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TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

X.36

Amendment 3
(09/98)

SERIES X: DATA NETWORKS AND OPEN SYSTEM COMMUNICATIONS

Public data networks – Interfaces

Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for public data networks providing frame relay data transmission service by dedicated circuit

Amendment 3: Frame discard priority, service classes, NSAP signalling and protocol encapsulation

ITU-T Recommendation X.36 – Amendment 3
Superseded by a more recent version

(Previously CCITT Recommendation)

Superseded by a more recent version

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ITU-T RECOMMENDATION X.36

INTERFACE BETWEEN DATA TERMINAL EQUIPMENT (DTE) AND DATA CIRCUIT-TERMINATING EQUIPMENT (DCE) FOR PUBLIC DATA NETWORKS PROVIDING FRAME RELAY DATA TRANSMISSION SERVICE BY DEDICATED CIRCUIT

AMENDMENT 3

Frame discard priority, service classes, NSAP signalling and protocol encapsulation

Summary

Amendment 3 to Recommendation X.36 contains the following capabilities: Frame discard priority, service classes, NSAP signalling and protocol encapsulation identification. Frame discard priority is an optional network facility. It allows networks and DTEs to apply different discard priority to virtual circuits. When frames have to be discarded, the discard priority class assigned to the underlined frame relay SVC or PVC is taken into consideration to determine the discard order. Frame relay service classes allow the assignment of a delay and frame loss class to virtual circuits. The NSAP signalling capability allows the coding in the signalling messages of a DTE number as an NSAP. Protocol encapsulation identification extends the coding of the Low layer compatibility information element to indicate that over an SVC either multiprotocol encapsulation or a given protocol is used; it also allows DTEs to negotiate the encapsulated protocol.

Source

Amendment 3 to ITU-T Recommendation X.36, was prepared by ITU-T Study Group 7 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on the 25th of September 1998.

FOREWORD

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The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation the term *recognized operating agency (ROA)* includes any individual, company, corporation or governmental organization that operates a public correspondence service. The terms *Administration*, *ROA* and *public correspondence* are defined in the *Constitution of the ITU (Geneva, 1992)*.

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As of the date of approval of this Recommendation, the ITU had received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

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AMENDMENT 3

Frame discard priority, service classes, NSAP signalling and protocol encapsulation

(Geneva, 1998)

1) Insert new subclauses 13.2 through 13.4.2.3.

13.2 Frame discard priority

13.2.1 General description

The frame discard priority at the user-network interface is an optional network facility. It allows networks and DTEs to apply different frame discard priorities to virtual circuits at the UNI. Each discard priority can be associated with a different frame loss ratio. When frame relay frames have to be discarded under adverse network conditions, frames belonging to a virtual circuit assigned a lower frame discard priority will be discarded by the network prior to those belonging to virtual circuits assigned higher frame discard priorities. Frame discard priorities are assigned per virtual circuit at the UNI and may be assigned for each direction of data transmission.

13.2.2 Service provisioning and signalling

Supporting the frame discard priority service is a network option. It is also a network option to support a different frame discard priority per direction of data transmission. If a network does not support different frame discard priorities for each direction, the highest requested priority is used for both directions.

For permanent virtual circuits, Frame discard priority is assigned at subscription time. For switched virtual circuit, subscription parameters may be required to manage by the networks the usage of frame discard priorities. Frame discard priority is requested by the calling DTE, the request is processed by the network and transmitted to the called DTE. When progressing the call setup, the network accommodates the request of the calling DTE based on its own frame discard priority capabilities.

Although the assignment of frame discard priority is different between switched virtual circuits and permanent virtual circuits, its operation is similar during the data transfer phase.

It is the responsibility of network operators to build mechanisms that will lead DTEs to request different frame discard priorities. Such mechanisms could be based on items or combinations of items of the following non-exhaustive and non-constraining list. Items defined for a DTE/DCE interface and per priority are:

– A different tariff.

– A maximum number (Note 1) of VCs (PVCs + SVCs) per interface.

– A maximum limit to frame information field size per VC.

– A maximum limit (Note 1) to sum of CIR, aggregated per interface.

– A maximum limit (Note 1) to sum of (CIR + EIR) (Note 3), aggregated per interface.

– A maximum limit (Note 1) to sum of Committed burst size, aggregated per interface.

– A maximum limit (Note 1) to sum of Excess burst size, aggregated per interface.

– A maximum limit (Note 2) to individual CIR, i.e. per PVC.

– A maximum limit (Note 2) to individual (CIR + EIR) (Note 3), i.e. per VC.

– A maximum limit (Note 2) to individual Excess burst size, i.e. per VC.

NOTE 1 – Actual value can be an absolute figure or a function of access rate of the DTE/DCE interface.

NOTE 2 – Actual value can be an absolute figure or a function based on the minimum of access rate of the two considered DTE/DCE interfaces.

NOTE 3 – CIR + EIR = CIR (1 + Be/Bc).

Regarding traffic policing based on link layer core parameters, different behaviours may exist based on frame discard priority classes (possibly more constraining on highest one) in cases where CIR and EIR are exceeded.

13.2.2.1 Frame discard priority indices and classes

A Frame discard priority class corresponds to a distinct frame discard priority supported by the network. The number and characteristics of frame discard priority classes rely highly on internal network capabilities and as such cannot be standardized.

A frame discard priority index is an integer from zero to seven used at the DTE/DCE interface to signal a frame discard priority:

- Frame discard priority 0: Lowest frame discard priority. Virtual circuits assigned this frame discard priority will have their frames discarded first. This should result in the highest frame loss ratio.

- Frame discard priority 7: Highest frame discard priority. Virtual circuits assigned this frame discard priority will have their frames discarded last. This should result in the lowest frame loss ratio.

Frame discard priority indices can be grouped into frame discard priority classes within a network, each of which corresponds to a distinct frame discard priority. A frame discard priority index has a local significance. It has a local meaning determined according to the service description of the network a DTE is connected to.

13.2.2.2 Conformance to the frame discard priority service

In order to conform to the frame discard priority service, a network must ensure that its mapping between frame discard priority indices and classes always satisfies the following propositions:

Let i and j be two frame discard priority indices with $i < j$;
then $FDP\_Class(i) \leq FDP\_Class(j)$

In other words, if i and j are two frame discard priority indices such that i is smaller than j, the frame discard priority class (FDP_Class) assigned to a virtual circuit requesting a frame discard priority index equal to i shall not be greater than the frame discard priority class assigned by the network to a virtual circuit requesting a frame discard priority index equal to j. It may, however, be equal (if i and j map to the same frame discard priority class).

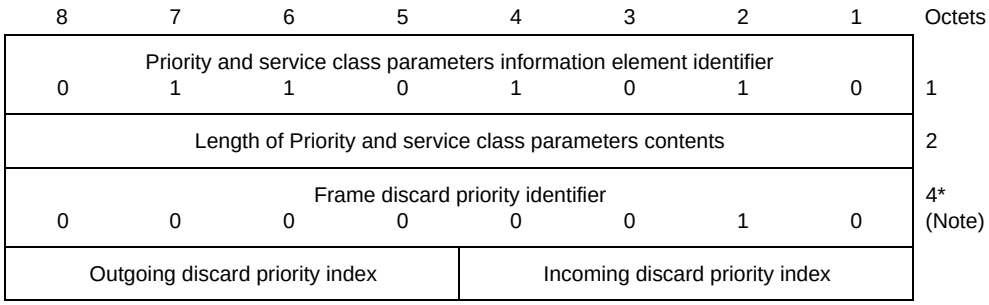
In addition, a network must ensure that if FDP_Class (j) > FDP_Class (i), the performance bound such as frame loss ratio assigned to FDP_Class (j) is better than that assigned to FDP_Class (i). This text does not specify what is meant by "better", nor does it define specific performance bounds. This is the prerogative of the service provider. Intuitively, it should be expected that a higher FDP_Class would support a lower frame loss ratio.

13.2.3 Frame discard priority and other frame relay parameters

While both frame discard priority and the frame relay discard eligibility (DE) bit deal with frame discards, they function differently but in a complementary manner. At a given point in time when a network supporting multiple virtual circuits of different frame discard priority classes decides to discard frames due to congestion, all frames with DE bits ON (called EIR traffic/frames), regardless of the frame discard priority classes assigned to the connections they belong to, are discarded ahead of frames with DE bit OFF (called CIR traffic/frames). In other words, EIR traffic is treated as the least critical traffic and is discarded first. In the event of continuing congestion, if necessary, CIR frames are then discarded according to their assigned frame discard priorities: CIR frames belonging to connections with lower frame discard priority values will be discarded ahead of those belonging to connections with higher frame discard priority values.

13.2.4 Priority and service class parameters information element

The purpose of the Priority and service class parameters information element is to select and identify the frame transfer and/or discard priority indices of a switched virtual circuit or a service class. The priority and service class parameters information element is shown in Figure 13-2.1/X.36 and in Table 13-3/X.36.



NOTE – Octet group 3 is defined in 13.1. The frame transfer and discard priority parameters are optional and position independent.

Figure 13-2.1/X.36 – Priority and service class parameters information element

Table 13-3/X.36 – Priority and service class parameters information element

Outgoing Frame Discard Priority index (octet 4.1 bits 5-8) (Notes 1 and 2)
A binary number in the range of 0 to 7 indicating the Frame Discard Priority index in the outgoing direction. 0 denotes the lowest priority (first to be discarded) and 7 the highest. Other values (8 to 15) are reserved.
Incoming Frame Discard Priority (octet 4.1 bits 1-4) (Notes 1 and 2)
A binary number in the range of 0 to 7 indicating the Frame Discard Priority index in the incoming direction. 0 denotes the lowest priority (first to be discarded) and 7 the highest. Other values (8 to 15) are reserved.
NOTE 1 – A frame discard priority index has a local significance.
NOTE 2 – The term *outgoing* refers to the calling to called DTE direction and the term *incoming* refers to the direction from the called to calling DTE.

13.2.5 SETUP message

Table 10-9/X.36 (SETUP message) is modified as per clause 13 to include the Priority and service class parameters information element. The modified contents of the SETUP message appear in Table 13-2/X.36.

13.2.6 Procedures

The procedures specified in this subclause are specific to the frame discard priority. They are extensions to the procedures specified in Amendment 1 of Recommendation X.36.

13.2.6.1 Actions by the calling DTE

To request a specific frame discard priority for each direction of a switched virtual circuit, the calling DTE has to include the Priority and service class parameters information element in the SETUP message with the requested frame discard indices. The discard indices for the outgoing and incoming directions can be the same or different.

13.2.6.2 Actions by the network

Upon receiving a SETUP message from the calling DTE/DCE interface that includes frame discard priority indices in the Priority and service class parameters information element, the network maps these indices to its internal frame discard priority classes that it supports. If a network does not support a different frame discard priority per data

transmission direction, the highest priority index is used for both directions. A network may assign a default discard priority class to a switched virtual connection when the calling DTE has not signalled a discard priority. The value of this default is network dependent.

The SETUP message transmitted by the network to the called DTE contains frame discard priority indices in the Priority and service class parameters information element as requested by the calling DTE.

If the network is unable to provide the requested Frame Discard Priorities, it will reject the setup request with cause No. 49, *Quality of Service not available.* If the priority and service class parameters information element is not recognized by the network, the error handling procedures for unrecognized information element apply. When applicable, cause No. 29, *Facility rejected*, or cause No. 50, *Requested facility not subscribed*, may also be used.

In cases where the network puts some limits on the use of given priorities as described in 13.2.2 and if a particular limit is exceeded at call setup, the network can adjust the link layer core parameters or clear the call.

13.2.6.3 Actions by the called DTE

If the called DTE receives a SETUP message containing a Priority and service class parameters information element, it may either accept the call if the requested frame discard priority indices for the outgoing and incoming directions are acceptable, or reject it if any of the requested frame discard priority index is not acceptable with a cause No. 49, *Quality of Service not available.*

13.3 Frame Relay Service Class

13.3.1 General description

Frame Relay Service Class is an optional facility allowing Frame Relay networks to apply different Quality of Service Classes to Frame Relay virtual circuits to meet delay and loss requirements for different applications. During the data transfer phase, frames will be processed such that the performance characteristics of the subscribed or requested Service Class will be met.

The use of Frame Relay Service Class at the DTE/DCE interface is by subscription for a PVC or by signalling for SVCs. For SVCs, the Service Class is requested by the calling DTE by signalling a service class number at the time of call establishment.

Defined Service Classes are specified in Table 13-4/X.36. Each Service Class has associated maximum end-to-end delay and loss values as appropriate for the requirements of applications for each class. Service Classes and their defined delay and loss parameter values will be as specified in Recommendation X.146.

Table 13-4 /X.36 – Service class description

Service class number	Support requirement	Application notes
0	Mandatory, default class	Unbounded frame loss and delay requirements
1	Mandatory	Moderate frame loss and moderate delay requirements
2	Optional	Stringent frame loss and moderate delay requirements
3	Optional	Stringent frame loss and stringent delay requirements

13.3.2 Priority and service class parameters information element

The Priority and service class parameters information element is used to convey information in the Setup message on the Service Class applicable to the call.

The Priority and service class parameters information element is shown in Figure 13-3/X.36 and in Table 13-5/X.36.

8	7	6	5	4	3	2	1	Octets
Priority and service class parameters information element identifier								
0	1	1	0	1	0	1	0	1
Length of the Priority and service class parameters contents								2
Service class identifier								5*
0	0	0	0	0	0	1	1	(Note)
Service class value								5.1*

NOTE – Octet group 3 is defined in 13.1. Octet group 4 is defined in 13.2.

Figure 13-3/X.36 – Priority and service class parameters information element

Table 13-5/X.36 – Priority and service class parameters information element

Service class value (Octet 5.1)* A binary number in the range of 0 to 3 indicating the specified Service Class. Other values are reserved. Service classes and their associated Quality of Service characteristics are standardized – see Table 13-4/X.36 and Recommendation X.146.

13.3.3 SETUP message

Table 10-9/X.36 SETUP message is modified as per 13.1 (see Amendment 2 of Recommendation X.36) to include the Priority and service class parameters information element. The modified contents of the SETUP message appear in Table 13-2/X.36.

13.3.4 Procedures

13.3.4.1 Action by the calling DTE

To request a particular Service Class, the calling DTE includes a Service Class Parameter Priority and service class parameters information element in the SETUP message with a value set to the Service Class number corresponding to the Service Class selected.

13.3.4.2 Action by the network

Upon reception of a Service Class parameter in the Priority and service class parameter information element of the SETUP message, the network will set up an SVC taking the requested Service Class value into account in the SVC establishment procedures.

If Service Class parameter is not included in the Priority and service class parameter information element of the SETUP message, the network's default Service Class (Service Class 0) will be used in the SVC establishment procedures.

If unable to establish the call with the specified service class parameter value, the network will clear the call with cause No. 49, *Quality of Service not available*.

The network signals to the called DTE the service class associated within the network to the call being presented by inserting a Service Class parameter in the Priority and service class parameter information element of the SETUP message, the value being the same as the one sent by the calling DTE.

13.3.4.3 Action by the called DTE

The Called DTE may use the signalled Service Class parameter value in the Priority and service class parameters information element of the SETUP message to apply an internal Quality of Service mechanism.

If the Called DTE can accept the incoming call with the indicated Service Class parameter value, normal call establishment procedures will be followed.

If the Called DTE cannot accept the incoming call with the indicated Service Class parameter value, it will clear the call using cause No. 49, *Quality of Service not available*.

13.4 Support of both Service Class and Priorities

13.4.1 General description

Networks may support Service Class, Priorities, both or none.

Networks will make known by administrative means whether Service Classes, Priorities, or both, are available at a DTE/DCE interface.

In the case where a network provides both options, two modes of operation are possible:

– An optional DTE subscription option that indicates whether the DTE supports Service classes or priorities.

– No DTE subscription.

In any case, on a per PVC or on a per SVC basis, network supports either service class or Priority(ies) but not both at the same time on the same PVC or SVC.

13.4.2 Procedures

13.4.2.1 Action by the calling DTE

In the optional DTE subscription option, the calling DTE is expected to always request either priorities or service classes.

In the no DTE subscription case, the calling DTE will include either Service class parameter or Priority(ies) parameter(s) in the Priority and service class parameters information element of the SETUP message.

13.4.2.2 Action by the network

In the optional DTE subscription option, the network acts at the calling DTE/DCE interface according to what the DTE has subscribed to. Refer to 13.1.5.2 and 13.2.6.2 for Priorities and to 13.3.4.2 for Service classes.

In the no DTE subscription case, the network acts at the calling DTE/DCE interface according to what the DTE signals on a per call basis. Refer to 13.1.5.2 and 13.2.6.2 for Priorities and to 13.3.4.2 for Service classes.

NOTE – In the error case, where both Service Class and Priority parameters are received in the Priority and Service Class information element of the SETUP message, the network will act on Service Class parameter if it appears first and will discard any Priority parameters. Alternatively, if a Priority parameter appears first, the network will discard any Service Class parameter.

At the called DTE/DCE interface, the network will insert either Priority parameter(s) or Service class parameter in the Priority and Service class parameters information element of the SETUP message, according to the DTE subscription if this option is supported. When the priority(ies) or service class associated within the network to the call being presented are not compatible with the subscription parameter of the called DTE, mapping from priority(ies) to the best matching service class or from service class to the best matching priority(ies) occurs.

In the no DTE subscription option, the network signals to the called DTE either the service class or the priority(ies) associated with the call being presented by inserting a Service Class parameter or Priority parameter(s) in the Priority and service class parameter information element of the SETUP message.

13.4.2.3 Action by the called DTE

When it supports either priorities or service class, the called DTE acts accordingly. Refer to 13.1.5.3 and 13.2.6.3 for Priorities and to 13.3.4.3 for Service classes.

When it supports both priorities and service class, the called DTE acts according to what the network signals on a per call basis. Refer to 13.1.5.2 and 13.2.6.2 for Priorities and to 13.3.4.2 for Service classes.

NOTE – In the error case where both Service Class and Priority parameters are received in the Priority and Service Class information element of the SETUP message, the called DTE will ignore the non-supported parameters. When it supports both Service class and Priority parameter(s), the called DTE will act on Service Class parameter if it appears first and will discard any Priority parameters. Alternatively, if a Priority parameter appears first, the called DTE will discard any Service Class parameter.

2) Insert new Annex F.

Annex F

Use of NSAP at the DTE/DCE interface

F.1 Introduction

Network Service Access Point (NSAP) addresses are defined in Annex A to ITU-T Rec. X.213 | ISO/IEC 8348. Some public ATM networks use the NSAP structure known as an ATM End System Address (AESA) to address end systems. To interwork between those ATM networks and frame relay networks using Recommendation X.36, it is essential to:

- allow the encoding of frame relay DTE X.121 numbers as NSAP so that ATM networks and ATM end systems can use them in signalling messages;
- allow frame relay DTEs to signal ATM end system addresses based on IDC, DCC and E.164 NSAP formats.

The purpose of this annex is to provide extensions to the basic signalling defined in clause 10 of Amendment 1 of Recommendation X.36 to allow the use of NSAP at the DTE/DCE interface and to recommend a coding of the Domain Specific Part (DSP) field of the NSAP. It also provides information on the coding of IDC, DCC and E.164 as supported in ATM networks.

It should be noted that the support of addresses coded according to the NSAP structure is a network option. Further, it does not imply that a public frame relay network will utilize a numbering plan other than E.164 or X.121 to identify DTEs.

F.2 Changes to the called party information element

To signal in the called party number information element an ATM End System Address (AESA) coded as an NSAP, the Called party number information element of 10.5.6 is modified as follows:

Type of number (*octet 3*)

Bits 7 6 5	
1 0 1	Alternative address (see Numbering plan identification below)

Numbering plan identification coding (octet 3) when type of address is alternative address

Bits
4 3 2 1
0 0 0 1 ISO NSAP address coded in accordance with Annex A to ITU-T Rec. X.213 | ISO/IEC 8348 and this annex

Valid combination of TON and NPI:		
Type of number	Numbering plan identification	Format
Alternative address	ISO NSAP	NSAP address (Note)
NOTE – This combination is used to allow the coding of an NSAP. The support of this combination is a network option. It is used to provide interworking of frame relay and ATM networks. The use of this combination does not imply that a frame relay network supports the numbering plans or addressing schemes identified in the NSAP. It rather allows the selection of a route towards a frame relay/ATM interworking unit.		

F.3 Changes to the calling party information element

To allow frame relay networks and DTEs to receive in the Calling party number information element the address of an ATM end system coded as an NSAP, the Calling party number information element is modified as follows:

Type of number (*octet 2*)

1 0 1 Alternative address (see Numbering plan identification below)

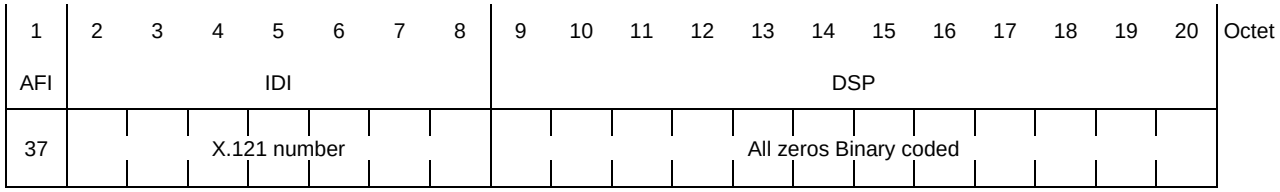
Numbering plan identification coding (octet 3) when type of address is alternative address

Bits
4 3 2 1
0 0 0 1 ISO NSAP address coded in accordance with Annex A to ITU-T Rec. X.213 | ISO/IEC 8348.

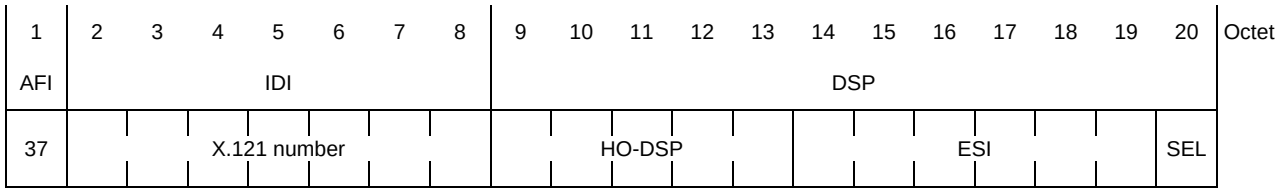
Valid combination of TON and NPI:		
Type of number	Numbering plan identification	Format
Alternative address	ISO NSAP	NSAP address (Note)
NOTE – This combination is used to allow the carriage of an address coded as an NSAP.		

F.4 Encoding of X.121 numbers as NSAP

Figure F.1/X.36 shows how to encode an X.121 number as an NSAP. There are two formats: The first one is with a null DSP and the second one with a non-null DSP. For case b) of Figure F.1/X.36, the DSP is structured according to ISO/IEC 10589. The same approach for embedding E.164 numbers in an NSAP structure is used in this Annex for X.121 numbers.



a) X.121 number with a null DSP



b) X.121 number with a non-null DSP

Figure F.1/X.36 – X.121 number embedded in NSAP format

Coding principles:

– The NSAP has a fixed length of 20 octets. It consists of three fields: The AFI, IDI and DSP.

– The AFI has a value of 37, it is encoded in "Binary Coded Decimal" (BCD). The hexadecimal value of the AFI is "37".

– The IDI field contains an X.121 number of up to 14 digits. If the length of the X.121 number is less than 14 digits, padding is done according to the preferred padding method of Annex A to ITU-T Rec. X.213 | ISO/IEC 8348 (see below). The X.121 number is BCD coded.

– The DSP is 12 octets long and is binary coded. It contains either zeros [null DSP, case a) of Figure F.1] or contains the following three fields: HO-DSP, ESI and SEL following ISO/IEC 10589 structure of the DSP and the AESA using DCC, IDC and E.164 IDI.

– Padding of the IDI:

  - Step 1: If necessary, the IDI is padded with leading zeros to obtain the maximum IDI length (14 digits for X.121 number).

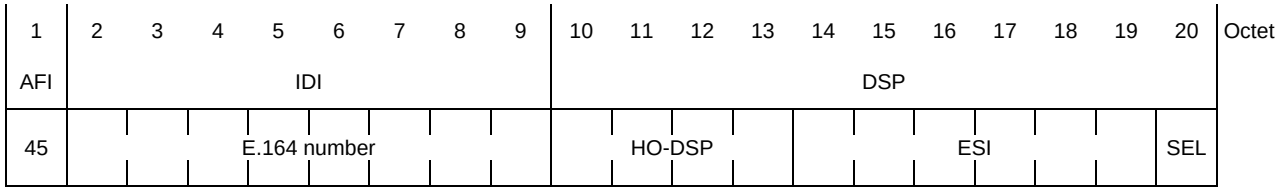
  - Step 2: If necessary, pad the last half octet of the IDI with '1111' to obtain an integral number of octets.

Padding with zeros is the only allowed padding since no significant zeros are allowed in the IDI; the AFI value of 37 reflects this fact.

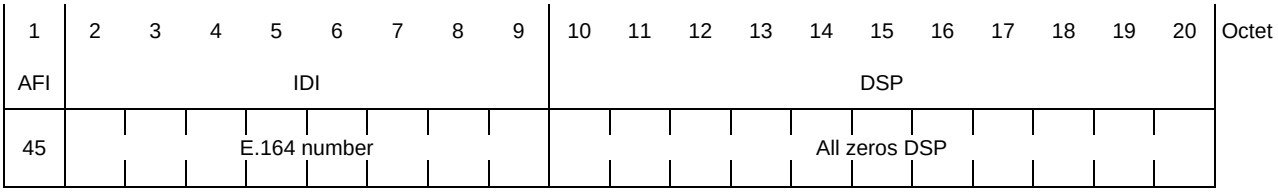
F.5 Encoding of E.164 numbers as NSAP

This subclause provides the NSAP coding of E.164 used by some public ATM networks. The coding follows the preferred coding of Annex A of ITU-T Rec. X.213 | ISO/IEC 8348. The coding provided here is also applicable to frame relay networks using Recommendation E.164 as the numbering plan for DTEs.

1) E.164 AESA with a non-null DSP



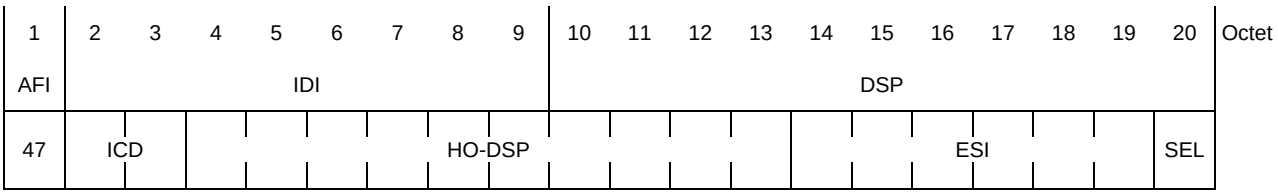
2) Native E.164 embedded in an NSAP format



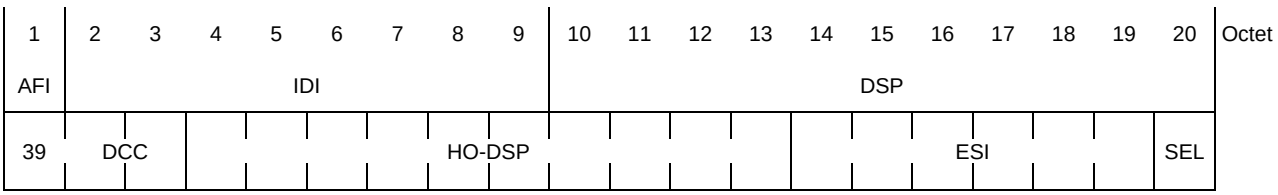
F.6 Existing coding of other ATM End System Addresses

Besides E.164 numbers coded as NSAP, ATM end system can be addressed using the following two formats: DCC and ICD.

1) ICD AESA format



2) DCC AESA format



3) Add extensions to Recommendation X.36 Amendment 1 clause 10 on Protocol Encapsulation over Frame Relay.

10.4.2 CONNECT

This message is sent by the called DTE to the DCE and by the DCE to the calling DTE to indicate that the called DTE has accepted the request to establish a switched virtual circuit.

Table 10-3/X.36 – CONNECT message content

Message type: CONNECT
Significance: Global
Direction: Both

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.5.1	Both	M	1
Call reference	10.5.2	Both	M	3
Message type	10.5.3	Both	M	1
Data Link Connection Identifier	10.5.14	Both	O (Note1)	4-6
Link layer core parameters	10.5.15	Both	O (Note 2)	2-27
Connected number	10.5.12	Both	O (Note 3)	2-*
Connected subaddress	10.5.13	Both	O (Note 4)	2-23
Low layer compatibility	10.5.17	Both	O (Note 6)	2-*
User-user	10.5.20	Both	O (Note 5)	2-131

NOTE 1 – Mandatory in the DTE-to-DCE direction when the called DTE replies to the incoming SETUP message with a CONNECT message. In all other cases, it is optional.

NOTE 2 – Mandatory in both directions to indicate the final parameters to be used for the call.

NOTE 3 – If included by the called DTE in the DTE-to-DCE direction, then its presence is optional in the DCE-to-DTE direction if it is the same as the Called party number presented to the called DTE in the SETUP message. Its presence is mandatory in the DCE-to-DTE direction if it is different from the called party number presented to the called DTE in the SETUP message.

NOTE 4 – Included in the DCE-to-DTE direction at the calling DTE/DCE interface if it was included in the DTE-to-DCE direction at the called DTE/DCE interface to identify the connected subaddress to the calling DTE.

NOTE 5 – Included in the DCE-to-DTE direction at the calling DTE/DCE interface if it was included in the DTE-to-DCE direction at the called DTE/DCE interface to pass user data from the answering DTE to the calling DTE.

NOTE 6 – Included in the DCE-to-DTE direction at the calling DTE/DCE interface if it was included in the DTE-to-DCE direction at the called DTE/DCE interface. See procedures D.6/X.36.

10.4.8 SETUP

This message is sent by the calling DTE to the DCE, and by the DCE to the called DTE to initiate the establishment of the Frame Relay switched virtual circuit.

Table 10-9/X.36 – SETUP message content

Message type: SETUP
Significance: Global
Direction: Both

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.5.1	Both	M	1
Call reference	10.5.2	Both	M	3
Message type	10.5.3	Both	M	1
Bearer capability	10.5.4	Both	M	5
Data Link Connection Identifier	10.5.14	n → u	M (Note 1)	4-6
Closed user group	10.5.11	Both	O	4-7
Link layer core parameters	10.5.15	Both	O (Note 2)	2-27
Link layer protocol parameters	10.5.16	Both	O	2-*
Reverse charging indication	10.5.18	Both	O	3
Calling party number	10.5.8	Both	O (Note 3)	2- *
Calling party subaddress	10.5.9	Both	O (Note 4)	2-23
Called party number	10.5.6	Both	O (Note 5)	2- *
Called party subaddress	10.5.9	Both	O (Note 6)	2-23
Transit network selection	10.5.19	Both	O	2- *
Low layer compatibility	10.5.17	Both	O (Note 7)	2- *
User-user	10.5.20	Both	O (Note 6)	2-131

NOTE 1 – Mandatory in the DCE-to-DTE direction. Not allowed in the DTE-to-DCE direction.

NOTE 2 – Included in the DTE-to-DCE direction when the calling DTE wants to indicate the proposed link layer core parameters to the network. Always include in the DCE-to-DTE direction. If the link layer core parameters information element is missing, or partially specified, in the DTE-to-DCE direction, the network will use default values and will present them to the called DTE.

NOTE 3 – Mandatory in the DCE-to-DTE direction to identify the calling user. Optional in the DTE-to-DCE direction.

NOTE 4 – Included in the DCE-to-DTE direction if the calling party included this information element in the DTE-to-DCE direction.

NOTE 5 – Mandatory in the DTE-to-DCE direction to identify the called user. Included in the DCE-to-DTE direction when called party number information is to be conveyed to the called DTE (e.g. when the called DTE is a private network).

NOTE 6 – Included in the DCE-to-DTE direction at the called DTE/DCE interface if it was included by the calling DTE.

NOTE 7 – Included in the DCE-to-DTE direction at the called DTE/DCE interface if it was included by the calling DTE. This information element may be repeated according to the procedures in D.6/X.36.

10.5.17 Low layer compatibility

The purpose of the Low layer compatibility information element is to provide a means which should be used for compatibility checking by an addressed entity (e.g. remote DTE or an interworking unit or a high layer function of a DCE node addressed by the calling DTE). The Low layer compatibility information element(s) is/are transferred transparently by a frame relay network between the calling DTE and the addressed entity. The Low layer compatibility information element is coded as shown in Figure 10-19/X.36. Low layer compatibility negotiation may be performed according to the procedures in Annex D/X.36.

8	7	6	5	4	3	2	1	Octet
0	Low layer compatibility information element identifier 1	1	1	1	1	0	0	1
Length of the low layer compatibility contents								2
ext. 1	Coding standard 0	0	Information transfer capability 0	1	0	0	0	3
ext. 1	Transfer Mode 0	1	Reserved 0	0	0	0	0	4
ext. 0/1	Layer 2 ident. 1	0	User information layer 2 protocol					6 (Notes 1, 4)
ext. 1	Reserved 0	0	SREJ use	Modulo		Address inclusion		6a*
ext. 1	User specified							6a*
ext. 0/1	Layer 3 ident. 1	1	User information layer 3 protocol					7*
ext. 1	User specified layer 3 protocol information							7a*
ext. 0	ISO/IEC TR 9577 Initial Protocol Identifier (IPI) bits 8-2							7a*
ext. 1	IPI (bit 1)	Spare 0	0	0	0	0	0	7b* (Note 2)
ext. 1	SNAP ID 0	0	Spare 0	0	0	0	0	8* (Note 3)
OUI Octet 1								8.1* (Note 3)
OUI Octet 2								8.2* (Note 3)
OUI Octet 3								8.3* (Note 3)
PID Octet 1								8.4* (Note 3)
PID Octet 2								8.5* (Note 3)

NOTE 1 – Octet group 5 defined in Recommendation Q.933 is not used in Recommendation X.36.

NOTE 2 – These octet(s) may be present only if octet 7 indicates ISO/IEC TR 9577.

NOTE 3 – This octet group shall be present only if octet 7 indicates ISO/IEC TR 9577 and octets 7a and 7b indicate IEEE 802.1 SNAP.

NOTE 4 – Octet group 6 is omitted if no layer 2 protocol is used.

Figure 10-19/X.36 – Low layer compatibility information element

Table 10-23/X.36 – Low layer compatibility information element

Information transfer capability (octet 3)

Bits
5 4 3 2 1
0 1 0 0 0 Unrestricted digital information

All other values are reserved.

User information layer 2 protocol (octet 6)

Bits
5 4 3 2 1
0 0 0 0 1 Basic ISO 1745
0 0 1 1 0 X.25 link level (Note 1)
0 0 1 1 1 X.25 multilink level (Note 2)
0 1 0 0 0 Extended LAPB for half duplex operation (Rec.T.71) (Note 1)
0 1 0 0 1 HDLC ARM (ISO/IEC 4335) (Note 3)
0 1 0 1 0 HDLC NRM (ISO/IEC 4335) (Note 3)
0 1 0 1 1 HDLC ABM (ISO/IEC 4335) (Note 3)
0 1 1 0 0 LAN logical link control (ISO/IEC 8802-2) (Notes 4 and 5)
0 1 1 0 1 X.75 Single Link Procedure (SLP) (Note 1)
0 1 1 1 0 Recommendation Q.922 (Note 6)
0 1 1 1 1 Core aspects of Annex A/Q.922 (Note 7)
1 0 0 0 0 User specified (Note 8)
1 0 0 0 1 ISO/IEC 7776 DTE-to-DTE operation (Note 1)

All other values are reserved.

NOTE 1 – Normally the LAPB address is not provided. When provided, octet 6a will indicate that the address is present. When the LAPB address is provided, the calling DTE assumes address A (value 3) and the called DTE assumes address B (value 1).

NOTE 2 – Normally the X.25 multilink address is not provided. When provided, octet 6a will indicate that the address is present. When the X.25 multilink address is provided, the calling DTE assumes address C (value 15) and the called DTE assumes address D (value 7).

NOTE 3 – Normally the HDLC address is not provided. When provided, octet 6a will indicate that the address is present.

NOTE 4 – Destination Service Access Point (DSAP) and Source Service Access Point (SSAP) are included. When a logical link control frame (which contains a logical link control PDU) is required (transparent inter-connection of similar LANs by frame relay), octet 6a will indicate that the logical link control frame is encapsulated. The contents of a logical link control frame are defined in the LAN Media Access Control (MAC) standards (e.g. ISO/IEC 8802-5).

NOTE 5 – The indication of command or response bit in the frame relay address will be ignored.

NOTE 6 – Address is not encapsulated.

NOTE 7 – This code point is not used in Recommendation X.36.

NOTE 8 – When this coding is included, octet 6a will include the code point for user specified layer 2 protocol.

* *Octet 6a coding for user specified code point*

User information layer 2 protocol (octet 6a) (applies for layer 2 = User specified)

User specified.

* *Octet 6a coding for Address inclusion*

User information layer 2 protocol (octet 6a) (Note 9)

Bits
2 1
0 1 Address included (Note 10)
1 0 Encapsulation of logical control frame (Note 11)

All other values are reserved.

Table 10-23/X.36 – Low layer compatibility information element *(concluded)*

NOTE 9 – When the octet is present, the indication of C/R bit in the frame relay core aspects address will be ignored.

NOTE 10 – Applies for the following layer 2 protocols specified in octet 6: X.25 link layer, X.25 multilink, extended LAPB for half duplex operation (see Recommendation T.71) HDLC ARM, HDLC NRM, HDLC ABM, X.75 Single Link Procedures (SLP) and ISO/IEC 7776.

NOTE 11 – Applies for the following layer 2 protocol specified in octet 6: LAN logical link control (ISO/IEC 8802 -2).

Bits 4 3	
0 0	Modulo 8
0 1	Modulo 128
1 0	Modulo 32 768
1 1	Modulo 2 147 483 648

Bits 5	
0	SREJ not used
1	SREJ used

User information layer 3 protocol (octet 7)

Bits 5 4 3 2 1	
0 0 1 1 0	X.25 packet level
0 0 1 1 1	ISO/IEC 8208 (X.25 packet level protocol for DTE)
0 1 0 0 0	Rec. X.223 or ISO/IEC 8878 (use of ISO/IEC 8208 and X.25 to provide the OSI-CONS)
0 1 0 0 1	ISO/IEC 8473 (OSI connectionless mode protocol)
0 1 0 1 0	T.70 minimum network layer
0 1 0 1 1	ISO/IEC TR 9577 (Protocol identification in the network layer); (Note 13)
1 0 0 0 0	User specified (Note 12)

All other values are reserved.

NOTE 12 – When this coding is included, octet 7a will include the code point for user specified layer protocol.

NOTE 13 – If extension octets (7a-7b) are not included, more than one protocol may be encapsulated over the SVC using the ISO/IEC TR 9577 format as described in Annex D/X.36

If extension octets are present, one protocol is carried on the SVC. The ISO/IEC TR 9577 Initial Protocol Identifier (IPI) as well as the subsequent protocol identification octets are not carried in the user plane.

Optional layer 3 protocol information (octet 7a)

User specified.

ISO/IEC TR 9577 Network Layer Protocol Identifier (NLPID) and the IEEE 802.1 SNAP identifier (octets 7a-7b, 8-8.5)

Octet 7a and bit 8 of octet 7b indicate the ISO/IEC TR 9577 Initial Protocol Identifier (IPI) for the protocol to be carried in the user plane. If octets 7a and 7b are coded as '1000 0000', indicating an IEEE 802.1 SNAP identifier (see Annex D of ISO/IEC TR 9577), octets 8.1-8.5 will contain a 40-bit SNAP identifier, consisting of a 24-bit Organization Unique Identifier (OUI) and a 16-bit Protocol Identifier (PID). The NLPID coding shall only be used if there is no ITU-T standardized coding for the layer 3 protocol being used, and an ISO/IEC TR 9577 or SNAP coding applies for that protocol. The SNAP coding shall be used for a layer 3 protocol only if ISO has not assigned an NLPID for the layer 3 protocol. The SNAP coding can also be used to indicate that bridged LAN frames are to be carried in the user plane.

4) Add subclauses D.6 and D.7 to Annex D.

D.6 Low Layer compatibility negotiation procedures

D.6.1 General purpose

The Low layer compatibility negotiation procedures in this Annex are based on Annex J/Q.931 and are optional. The purpose of the Low layer compatibility information element is to provide a means which should be used for compatibility checking by an addressed entity (e.g. a remote user or an interworking unit or high layer function network node addressed by the calling user). The Low layer compatibility information element is transferred transparently by a frame relay network between the call originating entity (e.g. the calling user) and the addressed entity.

The user information protocol fields of the Low layer compatibility information element indicate the low layer attributes at the call originating entity and the addressed entity. This information is not interpreted by the frame relay network and therefore the bearer capability provided by the frame relay network is not affected by this information. The call originating entity and the addressed entity may modify the low layer attributes by the negotiation described below.

The Low layer compatibility information element is coded according to 10.5.17.

D.6.2 Low layer capability notification to the called user

When the calling user wishes to notify the called user of its information transfer attributes (OSI layer 2 and layer 3 attributes), then the calling user shall include a Low layer compatibility information element in the SETUP message; this element is conveyed by the network and delivered to the called user. However, if the network is unable to convey this information element, it shall act as described in 10.6.7.7.1 (unrecognized information element).

D.6.3 Low layer compatibility negotiation between users

If the user wishes to indicate alternative values of low layer compatibility parameters (e.g. alternative protocol suites), the Low layer compatibility information element is repeated in the SETUP message. Up to *three* Low layer compatibility information elements may be included in a SETUP message. The first Low layer compatibility information element in the list is the default and is used if the network or called user does not support negotiation. The order of appearance of the subsequent Low layer compatibility information elements indicates the order of preference of end-to-end low layer parameters.

If the network or called user does not support repeating of the Low layer compatibility information element, and therefore discards the subsequent Low layer compatibility information elements, only the first Low layer compatibility information element is used in the negotiation.

NOTE 1 – When the first Low layer compatibility information element of the SETUP message does not contain octets 7b* and 8.1* to 8.5*, it favours interoperability with DTEs that do not support these extensions.

NOTE 2 – When the length of the first Low layer compatibility information element of the SETUP message is less or equal to 8 octets (previous case, or octets 6, 6a* and 8.1* to 8.5* not included), it favours interoperability with networks that do not support the extension of octets 7b* and 8.1* to 8.5*, the transmission of more than one Low Layer Compatibility information element in the SETUP message and one in the CONNECT message.

The called user indicates a single choice from among the options offered in the SETUP message by including the Low layer compatibility information element in the CONNECT message. Absence of a Low layer compatibility information element in the CONNECT message indicates acceptance of the first Low layer compatibility information element in the SETUP message.

D.6.4 Backward compatibility considerations

Since the initial versions of frame relay implementations typically do not support Low Layer Compatibility negotiation, it is important that these implementations still interoperate with implementations of X.36 that do support the Low Layer Compatibility negotiation. Because the Low Layer Compatibility is an end-to-end function and was previously not negotiated, a called DTE that does not support LLC negotiation will accept the call based on its comprehension of the first Low Layer Compatibility presented in the SETUP, and it will send a CONNECT without a Low Layer Compatibility or it will clear the call. The calling DTE interprets the absence of an LLC IE in the CONNECT as an acceptance of the first LLC presented in the SETUP. In either case, this is acceptable behaviour to the negotiation procedures proposed and provides consistent function to the older implementation.

Since a calling DTE that does not support negotiation can only send one LLC IE in the SETUP, this indicates to the called DTE that the calling DTE does not support negotiation or does not wish to negotiate the LLC for the call. The call, if accepted, will use the LLC IE from the SETUP and no LLC will be returned in the CONNECT.

If any network connecting two DTEs does not support LLC negotiation, all but the first LLC IE in the SETUP will be discarded and the call is progressed to the called DTE. The called DTE interprets the call as though the calling DTE does not support negotiation or does not wish to negotiate the LLC. The call, if accepted, will use the LLC IE from the SETUP and no LLC will be returned in the CONNECT.

D.7 Examples

The following are examples (see Figures D.15/X.36 to D.19/X.36) of how one would encode the Low Layer Compatibility IE to signal the use protocol indicated.

8	7	6	5	4	3	2	1	Octet
0	Low layer compatibility information element identifier 1 1 1 1 1 0 0							1
Length of the low layer compatibility contents								2
ext. 1	Coding standard 0 0		Information transfer capability 0 1 0 0 0					3
ext. 1	Transfer Mode 0 1		Reserved 0 0 0 0 0					4
ext. 1	Layer 3 ident. 1 1		User information layer 3 protocol ISO/IEC TR 9577 0 1 0 1 1					7

Figure D.15/X.36 – Encoding for ISO/IEC TR 9577 multiprotocol encapsulation

8	7	6	5	4	3	2	1	Octet
0	Low layer compatibility information element identifier 1 1 1 1 1 0 0							1
Length of the low layer compatibility contents								2
ext. 1	Coding standard 0 0		Information transfer capability 0 1 0 0 0					3
ext. 1	Transfer Mode 0 1		Reserved 0 0 0 0 0					4
ext. 0	Layer 3 ident. 1 1		User information layer 3 protocol ISO/IEC TR 9577 0 1 0 1 1					7*
ext. 0	ISO/IEC TR 9577 Initial Protocol Identifier (IPI) for IP (bits 8-2) 1 1 0 0 1 1 0							7a*
ext. 1	IPI (bit 1) 0	Spare 0 0 0 0 0 0						7b*

Figure D.16/X.36 – Single protocol encoding for IP

8	7	6	5	4	3	2	1	Octet
0	Low layer compatibility information element identifier 1	1	1	1	1	0	0	1
Length of the low layer compatibility contents								2
ext. 1	Coding standard 0	0	Information transfer capability 0	1	0	0	0	3
ext. 1	Transfer Mode 0	1	Reserved 0	0	0	0	0	4
ext. 0	Layer 3 ident. 1	1	User information layer 3 protocol ISO/IEC TR 9577 0	1	0	1	1	7*
ext. 0	ISO/IEC TR 9577 Initial Protocol Identifier (IPI) for SNAP (bits 8-2) 1	0	0	0	0	0	0	7a*
ext. 1	IPI (bit 1) 0	Spare 0	0	0	0	0	0	7b*
ext. 1	SNAP ID 0	0	Spare 0	0	0	0	0	8*
OUI Octet 1								8.1*
OUI Octet 2								8.2*
OUI Octet 3								8.3*
PID Octet 1								8.4*
PID Octet 2								8.5*

Figure D.17/X.36 – Single protocol encoding for Protocol Identified via SNAP convention

8	7	6	5	4	3	2	1	Octet
0	Low layer compatibility information element identifier 1	1	1	1	1	0	0	1
Length of the low layer compatibility contents								2
ext. 1	Coding standard 0	0	Information transfer capability 0	1	0	0	0	3
ext. 1	Transfer Mode 0	1	Reserved 0	0	0	0	0	4
ext. 0	Layer 2 ident. 1	0	Q.922 user info layer 2 protocol 0	1	1	1	0	6
ext. 0	Layer 3 ident. 1	1	User info layer 3 protocol User specified 1	0	0	0	0	7*
ext. 1	User specified layer 3 protocol information x	x	x	x	x	x	x	7a*

Figure D.18/X.36 – Single protocol encoding for Protocol Identified via Q.933 convention (Layer 2: Q.922, Layer 3: User specified)

8	7	6	5	4	3	2	1	Octet
0	Low layer compatibility information element identifier 1	1	1	1	1	0	0	1
Length of the low layer compatibility contents								2
ext. 1	Coding standard 0	0	Information transfer capability 0	1	0	0	0	3
ext. 1	Transfer Mode 0	1	Reserved 0	0	0	0	0	4
ext. 0	Layer 2 ident. 1	0	Q.922 user info layer 2 protocol 1	0	0	0	1	6
ext. 1	User specified layer 3 protocol information Reserved 0	0	SREJ 1	Modulo 1	0	Address inclusion x	x	6a*

Figure D.19/X.36 – Single protocol encoding for ISO/IEC 7776 with use of SREJ and modulo 32768

D.8 Protocol encapsulation format

D.8.1 Multiprotocol encapsulation format

Formats described in D.1 to D.5 are applicable.

D.8.2 Mono encapsulation format

Figure D.20/X.36 describes, in the case where single protocol encapsulation is selected, the format used to encapsulate a PDU of the particular protocol in the information field of the FR frame. No protocol identifier related to the encapsulating FR technology is included.

8	7	6	5	4	3	2	1	Octet
Flag								1
Address field first octet								2
Address field second octet								3
First octet of the encapsulated PDU … last octets of the encapsulated PDU								4 N - 3
Frame Check Sequence first octet								N - 2
Frame Check Sequence second octet								N - 1
Flag								N

Figure D.20/X.36 – Single protocol encapsulation format

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