ETSI TECHNICAL REPORT

ETR 145

October 1994

Source: ETSI TC-NA

Reference: DTR/NA-025105

ICS: 33.080

Key words: Frame relay, service

Network Aspects (NA); European frame relay services General information and standardization overview

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Foreword

This ETSI Technical Report (ETR) was produced by the Network Aspects (NA) Technical Committee of the European Telecommunications Standards Institute (ETSI).

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

Introduction

This ETR has been developed in order to identify the required standards for provisioning of the frame relay service in Europe.

The document consists of a descriptive part (clauses 5 and 6), an evaluation part (clause 7), and a recommendation part (clause 8):

a) the descriptive part presents configurations for different network types and for interworking with private networks as well as service aspects of Frame Relay Bearer Service (FRBS) in which the required frame relay standards can be placed;

b) in the evaluation part priorities are given to all kinds of items related to frame relay services. The required standards shall cover the items of priority;

c) finally, subjects are listed for which standards are required. For each subject it is indicated:

   1) which starting material (e.g. ITU-T Recommendations) should be used;

   2) what is its priority. This priority is deduced from the priorities given to the items in point b).

The priorities given in this ETR take into account the market demands for frame relay services, as expected for the forthcoming years, the current status of frame relay services in various standards setting organizations, today's state of the art of frame relay technology and the efforts required to implement frame relay services in Europe.

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1 Scope

This ETSI Technical Report (ETR) provides configurations and a structure of the European frame relay service and gives an overview of the related ITU-T Recommendations and ETSI European Telecommunication Standards (ETSs). The services can be provided by various networks such as Integrated Services Digital Network (ISDN), Public Data Network (PDN) or Broadband Integrated Services Digital Network (B-ISDN). However, the viewpoint of this ETR is that the possible variants should be very similar such that they can use an (almost) identical set of standards, with minor differences. Therefore, it makes sense to refer to a single frame relay service, although, in reality, this means a family of similar services. The scope of this ETR includes the frame relay service in all kinds of public networks, as well as interworking with all kinds of private networks.

2 Reference

[1] CCITT Recommendation I.233: "Frame mode bearer services".

[2] CCITT Recommendation I.233.1: "ISDN frame relaying bearer service".

[3] ITU-T Recommendation Q.72.2: "Stage 2 description for packet mode and frame mode services - Frame mode".

[4] CCITT Recommendation Q.922: "ISDN data link layer specification for frame mode bearer services".

[5] ITU-T Recommendation Q.933: "Layer 3 signalling specification for frame mode bearer service".

[6] CCITT Recommendation I.370: "Congestion management for the ISDN frame relaying bearer service".

[7] ITU-T Recommendation I.372: "Frame relaying bearer service network-to-network interface requirements".

[8] ITU-T Recommendation I.555: "Frame relaying bearer service interworking".

[9] ETS 300 099: "Integrated Services Digital Network (ISDN); Specification of the Packet Handler access point Interface (PHI)".

[10] ITU-T Recommendation I.431: "Primary rate user-network interface - Layer 1 specification".

[11] ITU-T Recommendation G.703: "Physical/electrical characteristics of hierarchical digital interfaces".

[12] Draft ITU-T Recommendation X.76: "Network-to-network interface between public data networks between public data networks providing the frame relay data transmission service".

[13] Draft 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".

[14] ETS 300 402-3: "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1); User-network interface data link layer; Part 3: Frame relay protocol specification".

[15] ETS 300 458: "Integrated Services Digital Network (ISDN); Specification of the Remote Frame Handler Interface (RFHI)".

[16] ETS 300 467: "Broadband Integrated Services Digital Network (B-ISDN); Support of B-ISDN frame relaying bearer service".

[17] ETS 300 007: "Integrated Services Digital Network (ISDN); Support of packet-mode terminal equipment by an ISDN".

3 Definitions

For the purposes of this ETR, the following definitions apply:

NOTE 1: The definitions presented here are only for the purpose of this document. More precise definitions should be formulated in standards.

Frame Handler (FH): the set of all network functions required to handle autonomously U-plane and C-plane for the ISDN frame relay bearer service.

NOTE 2: The FH in this context is different from the FH in the context of ETS 300 099 [9].

Connection Related Function at Subscriber side (CRF-S): the Connection Related Function (CRF) to which the subscriber is connected.

NOTE 3: This definition is identical to that of the CRF-S in ETS 300 099 [9].

Remote Frame Handler (RFH): a type of FH which is assumed to be remote with respect to the subscriber. The remote location of the FH is well known to the subscriber and the signalling procedures are adapted to this situation (Case A signalling mode). The RFH may reside in another network.

NOTE 4: The RFH is not quite the frame mode equivalent of the access unit for packet mode: the access unit belongs logically to the Packet Switched Public Data Network (PSPDN) and provides the PSPDN service; whereas the RFH belongs logically to the ISDN and provides the ISDN frame relay bearer service.

Integrated Frame Handler (IFH): a type of FH which is assumed to be local with respect to the subscriber and which is integrated in the CRF-S. The assumption of local location is reflected in the signalling procedure (Case B signalling mode).

Non-Integrated Frame Handler (NIFH): a type of FH which is assumed to be local with respect to the subscriber but which is not integrated in the CRF-S. The remote location of the FH is invisible to the subscriber and is rather a network configuration decision. The NIFH may reside in another network.

NOTE 5: The NIFH is the frame mode equivalent of the Packet Handler for packet mode, accessed through the PHI (see ETS 300 099 [9]).

Connection Related Function at Frame handler side (CRF-F): the CRF to which the RFH or the NIFH is connected.

NOTE 6: This definition is similar to that of the CRF-P in ETS 300 099 [9].

Frame Handler Interface (FHI): the interface between the CRF-F and the NIFH.

NOTE 7: The FHI is the frame mode equivalent of the Packet Handler access point Interface for packet mode.

Remote Frame Handler Interface (RFHI): the interface between the CRF-F and the RFH.

Frame Concentrator (FC): an adjunct to the FH functionality, located in the CRF-S, required to (de)concentrate frame relay traffic from/to the NIFH, according to the FHI standard.

NOTE 8: The Frame Concentrator is the frame mode equivalent of the FH for packet mode.

Access network: the part of the ISDN giving access to a RFH or a NIFH, consisting of the CRF-S, CRF-F and all intermediate CRFs (if any).

Long duration connection: a circuit switched connection which can be established in order to convey multiple overlapping frame mode calls. In principle, the connection is retained for an unlimited period of time, unless faults occur which cause its forced release (and later re-establishment). The establishment and release of a long duration connection are independent of frame mode calls. Such a connection lasts longer than the last frame mode call.

4 Abbreviations

For the purposes of this ETR, the following abbreviations apply:

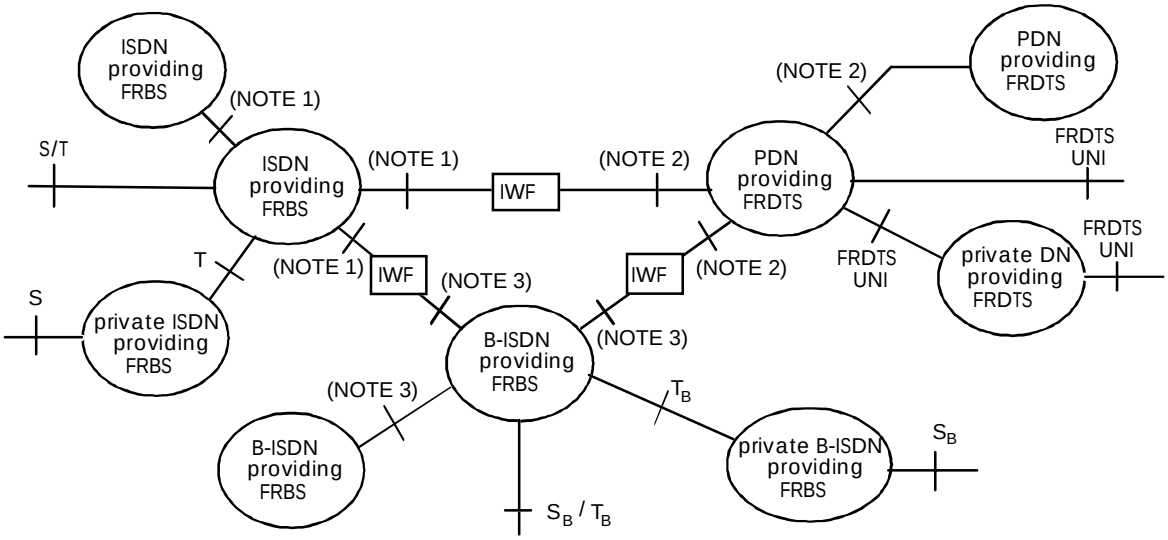
B-ISDN	Broadband Integrated Services Digital Network
CRF	Connection Related Function
CRF-F	Connection Related Function at Frame handler side
CRF-S	Connection Related Function at Subscriber side
DSS1	Digital Subscriber Signalling System No. one
FH	Frame Handler
FHI	Frame Handler Interface
FRBS	Frame Relay Bearer Service
FRDTS	Frame Relay Data Transmission Service
IFH	Integrated Frame Handler
ISDN	Integrated Services Digital Network
MAN	Metropolitan Area Network
NIFH	Non Integrated Frame Handler
NNI	Network to Network Interface
PDN	Public Data Network
PSPDN	Packet Switched Public Data Network
PVC	Permanent Virtual Circuit (CCITT Recommendation I.233 [1]) or Permanent Virtual Connection (ITU-T Recommendation Q.933 [5])
QOS	Quality Of Service
RFH	Remote Frame Handler
RFHI	Remote Frame Handler Interface
SVC	Switched Virtual Circuit (CCITT Recommendation I.233 [1]) or Switched Virtual Connection (ITU-T Recommendation Q.933 [5])
UNI	User to Network Interface

5 Configurations for frame relay services

This clause deals with various network configurations for the provisioning of frame relay services. The only goal is to help understanding of the priority items and standards formulated in clauses 6 and 7.

5.1 Overall configuration

The configuration for frame relay services includes private and public ISDNs, PDNs and B-ISDNs. The interfaces with B-ISDN requires further study and input from NA 5. More detailed configurations for ISDN Frame Relay Bearer Services (FRBSs), PDN frame relay services and B-ISDN FRBSs are elaborated below.



NOTE 1: This interface is a Network to Network Interface (NNI) between two ISDNs providing FRBS or between an ISDN providing FRBS and an IWF. This interface will be based on ITU-T Recommendation I.372 [7].

NOTE 2: This interface is a NNI between two PDNs providing Frame Relay Data Transmission Service (FRDTS) or between a PDN providing FRDTS and an IWF. This interface may be based on ITU-T Recommendation I.372 [7].

NOTE 3: This interface is a NNI between two B-ISDNs providing FRBS or between a B-ISDN providing FRBS and an IWF.

Figure 1: Frame relay overall configuration

The configuration in figure 1 does not show all possibilities. Private networks may for instance interwork with various public networks, e.g. a private ISDN providing FRBS may interwork with a public PDN and/or with a public B-ISDN providing FRBS. In addition to the shown cases, feeder networks could exist between the UNIs and the networks providing frame relay services. Two networks providing frame relay services could also be interconnected by transit networks, not using any frame relay functionality. These cases however do not require any specific frame relay related standards and therefore are not mentioned further in the main text. Annex B addresses the topic of feeder networks and transit networks in more detail.

Interworking between the various frame relay services offered by different networks is included in this configuration. In this case interworking functions (IWF) as shown in figure 1 are needed. Other interworking aspects (e.g. with frame switching services, or with packet mode bearer services) are not included.

5.2 Configurations for ISDN FRBSs

5.2.1 General

Configurations for ISDN frame relay bearer services are based on ITU-T Recommendations Q.933 [5] and Q.72.2 [3] which define Case A and Case B signalling procedures to be used in combination with local and remote locations of frame handling functions. This results in 3 configurations, which are elaborated below.

The configurations do not show network internal interfaces (e.g. between FHs) as these are not subject to ETSI standardization.

5.2.2 Case A services provided by a RFH

Signalling procedures for Case A are used for B and multiple rate channel associated frame relay connections, provided by a RFH. The RFH belongs logically to the ISDN but may reside in another network (ITU-T Recommendation Q.933 [5], figure 2-1).

NOTE 1 The signalling procedures employed in Case A, as defined in ITU-T Recommendation Q.933 [5] for frame mode bearer services, differs from the Case A signalling mode, as defined in ETS 300 007 [17] for packet switched services: packet switched Case A gives access to PSPDN services; frame mode Case A is used to access an ISDN FH.

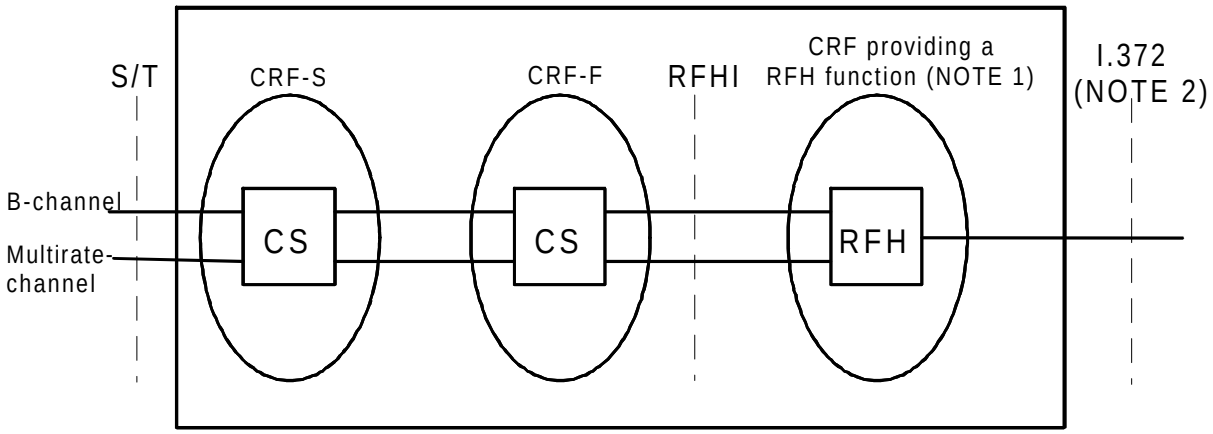
NOTE 2 The signalling procedures employed in Case A would also apply for accessing, through the ISDN, frame relay services of another network (e.g. FRDTS of a PDN) but this would then rather belong to the configuration of that other network.

Functional split

The ISDN access network has no FRBS capabilities: only circuit switched functions (CS) and related signalling capabilities are required. All typical frame handling functions and related signalling capabilities are located in the RFH.

Standards

The RFHI is trivial and needs little standardization. It could be based on e.g. digital trunk interface (ITU-T Recommendation G.703 [11] with circuit mode CCSN7 signalling) or ISDN primary rate interface (ITU-T Recommendation I.431 [10] with circuit mode Digital Subscriber Signalling System No. one (DSS1) signalling).



ISDN providing Case A FRBS

NOTE 1: The RFH belongs logically to the ISDN but may reside in another network.

NOTE 2: If both sides reside in the same network, a network internal protocol may be used instead.

Figure 2: Configuration for Case A

5.2.3 Case B services provided by the integrated FH

Signalling procedures employed for Case B are used for frame relay connections provided by a FH integrated in the local exchange (IFH). This IFH belongs logically to and resides physically in the CRF-S (ITU-T Recommendation Q.933 [5], figure 2-2).

As compared to Case A, Case B signalling procedures offer some additional functions:

a) D-channel FRBSs;

b) integrated OA&M;

c) integrated supplementary services (SVC only);

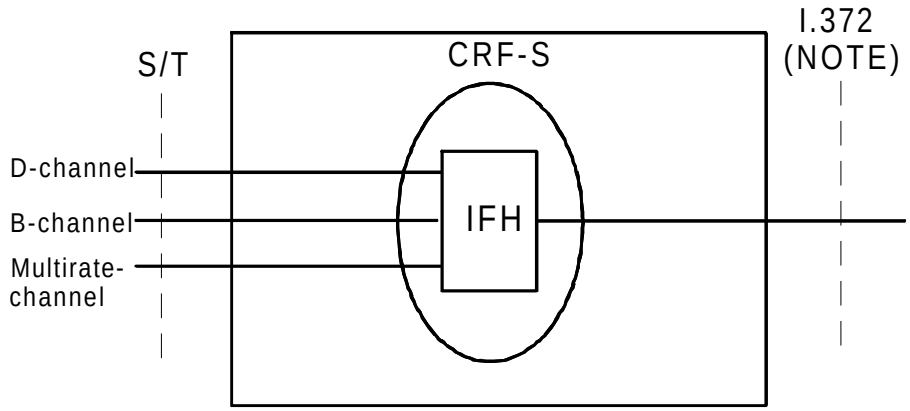
d) channel negotiation for frame relay connections (SVC only).

Functional split

All frame handling functions and related signalling capabilities are located in the CRF-S.

Standards

None specially related to this configuration.



ISDN providing Case B FRBS locally

NOTE: If both sides reside in the same network, a network internal protocol may be used instead.

Figure 3: Configuration for Case B with IFH

5.2.4 Case B services provided by the non-integrated FH

Signalling procedures for Case B are used for frame relay connections, provided by a FH not integrated in the local exchange (NIFH). This NIFH belongs logically to the CRF-S but may reside physically in another network (ITU-T Recommendation Q.933 [5], figure 2-2, Note 2).

Functional split

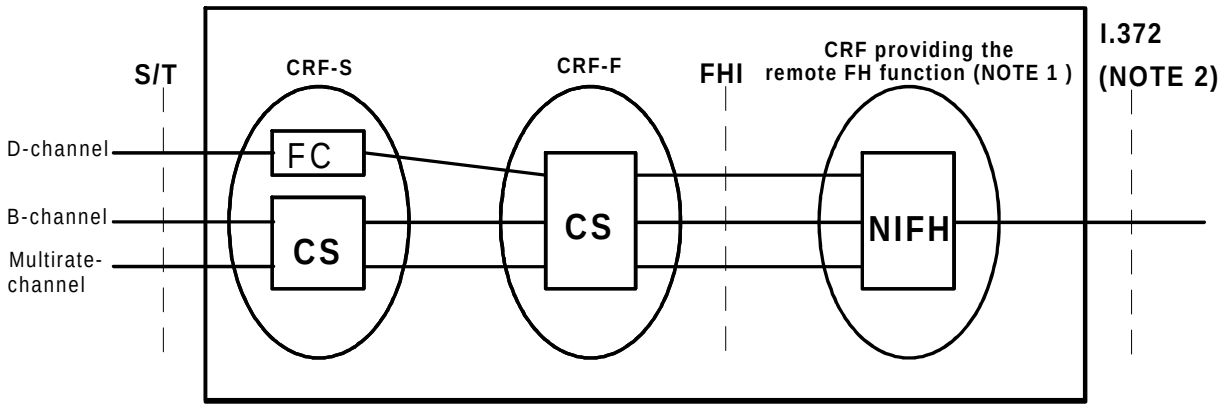
The functions needed in the ISDN access network are:

- Circuit Switching functions (CS) for B- and multiple rate channels;
- Frame Concentration functions (FC) for D-channel frame mode connections;
- circuit mode and frame mode signalling capabilities.

More complete frame handling functions and related signalling capabilities are located in the NIFH.

Standards

The FHI is in general complex and needs standardization. It could be based on e.g. a digital trunk interface (ITU-T Recommendation G.703 [11]) or ISDN primary rate interface (ITU-T Recommendation I.431 [10]).



ISDN providing Case B FRBS remotely

NOTE 1: The RFH belongs logically to the ISDN but may reside in another network.

NOTE 2: If both sides reside in the same network, a network internal protocol may be used instead.

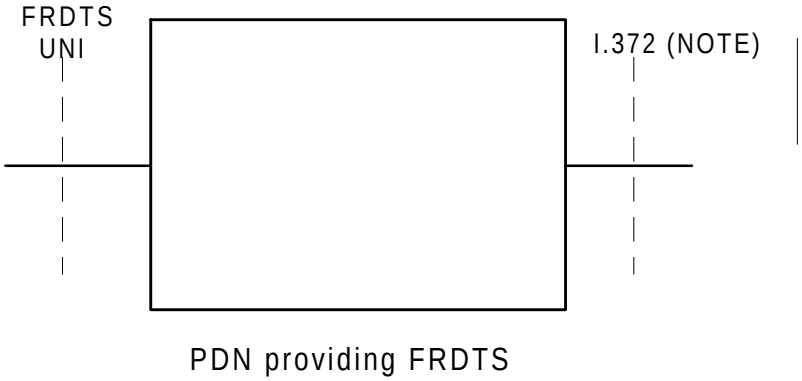
Figure 4: Configuration for Case B with NIFH

5.3 Configuration for FRDTS

FRDTS is a frame relay service provided by the PDN. PDNs may be based on various technologies and be implemented in new dedicated (to frame relay) networks or in existing networks (e.g. PSPDNs, Metropolitan Area Networks (MANs), etc.). In spite of this variety they all provide one and the same service: FRDTS.

NOTE 1: Annex A shows one possible implementation of FRDTS in a PSPDN.

NOTE 2: Interworking between FRDTS and other services which may be offered by the PDN (e.g. with SDTS of a PSPDN) are not part of the configuration.



NOTE: This interface is under study in ITU-T SG XVIII, XI and VII. Implementation agreements related to this interface exist in Frame Relay Forum.

Figure 5: Configuration for FRDTS

For the FRDTS provided by the PDN, there is no need for a more detailed configuration in order to identify the required standards.

5.4 Configurations for FRBSs offered by B-ISDN

5.4.1 FRBS provided by frame relay service function inside B-ISDN

In this case the frame relay service function is provided within the B-ISDN. The Frame Relay Service Function (FRSF) handles frame relay protocols and routes data according to routeing information provided during frame relay connection establishment.

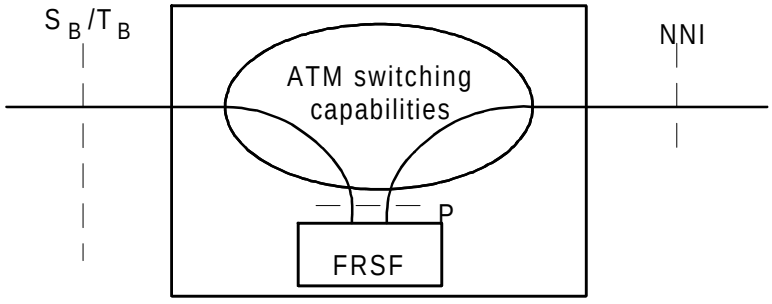


Figure 6: Configuration for B-ISDN FRBS provided by FRSF inside B-ISDN

5.4.2 FRBS provided by frame relay service function outside B-ISDN

In this case a transparent connection of the asynchronous transfer mode layer, either permanent, reserved or on demand, is used between B-ISDN interfaces (at reference points S_B/T_B or M). Frame relay protocols operating on and above the adaptation layer are transparent to the B-ISDN. The frame relay service and adaptation layer functions are implemented outside the B-ISDN.

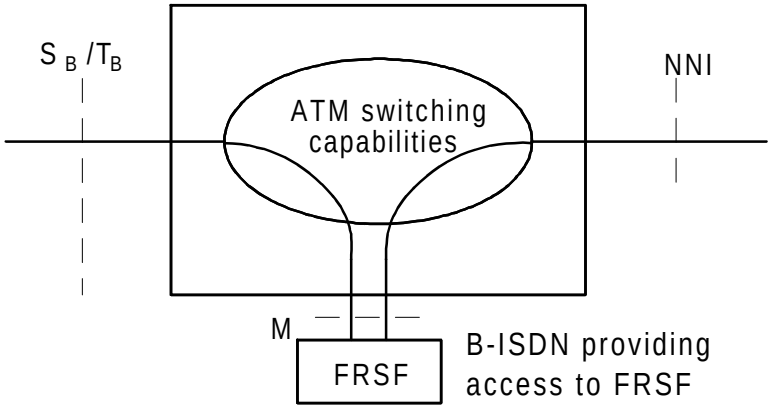


Figure 7: Configuration for B-ISDN FRBS provided by FRSF outside B-ISDN

5.5 Configurations for interworking with private networks

Several configurations (scenarios) for private networks are considered. The list of scenarios is not exhaustive but should show at least those with relevance to the required frame relay standards.

In the following figures, the TE functional entity may represent two physical implementations:

- a single ISDN terminal;
- a LAN including its non-ISDN terminals.

5.5.1 Interworking of public ISDNs with private ISDNs

5.5.1.1 Scenario 1: B-channel or multiple rate channel access to public ISDN Case A FRBS via circuit switching functions of private and public ISDN

The private and the public ISDN employ circuit switching functions (see figure 8).

Depending on the location of the RFH, the location of the RFHI may coincide with the interface at the T reference point, or may occur anywhere within the pubic ISDN, or may occur beyond the public ISDN (as shown in figure 8).

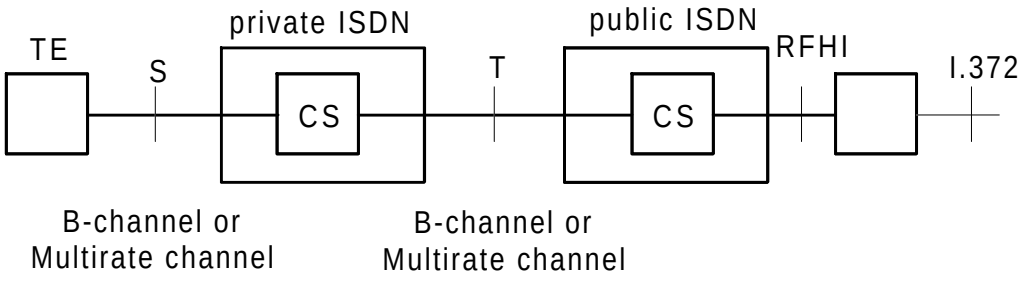


Figure 8: Scenario 1

5.5.1.2 Scenario 2: B-channel or multiple rate channel access to public ISDN Case B FRBS via circuit switching functions of the private ISDN

Two kinds of FRBS provisioning by the public ISDN are possible:

- FRBS by the integrated FH (IFH, see figure 9);

- FRBS by the non-integrated FH (NIFH, see figure 10).

There is no difference between the two kinds of provisioning at the T reference point.

Interworking between B-channels at the S reference point and multiple rate channels at the T reference point and vice versa is outside the scope of this ETR.

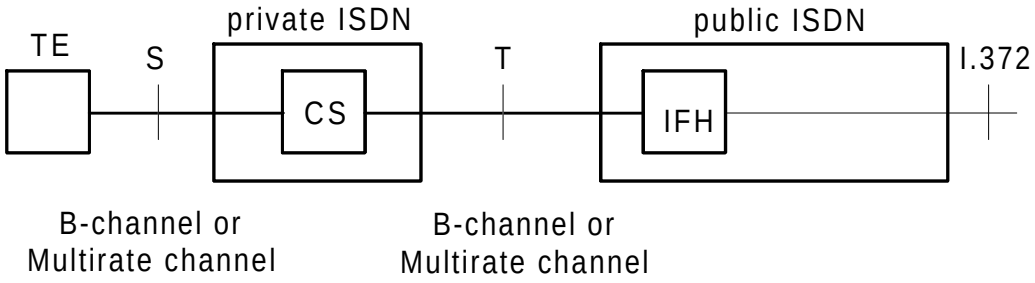


Figure 9: Scenario 2.1

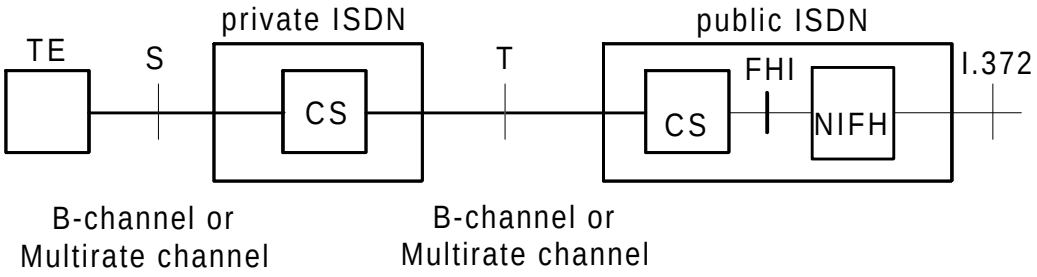


Figure 10: Scenario 2.2

5.5.1.3 Scenario 3: D-channel access to public ISDN Case B FRBS via a frame handling function in the private ISDN

The concatenation of the D-channel link at S and the D-channel link at T is achieved by a frame handling function in the PTN. This frame handling function does not necessarily handle local frame relay traffic.

Two kinds of FRBS provisioning by the public ISDN are possible:

- FRBS by the integrated FH (IFH, see figure 11);

- FRBS by the non-integrated FH (NIFH, see figure 12).

There is no difference between the two kinds of provisioning at the T reference point.

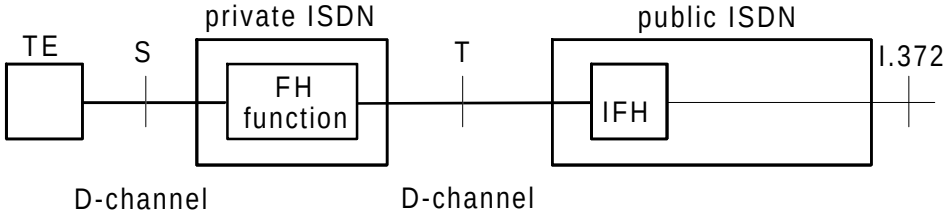


Figure 11: Scenario 3.1

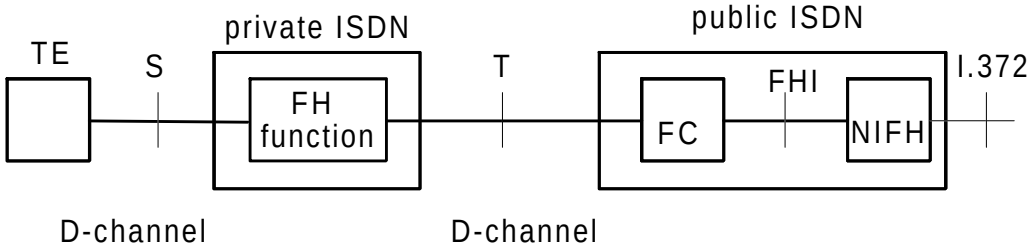


Figure 12: Scenario 3.2

5.5.1.4 Scenario 4: B-channel access from the private ISDN FC to public ISDN Case B FRBS

This scenario uses a private FC which concentrates the connections to the public IFH or NIFH. It represents the extension of the public network D-channel FRBS into the private ISDN by allocating the FHI relevant local CRFs (i.e. CRF-S) to the frame concentrator of the private ISDN.

Two kinds of FRBS provisioning by the public ISDN are possible:

- FRBS by the integrated FH (IFH, see figure 13);

- FRBS by the non-integrated FH (NIFH, see figure 14).

Whether there are differences at the T Reference point between these two kinds of provisioning has to be clarified.

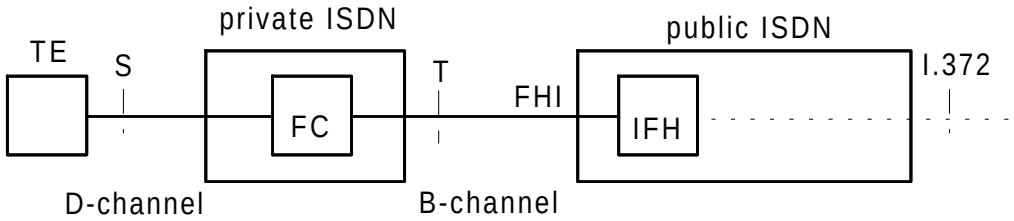


Figure 13: Scenario 4.1

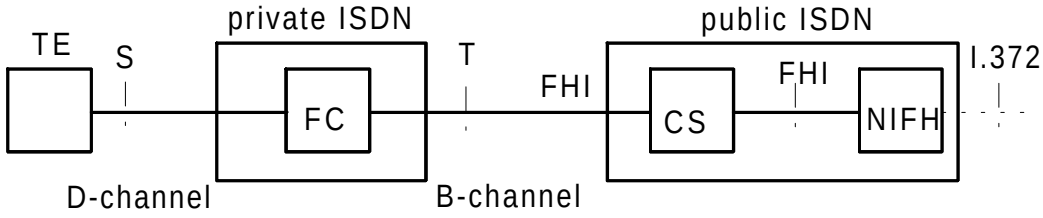


Figure 14: Scenario 4.2

5.5.1.5 Scenario 5: B-channel and/or multiple rate channel access from the private IFH to the public ISDN Case B FRBS

In this scenario a private IFH is connected to the public ISDN providing FRBS. Private network internal FRBS connections are possible. Interworking at the T reference point is according to ITU-T Recommendation I.372 [7] (see figure 15).

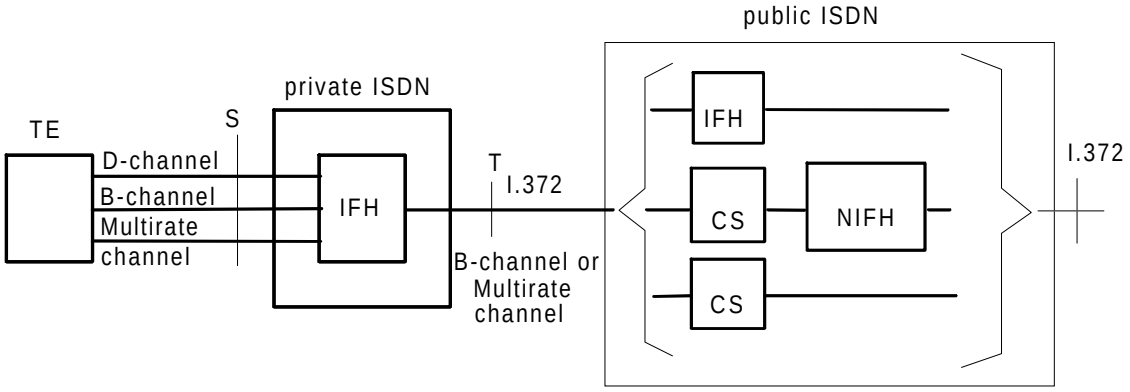


Figure 15: Scenario 5

5.5.2 Access from private ISDN to PDNs providing FRDTS

In the following two scenarios the Access Unit (AU) can be placed within the private ISDN or within the PDN. In the second case the private ISDN and the PDN employ ISDN circuit switching functions.

5.5.2.1 Scenario 6: access to public frame relay service

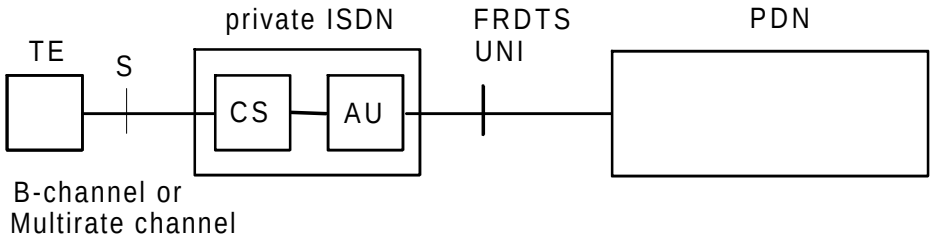


Figure 16: Scenario 6.1

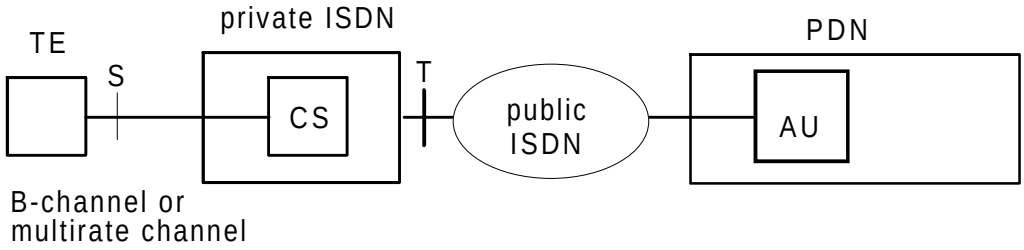


Figure 17: Scenario 6.2

5.5.2.2 Scenario 7: Access from the private ISDN FC to a PDN

This scenario uses a private FC function which concentrates the connections to the PDN providing FRDTS.

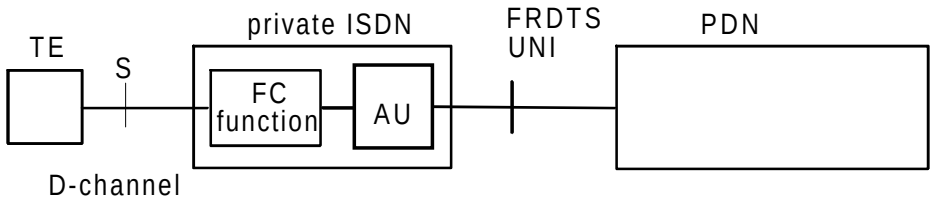


Figure 18: Scenario 7.1

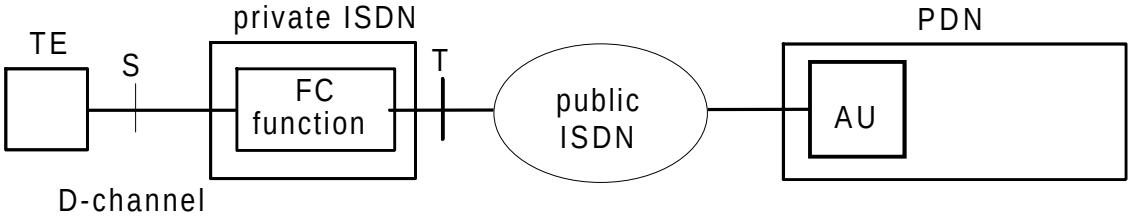


Figure 19: Scenario 7.2

5.5.3 Other Interworking cases of public and private networks

For example in case of:

- interworking of public ISDNs providing FRBS with private dedicated data networks;
- interworking of public B-ISDNs with private B-ISDNs;
- interworking of PDNs with private B-ISDNs;
- interworking of PDNs with private dedicated data networks (private data network),

there is up to now not enough information available to derive detailed descriptions.

6 Service classes for FRBS

This clause deals with the service aspects of FRBS with the aim to help understanding the priority items and standards formulated in clauses 7 and 8. Clause 6 concentrates on FRBS only because the service stacks are more complex in this case.

6.1 Service classes at the S/T reference point

6.1.1 Physical circuit characteristics

6.1.1.1 Demand circuit, virtual call dependent

The establishment of the circuit switched connection between FH and TE is initiated by the beginning of the first frame mode call, and its release is initiated by the end of the last frame mode call. Connection establishment and disestablishment are under ISDN call control.

6.1.1.2 Demand circuit, long duration, virtual call independent

Establishment and release of the circuit switched connection between FH and TE are independent of frame mode calls; instead, they are initiated by the user. Typically the circuit switched connection lasts longer than the last active frame mode call (long duration). Connection establishment and disestablishment are under ISDN call control.

6.1.1.3 Permanent circuit, virtual call independent

Establishment and release of the circuit switched connection between FH and TE are achieved independently of frame mode calls by OAM procedures of the network provider.

6.1.2 Virtual circuit characteristics

6.1.2.1 Demand Switched Virtual Circuit (SVC)

The establishment and disestablishment of the virtual circuit are under ISDN call control.

6.1.2.2 Permanent Virtual Circuit (PVC)

Establishment and release of the virtual circuit between FH and TE are achieved by OAM procedures of the network provider.

6.1.3 Service classes

A service class is a combination of physical and virtual circuit characteristics. An overview of service classes is given table 1.

Table 1: Overview of service classes for FRBS

Physical circuit characteristics	**Demand circuit, virtual call dependent**		**Demand circuit, Long duration virtual call independent**		**Permanent circuit, virtual call independent**	
ISDN channel	multiple rate; unrestricted B-channel (Case A/B)		multiple rate:, unrestricted B-channel (Case A)		multiple rate, unrestricted B-channel (Case A/B) D-channel (Case B)	
Initialization	by the user or the network		by the user		by the network, on subscription	
Resilience	by the user		by the user		by the network	
Virtual circuit characteristics	**Demand**	**Permanent**	**Demand**	**Permanent**	**Demand**	**Permanent**
Initialization	by the user or the network	by the network	by the user or the network	by the network	by the user or the network	by the network, on subscription
Resilience	by the user	by the network	by the user	by the network	by the user	by the network
Address Data Link	NOTE	fixed	Note 1	fixed	NOTE	fixed

NOTE: Case A: determined by an inband ITU-T Recommendation Q.933 [5] procedure (DLCI = 0).
Case B: determined by an ITU-T Recommendation Q.933 [5] procedure across the D-channel.

6.2 Particular service classes at the T reference point

The number of available frame mode links which finally is responsible for the total number of TEs supported at the various instances of S reference points over a given B-channel at the T reference point needs to be studied. Special care should be taken of load sharing when overflow involves B-channels of more than one interface.

6.3 Service classes at the S reference point in private ISDN

This shall be the subject of private network standardization.

6.4 Combination of service classes at the S and T reference points

This shall be the subject of private network standardization.

7 Items and priorities for standardization of frame relay services

For the standardization of frame relay services, distinction is made according to priorities for:

1) items with high priority, which should be covered in a first release of ETSI standards. Such items are marked with "(1)";

2) items which need to be considered for a later release of ETSI standards. Such items are marked with "(2)". Standards in the first release may already consider the content of these items;

3) items which, at the moment, are not considered for ETSI standardization. Such items are absent from the priority list.

Following reasons and arguments were considered for grouping standardization items into these priority classes:

- urgency for inclusion of the item in the first set of standards, in order to obtain a complete basis for a first implementation step of frame relay services;

- status of supporting standards e.g. ITU-T Recommendations Q.933 [5] and I.372 [7];

- feasibility to meet the time schedule (spring 1994) for the first set of ETSI frame relay standards;

- demand by users (e.g. as seen by European Frame Relay Forum);

- coverage of application by other services (e.g. D-channel PMBS);

- technical feasibility of realization in a first implementation step.

The following priority items have been identified:

- service characteristics:

- physical service characteristics:

(1) permanent circuit, VC independent;
(1) demand circuit, VC independent;
(1) demand circuit, VC dependent;

- virtual circuit characteristics:

(1) PVC;
(1) SVC, Case A;
(2) SVC, Case B;

- **data rates supported on the UNI:**

  - **provided by the PDN:**

    (1) rates up to 2 Mbit/s;
    (2) rates from 2 Mbit/s up to 34 Mbit/s (E3);

  - **provided by the ISDN:**

    (1) rates of 64 kbit/s (B-channel);
    (1) rates higher than 64 kbit/s up to 2 Mbit/s (n*64 kbit/s-channels);
    (2) rates of 16 kbit/s and 64 kbit/s (D-channel);

  - **provided by the B-ISDN:**

    (1) rate of 2, 34, 155 Mbit/s;
    (2) rate of 620 Mbit/s;

- **access to the FH:**

  - **public network configurations in ISDN:**

    (1) Case A, services provided by an RFH;
    (1) Case B, services provided by the IFH;
    (2) Case B, services provided by non integrated FH;

  - **private network scenarios:**

    (1) Case A, CS functions in private ISDN, scenario 1;
    (1) Case B, CS functions in private ISDN, scenario 2;
    (2) FH functions in private ISDN, scenario 3;
    (2) IFH functions, scenario 5;
    (2) CS functions to PDN, scenarios 6 and 7;

  - **network interworking:**

    (1) interworking between any two networks providing some kind of frame relay PVC service;
    (2) interworking between any two networks providing some kind of frame relay SVC service;

  - **service interworking:**

    (2) service interworking with X.25 in PDN;
    (2) service interworking with PMBS in ISDN.

The priority of a combination of the items listed above can be found by applying the following rule:

the priority of a combination equals the maximum value of the priorities of its components.

EXAMPLE: The priority for standardizing SVCs over demand B-channels in an integrated FH network configuration is (2) because:

- Case B services provided by the IFH (1);
- rate of 64 kbit/s (1);
- demand circuit, VC dependent (1);
- SVC, Case B (2).

Priorities are presented in table 2 for various methods to access the ISDN FH, in combination with the various configurations and in combination with the various service classes.

Table 2: Items and priorities for standardization of frame relay services

Service classes	**D-channel service classes**		**B-channel service classes**				**Multiple rate channel service classes**			
			D	LD	P		D	LD	P	
Virtual call characteristics	D (SVC)	P (PVC)	D (SVC)	D (SVC)	D (SVC)	P (PVC)	D (SVC)	D (SVC)	D (SVC)	P (PVC)
Configurations										
5.2.2 Case A services provided by a RFH	N/A	N/A	(1)		(1)	(1)	(1)		(1)	(1)
5.2.3 Case B services provided by the integrated FH	(2)	(2)	(2)		(2)	(1)	(2)		(2)	(1)
5.2.4 Case B services provided by the non-integrated FH	(2)	(2)	(2)		(2)	(2)	(2)		(2)	(2)
5.5.1.1 Scenario 1: B-channel or multiple rate channel access to public ISDN Case A FRBS via circuit switching functions of private and public ISDN	N/A	N/A	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
5.5.1.2 Scenario 2: B-channel or multiple rate channel access to public ISDN Case B FRBS via circuit switching functions of the private ISDN	N/A	N/A	(2)	(2)	(2)	(1)	(2)	(2)	(2)	(1)
5.5.1.3 Scenario 3: D-channel Access to public ISDN Case B FRBS via a frame handling function in the private ISDN	(2)	(2)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5.5.1.4 Scenario 4: B-channel access from the private ISDN FC to the public ISDN, Case B FRBS										
5.5.1.5 Scenario 5: B-channel and/or multiple rate channel access from the private IFH to the public ISDN Case B FRBS	NOTE 1	NOTE 1	(2) NOTE 2	(2) NOTE 2	(2) NOTE 2	(2) NOTE 2	(2) NOTE 2	(2) NOTE 2	(2) NOTE 2	(2) NOTE 2
5.5.2.1 Scenario 6: access to public frame relay service via circuit switching functions of the private ISDN	N/A	N/A	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
5.5.2.2 Scenario 7: access from the private ISDN FC to a PDN	NOTE 1	NOTE 1	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)

D: = Demand.

P: = Permanent.

LD: = Long Duration.

N/A: = Not applicable.

(1), (2), (3): = priorities.

NOTE 1: In this scenario the D-channel applies only to the S reference point, which is outside the scope of this ETR.

NOTE 2: The priority refers to B or multirate channels at the T reference point only.

8 Set of standards for frame relay services

The program for the standardization work regarding frame relay services should reflect the priorities given in clause 7 to the standardization items.

The standardization work should as much as possible seek alignment with ITU-T Recommendations and take into consideration Frame Relay Forum implementation agreements, therefore, for each standardization item an appropriate starting document is proposed.

The subjects are distinguished according to priorities for:

1) subjects with high priority, which need a standard urgently. Such subjects are marked with "(1)";

2) subjects with lower priority, for which the standard may be released later in time. Such subjects are marked with "(2)".

8.1 Standards providing service descriptions including Quality Of Service (QOS) aspects and reference configuration (mainly stages 1 and 2)

In addition to the scenarios according to ITU-T Recommendation Q.72.2 [3], the scenarios developed in subclause 5.5 shall be accounted for in the stage 2 specifications and, if necessary, even take precedence over those in ITU-T Recommendation Q.72.2 [3].

(1) General frame relay service description:

ETS 300 399-1, based on CCITT Recommendation I.233.1 [2].

(1) Service definition for FRBS in N-ISDN:

ETS 300 399-2, based on CCITT Recommendation I.233.1 [2].

(1) Service definition for FRDTS:

ETS 300 399-3, based on CCITT Recommendation I.233.1 [2].

(1) Service definition for FRBS in B-ISDN:

based on CCITT Recommendation I.233.1 [2].

(1) Functional model and relationships for FRBS and FRDTS:

based on ITU-T Recommendation Q.72.2 [3].

(1) Congestion management for FRBS and FRDTS:

ETS 300 399-1, based on CCITT Recommendation I.370 [6].

8.2 Standards for the user-network interface (stage 3)

(1) Data link core sublayer:

ETS 300 402-3 [14], based on CCITT Recommendation Q.922 [4], Annex A.

(1) Frame relay convergence sublayer:

based on CCITT Recommendation Q.922 [4], Annex A and ETS 300 467 [16].

(1) Signalling:

based on ITU-T Recommendation Q.933 [5].

8.3 Standards for interfaces between networks (/components)

- **General requirements:** based on ITU-T Recommendation I.372 [7].
- **Frame relay data transmission network-to-network requirements:** based on draft ITU-T Recommendation X.76 [12].
- **Frame relay ISDN network-to-network requirements:** based on ITU-T Recommendation I.372 [7].
- **B-ISDN FRBS network-to-network requirements:** ETS 300 467 [16].

(1) RFHI

ETS 300 458 [15], based on ETS 300 099 [9].

(2) FHI

based on ETS 300 099 [9].

8.4 Standards for Interworking of Networks providing a frame relay service, and for service interworking

(1) Network interworking:

this subject is covered by the subject (B-ISDN) network to network interface

(2) Service interworking:

based on ITU-T Recommendation I.555 [8]

based on draft ITU-T Recommendation X.36 [13].

8.5 Standards for Network Management

Identification of subjects to be provided by NA 4.

8.6 Standards for DTE testing

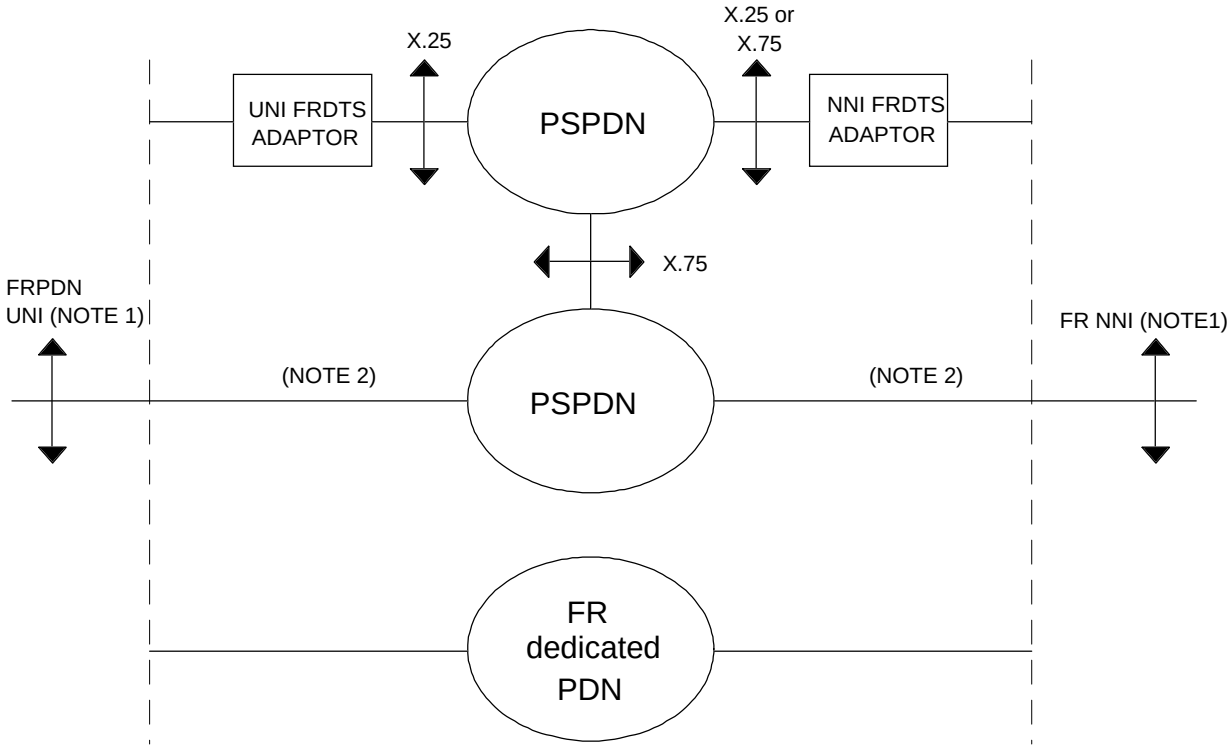
Identification of subjects to be provided by TE 5.

Annex A: Configuration for FRDTS

At this point, the configuration for FRDTS have to describe two possibilities to provide FRDTS: either the PDN is dedicated to FR, or the PDN is an existing PSPDN.

Concerning the NNI between PDNs providing FRDTS, some clarification is needed.

In order to answer to these strong requirements, subclause 5.3 may be completed as follows:



NOTE 1: These interfaces are under study by ITU-T Study Group VII, XI and XVIII, implementation agreements related to these interfaces exist in the Frame Relay Forum. ITU-T Recommendation I.372 [7] may be a starting point for the FR NNI.

NOTE 2: The PSPDN directly provides the FRPDN UNI and FR NNI.

Definitions:

UNI FRDTS adaptor: A network component which uses X.25 interface of existing PSPDNs to provide FRPDN UNI.

NNI FRDTS adaptor: A network component which uses X.25 or X.75 interfaces of existing PSPDNs to provide FR NNI.

Figure A.1: PDNs providing FRDTS

Annex B: Service integration

B.1 Introduction

This Annex shows the relationship between the different offerings of the frame relay service on different public interfaces. Although the service attributes concerning the access and possibly the QOS may be different, the attributes relating to the frame relay service itself are the same regardless on which interface the service is offered. This Annex illustrates this point of view.

B.2 Different frame relay networks

Figure B.1 shows a configuration where the frame relay service is presented as three different services depending on the public network on which the service is offered. All possible access and feeder configurations are shown together with the necessary interworking units. Of the six possible, only three transit network (trunk) configurations are shown (also with the necessary interworking units).

NOTE: Regardless of whether the access is direct or through a feeder network, customers can use identical equipment.

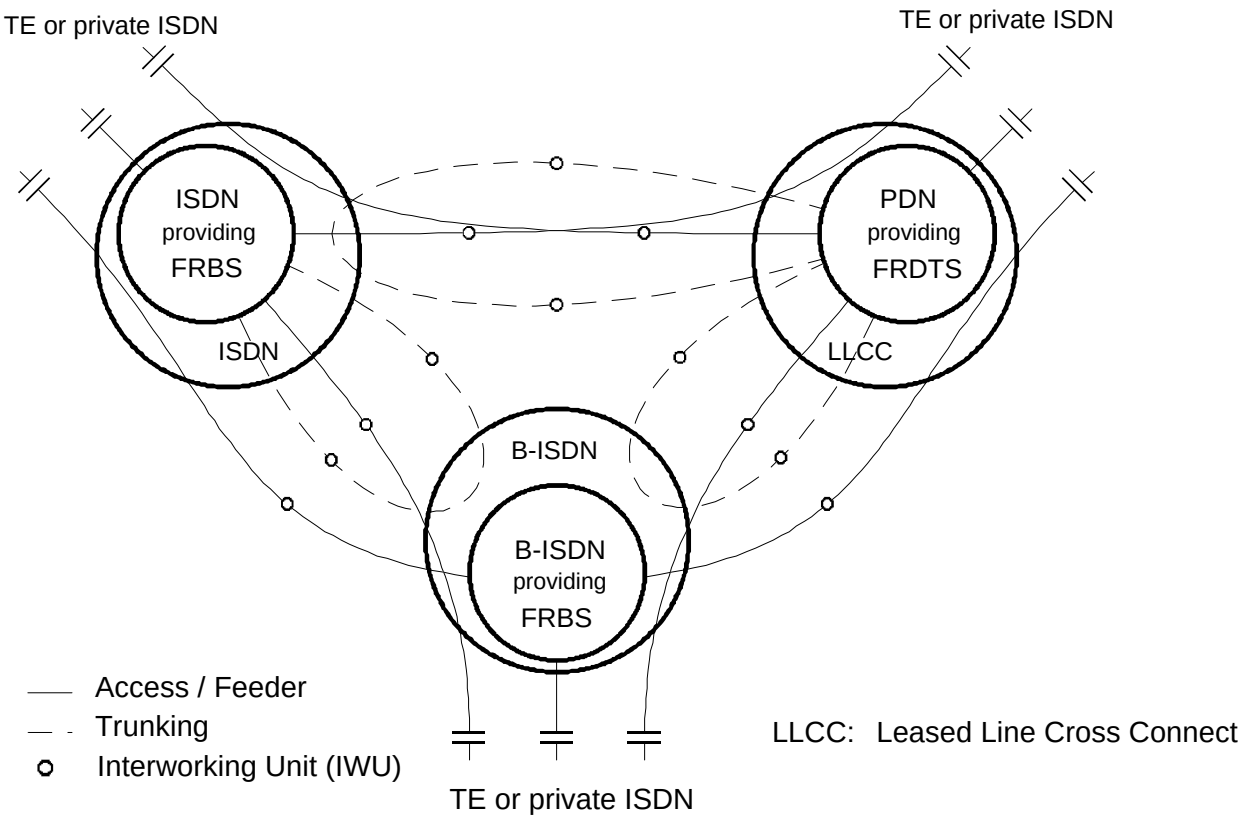


Figure B.1

B.3 Common frame relay server function

Figure B.2 shows a common FRSF. It is not assumed that this entity be a single equipment but rather that a distributed implementation is catered for with this configuration as well.

The interworking units are not shown in this configuration. They can be considered a functional subset of a general FRSF, i.e., an interworking unit is an FRSF that has only two interfaces and where there exists a one-to-one relationship between the frame relay virtual circuits at the two interfaces. Without loosing generality, those interworking units have been, therefore, subsumed in the general frame relay service as shown in figure B.2. In this configuration it is visible that the same frame relay service is offered on a number of different user-network interfaces.

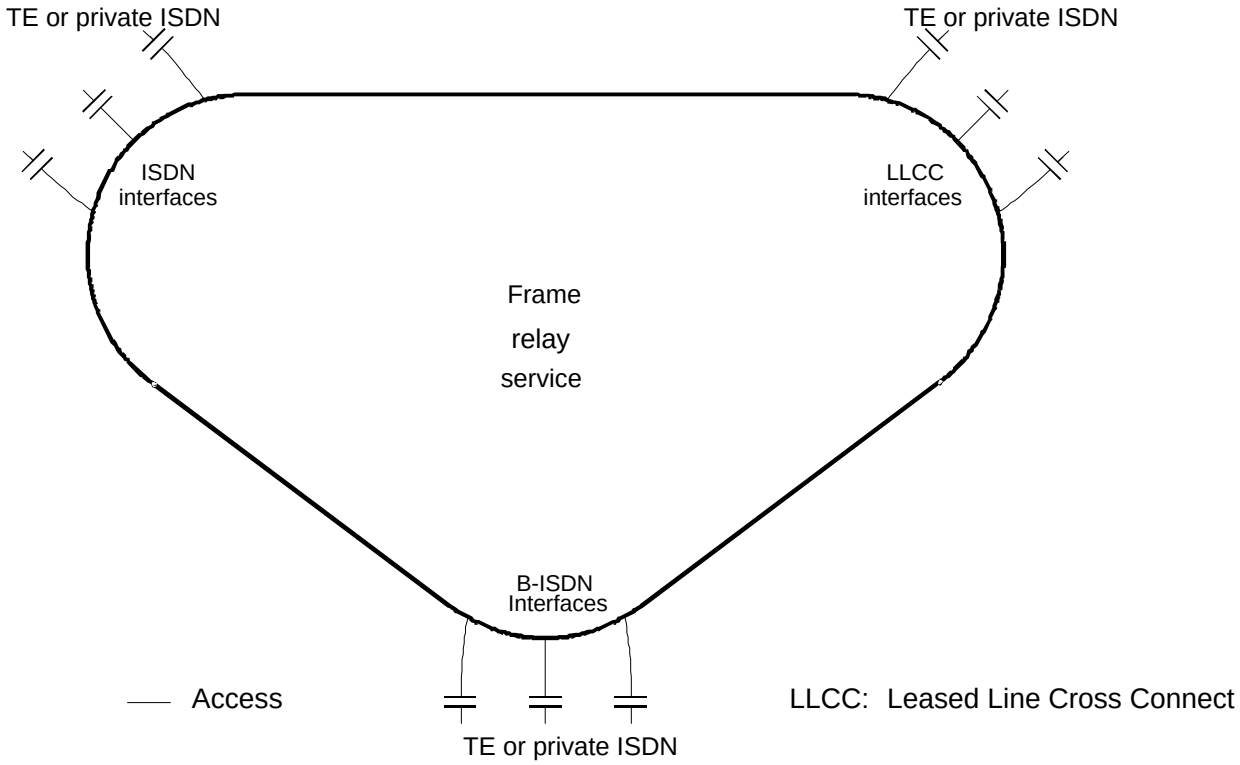
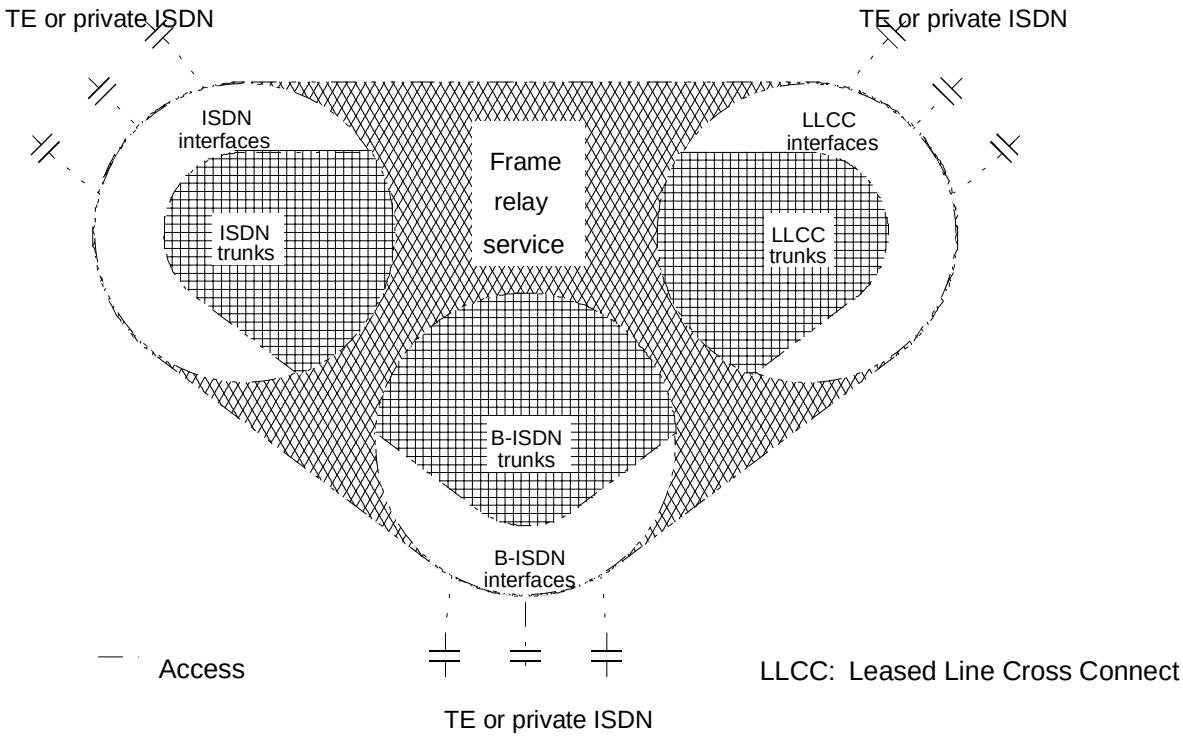


Figure B.2

B.4 Frame relay interfaces, trunks and private networks

Elaborating the configuration in figure B.2 leads to the configuration shown in figure B.3. The frame relay service is the main part that gives the reason for existence of all other parts. It is composed of a set of FRSFs (or FHs) that use trunking facilities among each other through any of the three network types under consideration. Similarly, they are serving user-network interfaces through all three network types.



NOTE: Although the frame relay service in this configuration is shown to offer three different user-network interfaces, it is not required that every frame relay network offer all of them.

Figure B.3

Private networks (private ISDNs, private B-ISDNs, private DNs) may adhere to the same structure as shown in figure B.4. In addition, they need interfaces to either a public or other private frame relay networks. Those interfaces may also be of any of the three different network types as discussed above.

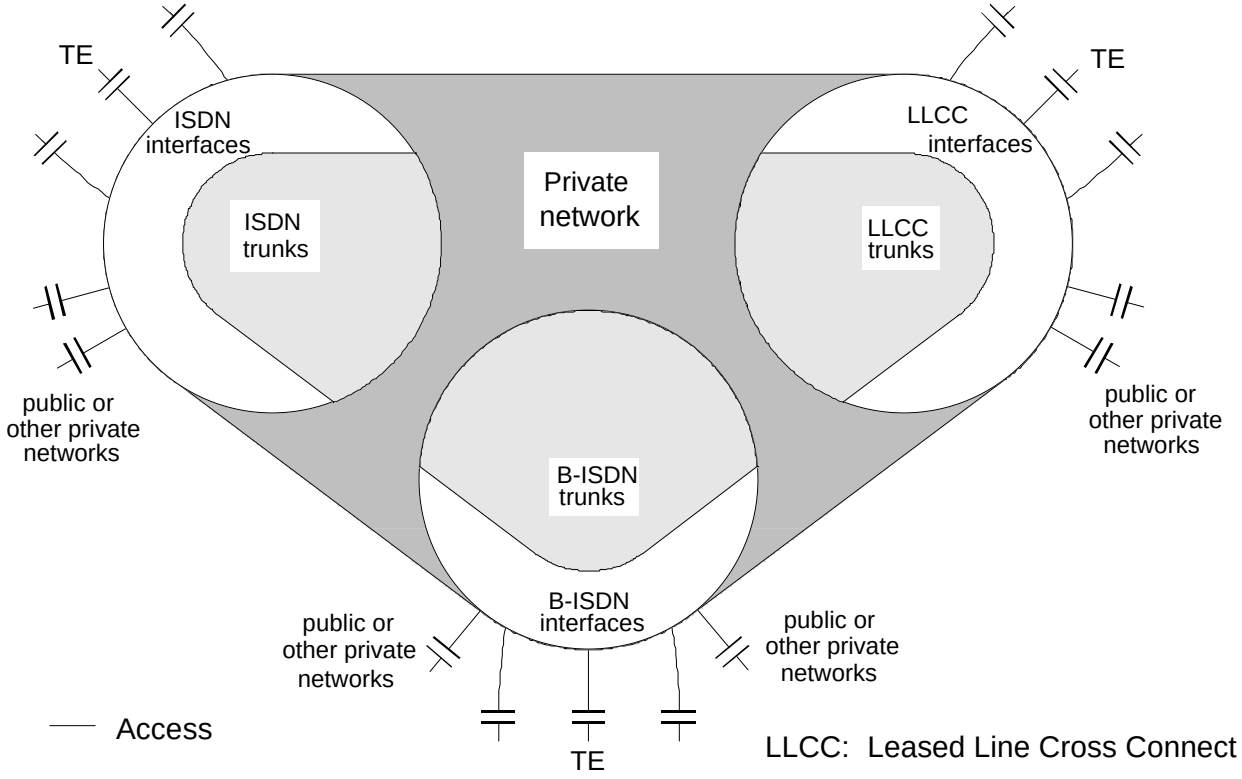


Figure B.4

B.5 Interworking

Finally, figure B.5 shows a configuration where only the relevant aspects to interworking are shown. As with the private networks, three different network types may serve as the basis for interworking.

NOTE: Only network interworking needs to be considered as there is only one common frame relay service.

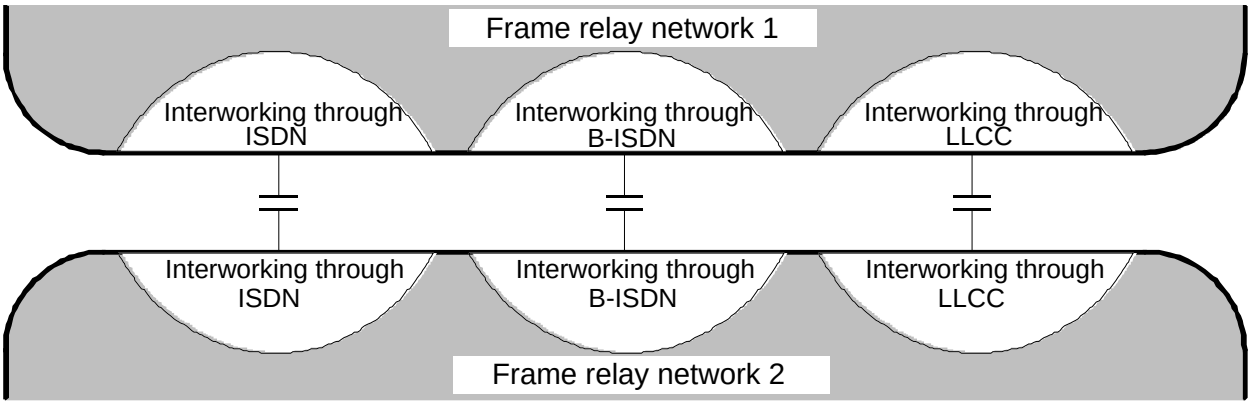


Figure B.5

History

Document history	
October 1994	First Edition
March 1996	Converted into Adobe Acrobat Portable Document Format (PDF)