still contain these fields when it is delivered. See 3.2.3/X.31 for mapping requirements.

6.2.2.3.3 Channel selection without call offering

Where the network and user have agreed beforehand, the network may route an incoming call to the called user over an established B-channel connection or D-channel link without the need for any signalling for channel selection.

6.3 X.25 virtual call establishment and release

In all cases, once the physical channel has been selected and, if necessary, connected to the PH or AU, the virtual call is established according to the procedures below. Some networks may require some of the terminal identification procedures of Recommendation X.32 as well. Not required by Telecom.

6.3.1 Link layer establishment and release

Link layer (LAPB on the B-channel or LAPD on the D-channel) establishment shall be initiated by

– the calling terminal in the case of outgoing calls; – the AU in the case of incoming calls in Case A;

or

– the PH in the case of incoming calls in Case B.

Link layer release may be initiated by:

– the terminal; – the AU in Case A; or – the PH in Case B.

TABLE 6-3/B

Mapping of X.25 information elements to corresponding Q.931 SETUP message information elements in packet-mode incoming call [a)]

	Information elements in X.25 *incoming call* packet	Corresponding information element in Q.931 SETUP message
	Calling DTE address	Calling party number (Note 6)
	Called DTE address	Called party number
	User data (UD)	~~User-user information (Note 1)~~
	A-bit (Note 2)	~~For further study~~
	D-bit	~~Packet layer binary parameters~~
	Modulus	~~Packet layer binary parameters~~
X.25 user facility	Flow control parameter negotiation	~~Packet size,~~ ~~Packet layer window size~~
	Throughput class negotiation	~~Information rate (Note 4)~~
	Fast select	~~Packet layer binary parameters~~
	Reverse charging	~~Reverse charging indication~~

	Closed user group selection	~~Closed user group~~
	Closed user group with outgoing access selection	~~Closed user group~~
	Bilateral closed user group	~~For further study~~
	Transit delay selection and indication	~~Transit delay selection and indication~~
	Call redirection and deflection notification	~~Redirecting number~~
DTE facility	Calling address extension	Calling party subaddress
	Called address extension	Called party subaddress (Note 5)
	End-to-end transit delay	End-to-end transit delay
	Minimum throughput class	~~Information rate (Note 3)~~
	Expedited data negotiation	~~Packet layer binary parameters~~
	Priority	~~For further study~~
	Protection	~~For further study~~

TABLE 6-3/B *(continued)*

Mappint of X.25 information elements to corresponding Q.931

SETUP message information elements in packet-mode incoming call a)

a) Mapping is optional or required as indicated in 3.2.3/X.31.

NOTES

1 The maximum length of the user data within the User-user information element is network dependent and is either 32 or 128 octets.

2 The need and procedures for A-bit mapping is for further study.

3 This information is not always present even when the “Information rate” is provided in the Q.931 SETUP message.

4 When the “Throughput class negotiation” is not set in the X.25 *incoming call* packet, this information shall be provided as the default throughput values applying to the virtual call.

5 The network will map bits 8 and 7 of the first octet of the called address extension facility parameter field in X.25 *incoming call* packet to *type of subaddress* field in octet 3 of the Called party subaddress information element in the Q.931 SETUP message, assuming that the X.25 *incoming call* packet is coded based on the 1988 version of X.25. Therefore, the called user should notice that the received *type of subaddress* may not be correct when the X.25 *incoming call* packet is coded based on the 1984 version of X.25. Not currently used by Telecom.

6 This mapping is mandatory and octet 3a shall be set with Presentation indicator set to *presentation allowed* and Screening indicator set to *network period*.

6.3.2 Packet layer virtual call setup and release

The packet layer procedures of Recommendation X.25 will be used for layer 3 call setup and release. The packet layer procedures will additionally be able to control and monitor the established or released state of the link layer.

In Case B, the PH may maintain a timer T320 (defined in this Recommendation). T320, if implemented, is started

a) upon clearance of the last virtual call; or

b) upon transmission of a CONNECT message by the network in case of an outgoing B-channel access connection; or

c) upon transmission of a CONNECT ACKNOWLEDGE message by the network in case of an incoming B-channel access connection; or

d) upon establishment of the link layer for D-channel access connections. T320 is cancelled upon:

1) establishment of the first (next) virtual call; or 2)

receipt of a Q.931 clearing message from the user; or

3) disconnection of the SAPI=16 link on the D-channel.

Upon expiry of timer T320, the PH will release the link layer and, in the case of B-channel access, initiate clearing of the B-channel.

Timer T320 is implemented.

X.25 logical channels are associated with their underlying logical link. Specifically, in the case of the use of the B-channel for packet communication there is an association between the logical channels and the LAPB logical link below them. Thus, the same logical channel number may be used simultaneously on each different B-channel.

6.4 Call clearing

6.4.1 B-channel access

The clearing of the switched connection shall be effected by using the D-channel signalling procedures for call clearing as specified in 5.3. For access to PSPDN services, no exceptions apply. For the ISDN virtual circuit service, the messages of 3.2 are used, and the following exceptions apply:

- The terms defined in 5.3.1 (Terminology) apply by replacing “circuit-switched ISDN connection” with “demand packet mode access connection”.
- The exception condition f) specified in 5.3.2 does not apply.
- The procedures for clearing with tones and announcements provided in 5.3.4.1 do not apply.

The B-channel may be cleared at any time by the user though, in general, it will be cleared following the clearing of the last virtual call over that B-channel. In the ISDN virtual circuit service, if the user clears the B-channel access connection using a Q.931 clearing message while X.25 virtual calls still exist on the B-channel, the network shall clear the X.25 virtual call(s) with cause No. 17, *remote procedure error*, and diagnostic No. 64, *call set-up, call clearing, or registration problem*.

In Case B, if a Q.931 RESTART message is received by the PH during the X.25 data transfer phase, the X.25 virtual calls shall be treated as follows:

- For switched virtual circuits, an X.25 *clear indication* packet shall be sent with cause No. 9, *out of order* and diagnostic No. 0, *no additional information*.
- For permanent virtual circuits, an X.25 *reset* packet shall be sent containing cause No. 9, *out of order* and diagnostic No. 0, *no additional information*.

At the expiration of timer T320, the network may disconnect the X.25 link layer and the access connection. B-channel clearing is as described in 5.3 with the exceptions above, with cause No. 102, *recovery on timer expiry*.

6.4.2 D-channel access

D-channel access connections are cleared using the disconnect procedures as defined in 6.3.

6.4.3 Additional error handling information

When an ISDN access connection failure occurs, or the X.25 virtual call is cleared prematurely, the rules of 5.8 shall apply. In addition, the following rules for determining the appropriate cause to be used shall apply in order of decreasing priority:

1) If a Q.931 clearing message or RESTART message is received by the PH during the X.25 data transfer phase, 6.4.1 applies.

2) In general, if an ISDN access connection is rejected by the destination user using Q.931 messages, the X.25 virtual call shall be cleared using a *clear indication* packet and cause No. 0, *DTE originated* with diagnostic

No. 0, *no additional information*. Some networks may map some Q.931 causes to the corresponding X.25 causes according to Table 6-4/B.

3) If a condition exists that prevents the Q.931 SETUP message from being delivered at the user-network interface, the X.25 virtual call shall be cleared using a *clear indication* packet and a cause shall be selected appropriate to the condition. Table 6-4/B shall serve as a guide to selecting an appropriate cause, i.e. the X.25 mapping of the Q.931 cause describing the interface condition shall be used.

4) If the Q.931 SETUP message is sent across the user-network interface, but no response is received prior to the second expiry of timer T303, rule No. 3 applies.

5) If the Q.931 SETUP message is sent across the user-network interface, and a response other than a call rejection is received from a user which results in the clearing of the ISDN access connection at the user-network interface, the X.25 virtual call shall be cleared using a *clear indication* packet containing cause No. 17, *remote procedure error* with diagnostic No. 64, *call setup, call clearing or registration problem.*

6) If an X.25 *clear request* packet is received from the originating user prior to the delivery of the X.25 *incoming call* packet to the called user (premature clearing), the PH shall send a *clear confirmation* packet to the calling user and the access connection shall be treated as follows:

   – If the Q.931 SETUP message was associated with the Unconditional notification class of service (see 3.2.3/X.31), the access connection, when and if established, shall be cleared. The Q.931 clearing message shall contain the appropriate cause as described in Table 6-5/B.

   – If the Q.931 SETUP message was associated with the Conditional notification class of service (see 3.2.3/X.31) and there exists at least one terminal which responds positively to the Q.931 SETUP message, then two options are allowed:

      a) the access connection is cleared as described for the Unconditional class of service; or

      b) the access connection is established and timer T320 is started. Upon expiry of timer T320, the access connection is cleared with cause No. 102, *recovery on timer expiry* and diagnostic indicating timer T320.

6.4.4 Cause mappings

6.4.4.1 Access to/from PSPDN services (Case A)

The AU may choose to follow the procedures in 6.4.4.2 when mapping between causes delivered by the ISDN or the PSPDN.

6.4.4.2 Access to/from the ISDN virtual circuit service (Case B)

There are several cases where it is necessary to map causes between this Recommendation and Recommendation X.25. ISDN networks shall use Table 6-4/B and Table 6-5/B to map the causes between Q.931 and X.25 messages. The figures in Appendix II describe some example situations.

TABLE 6-4/B

Mapping of Q.931 cause fields to X.25 cause field

Item	Q.931 cause	Code	Q.931diagnostic	X.25 cause	Code	X.25 diagnostic	Code
1	Unallocated (unassigned) number	1	Condition: unknown, transient, permanent	Not obtainable	13	Invalid called address	67
2	No route to destination	3	Condition: unknown, transient, permanent	Not obtainable	13	Invalid called address	67
3	Channel unacceptable	6	(None)	Remote procedure error	17	Call set-up, call clearing or registration problem	64

4	Normal call clearing	16	Condition: unknown, transient, permanent	DTE originated	0	No additional information	0
5	User busy	17	(None)	Number busy	1	No logical channel available	71
6	No user responding	18	(None)	Remote procedure error	17	Call set-up, call clearing or registration problem	64
7	User alerting, no answer	19	(None)	Remote procedure error	17	Call set-up, call clearing or registration problem	64
8	Call rejected	21	Condition: unknown, transient, permanent + user applied diagnostics	DTE originated	0	No additional information	0
9	Number changed	22	New destination address	Not obtainable	13	Invalid called address	67
10	Destination out of order	27	(None)	Out of order	9	No additional information	0
11	Invalid number format (incomplete number)	28	(None)	Local procedure error	19	Invalid called address	67
12	Normal, unspecified	31	(None)	DTE originated	0	No additional information	0
13	No circuit/Bhannel available	34	(None)	Number busy	1	No logical channel available	71
14	Network out of order	38	(None)	Out of order	9	No additional information	0

TABLE 6-4/B *(continued)* **Mapping of Q.931 cause fields to X.25 cause field**

Item	Q.931 cause	Code	Q.931diagnostic	X.25 cause	Code	X.25 diagnostic	Code
15	Temporary failure	41	(None)	Out of order	9	No additional information	0
16	Switching equipment congestion	42	Network identity	Network congestion	5	No additional information	0
17	Requested circuit/Bhannel available	44	(None)	Number busy	1	No logical channel available	71
18	Resources unavailable, unspecified	47	(None)	Network congestion	5	No additional information	0
19	Quality of service unavailable	49	Condition: unknown, transient, permanent	Network congestion	5	No additional information	0
20	Bearer capability not authorized	57	Attribute number	Incompatible destination	33	No additional information	0

21	Bearer capability not presently available	58	Attribute number	Remote procedure error	17	Call set-up, call clearing or registration problem	64
22m	Service or option not available, unspecified	63	(None)	Remote procedure error	17	Call set-up, call clearing or registration problem	64
23	Bearer service not implemented	65	Attribute numbers	Incompatible destination	33	No additional information	0
24	Channel type not implemented	66	Channel type	Remote procedure error	17	Call set-up, call clearing or registration problem	64
25	Service or option not implemented, unspecified	79	(None)	Remote procedure error		Call set-up, call clearing or registration problem	64
26	Valid call reference value	81	(None)	Remote procedure error	17	Call set-up, call clearing or registration problem	64
27	Identified channel does not exist	82	Channel identity	Remote procedure error	17	Call set-up, call clearing or registration problem	64
28	Incompatible destination	88	Incompatible parameter	Incompatible destination	33	No additional information	0
29	Invalid message, unspecified	95	(None)	Remote procedure error	17	Call set-up, call clearing or registration problem	64
30	Mandatory information element is missing	96	Information element identifier(s)	Remote procedure error	17	Call set-up, call clearing or registration problem	64
31	Message type nonexistent or not implemented	97	Message type	Remote procedure error	17	Call set-up, call clearing or registration problem	64
32	Message not compatible with call state or message type non-existent or not implemented	98	Message type	Remote procedure error	17	Call set-up, call clearing or registration problem	64

33	Information element non-existent or not implemented	99	Information element identifier(s)	Remote procedure error	17	Call set-up, call clearing or registration problem	64

TABLE 6-4/B *(end)*

	X.25 cause in clear indication packet				Q.931 error condition		
Item	X.25/X.96 cause	Code	Diagnostic	Code	Q.931 cause	Code	Diagnostic
1	DTE originated	0	No additional information	0	Normal call clearing	16	(None)
		1XX	DTE specified	XX			
2	Network congestion	5	No additional information	0	Switchting equipment congestion	42	(None)
3	Out of order	9	No additional information	0	Destination out of order	27	(None)
4	Remote procedure error	17	(Any allowed)		Protocol error, unspecified	111	(None)

NOTE – Instead of providing the above mapping of X.25 to Q.931, the PH, as a network option, may code the Q.931 Cause information element to indicate *CCITT Coding Standard* in octet 3, X.25 in octet 3a, and code octets 4 and 5 according to Recommendation X.25, copying the cause from the X.25 *clear indication* packet rather than mapping it to a Q.931 cause.

Mapping of Q.931 cause fields to X.25 cause field

Item	Q.931 cause	Code	Q.931diagnostic	X.25 cause	Code	X.25 diagnostic	Code
34	Invalid information element contents	100	Information element identifier(s)	Remote procedure error	17	Call set-up, call clearing or registration problem	64
35	Message not compatible with call state	101	Message type	Remote procedure error	17	Call set-up, call clearing or registration problem	64
36	Recovery on timer expiry	102	Timer number	Remote procedure error	17	Call set-up, call clearing or registration problem	64
37	Protocol error, unspecified	111	(None)	Remote procedure error	17	Call set-up, call clearing or registration problem	64
38	Interworking, unspecified	127	(None)	Remote procedure error	17	Call set-up, call clearing or registration problem	64

NOTES

1 When clearing occurs during the X.25 data transfer phase, the procedure described in 6.4.1 should be used.

2 When a Q.931 RESTART message is received during the X.25 data transfer phase, switched virtual circuits shall be cleared with a *clear indication* packet containing cause No. 9, *Out of order*, with diagnostic No. 0, *no additional information*. Permanent virtual circuits shall have an X.25 *reset* packet sent with the same cause and diagnostic.

6.5 Access collision

When the network offers a packet-mode call at the interface simultaneously with the user requesting a packet-mode call, the network shall give priority to the completion of the incoming call. If the user determines that accepting the incoming call would meet the needs of its own outgoing call request, the user may clear the call request and accept the incoming call.

TABLE 6-5/B

Mapping of X.25 cause to Q.931 cause for premature clearing of the incoming call B7 - 1

7 User signalling bearer service call control procedures

7.1 General characteristics

This feature allows the users to communicate by means of user-to-user signalling without setting up a circuit-switched connection. A temporary signalling connection is established and cleared in a manner similar to the control of a circuitswitched connection.

Not currently used by Telecom.

8 Circuit-mode multirate (64 kbit/s base rate) procedures

This clause provides the D-channel signalling procedures in support of circuit-mode multirate (64 kbit/s base rate) bearer capability.

Not currently used by Telecom.