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Specification of the Remote Frame Handler Interface (RFHI)

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New presentation - see History box

Contents

Foreword

This European Telecommunication Standard (ETS) has been produced by the Network Aspects (NA) Technical Committee of the European Telecommunications Standards Institute (ETSI).

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1 Scope

Applicability to frame mode services

The Remote Frame Handler (RFH) is an Integrated Services Digital Network (ISDN) frame handler, as defined in CCITT Recommendation Q.933 [4]:

- which is assumed to be remote with respect to the local connection-related function (refer to CCITT Recommendation I.324 [3]); and

- which is accessed by its subscribers via a two-step frame mode call establishment (CCITT Recommendation Q.933 [4], case A).

This European Telecommunication Standard (ETS) defines a manufacturer-independent interface between the local Connection Related Function (CRF) and the RFH, supporting a specific set of services. This interface is called the Remote Frame Handler Interface (RFHI).

The RFHI can operate:

a) as an ISDN network-internal interface, in case the RFH belongs to the ISDN;

b) as an inter-network interface, in case the RFH belongs to another network;

c) as a private-public network interface.

However, the existence of this specification does not preclude alternative implementations of a network-internal interface for Frame Relay Bearer Service (FRBS) provided by a RFH.

Scope reduction

This ETS specifies the interface between the local CRF and the RFH. It defines those additional requirements that are a direct result of standardizing this interface. Requirements to the ISDN and particularly to the RFH which are inherent to the provisioning of frame relay services by the ISDN/RFH and, therefore, are not a direct result of this interface, are specified in other standards. For such requirements this ETS makes reference to those standards.

Combination of the RFHI with the Packet Handler access point Interface (PHI), as specified in ETS 300 099 [8] is outside the scope of this ETS.

Supported ISDN frame mode services and conformance statement

The RFHI specification supports all case A services as defined in ETS 300 399-2 [10]; see clause 5 for details. No other services are supported by the RFHI specification.

The RFHI may be used to offer a subset of the frame relay services supported by the RFHI specification. Conformance to the RFHI specification is ensured by conforming to the sections of the specification that are relevant for the support of the subset of frame relay services to be offered with the RFHI.

2 Normative references

This ETS incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1]   CCITT Recommendation E.164: "Numbering plan for the ISDN era".

[2]   CCITT Recommendation E.165: "Timetable for coordinated implementation of the full capability of the numbering plan for the ISDN era (Recommendation E.164)".

[3]   CCITT Recommendation I.324: "ISDN Network Architecture".

[4]   CCITT Recommendation Q.933 (1992): "Digital Subscriber Signalling System No 1 (DSS1) - Signalling specification for Frame Mode Bearer Service".

[5]   ETS 300 011 (1992): "Integrated Services Digital Network (ISDN); Primary rate user-network interface; Layer 1 specification and test principles".

[6]   ETS 300 089 (1992): "Integrated Services Digital Network (ISDN): Calling Line Identification Presentation (CLIP) supplementary service; Service description".

[7]   ETS 300 090 (1992): "Integrated Services Digital Network (ISDN): Calling Line Identification Restriction (CLIR) supplementary service; Service description".

[8]   ETS 300 099 (1992): "Integrated Services Digital Network (ISDN); Specification of the Packet Handler access point Interface (PHI)".

[9]   ETS 300 399-1 (1995): "Frame relay services; Part 1: General description".

[10]   ETS 300 399-2 (1995): "Frame relay services; Part 2: Integrated Services Digital Network (ISDN); Frame relay bearer service; Service definition".

[11]   ETS 300 402-1: "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1); User-network interface data link layer; Part 1: General aspects [ITU-T Recommendation Q.920 (1993), modified]".

[12]   ETS 300 402-2: "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1); User-network interface data link layer; Part 2: General application protocol specification [ITU-T Recommendation Q.921 (1993), modified]".

[13]   ETS 300 403-1: "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1); User-network interface layer 3 specification for basic call control; Part 1: Protocol specification [ITU-T Recommendation Q.931 (1993), modified]".

[14]   ETS 300 403-2: "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1); User-network interface layer 3 specification for basic call control; Part 2: Specification and Description Language (SDL) diagrams".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

access channel: The channel used to access the RFH. This may be a 64 kbit/s or n x 64 kbit/s multiple-rate (see ETS 300 289) bearer channel.

access network: The set of ISDN CRFs providing the connection of the access channel between a subscriber and the RFH.

administrative procedures: These RFHI Operations, Administration and Maintenance (OA&M) procedures are separately activated on both sides of the interface. Synchronisation is not automated, i.e. consistency has to be ensured externally. No signalling on the RFHI is involved.

CRF-F: CRF physically connected to the RFH.

CRF-S: CRF to which subscribers are connected. Synonym for "local CRF" as defined in CCITT Recommendation I.324 [3].

incoming call: Call in the direction from RFH to CRF-F (CRF-S).

local RFHI access: The configuration where the ISDN subscriber accessing frame mode services is directly connected to the CRF-F, i.e. CRF-F equal to CRF-S.

outgoing call: Call in the direction from CRF-S (CRF-F) to RFH.

remote RFHI access: The configuration where the ISDN subscriber accessing frame mode services is connected to the CRF-F via a CRF-S, different from the CRF-F.

RFHI OA&M: The RFHI specification deals only with those RFHI related OA&M aspects, that require the coordination of CRF-F/S and RFH. These aspects are called "RFHI OA&M". OA&M requirements that are local to the CRF-F/S side or the RFH side of the RFHI are not within its scope.

RFHI: The interface between the access network and the RFH.

3.2 Abbreviations

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

CLIP	Calling Line Identification Presentation
CLIR	Calling Line Identification Restriction
CRF	Connection Related Function
CRF-F	CRF at RFH side
CRF-S	CRF at Subscriber side
DSS1	Digital Subscriber Signalling System No. one
FM	Frame Multiplexer
FRBS	Frame Relay Bearer Service
OA&M	Operations, Administration and Maintenance
PCM 30	30 channel Pulse Code Modulation
PRA	Primary Rate Access
PVC	Permanent Virtual Circuit
RFH	Remote Frame Handler
RFHI	Remote Frame Handler Interface
SS7	Signalling System No. 7
SVC	Switched Virtual Call
TE	Terminal Equipment
UUS1	User-to-User Signalling, service 1

4 Reference configuration and functional model

4.1 RFHI applications

4.1.1 RFHI as network-internal interface

If the ISDN itself provides the FRBS with CCITT Recommendation Q.933 [4] case A procedures, the RFHI may be used as a network-internal interface, e.g. when the ISDN is implemented with different physical equipment and in a multi-vendor environment. This RFHI application is illustrated in figure 1.
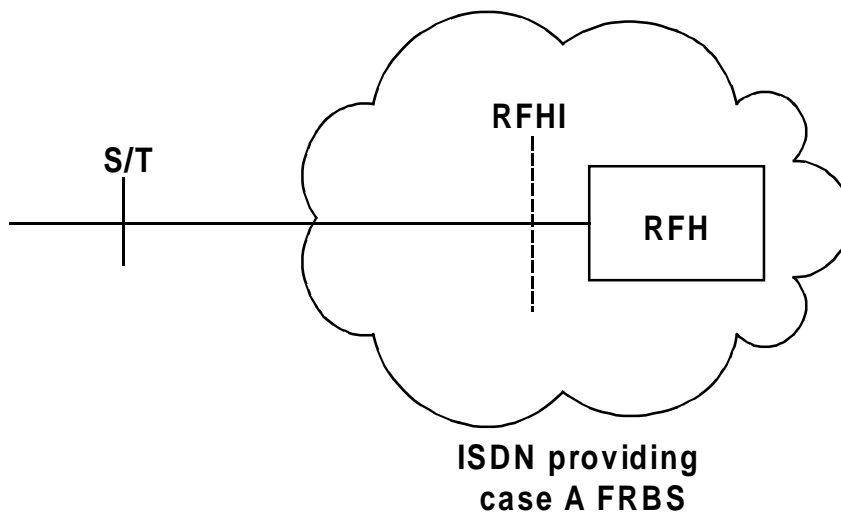
Figure 1: RFHI as network-internal interface

4.1.2 RFHI as inter-network interface

Frame relay services may also be provided by networks (e.g. public data networks) other than the ISDN the subscriber is connected to. CCITT Recommendation Q.933 [4] case A procedures may be used to access such services of other networks. This specification may therefore be used as an inter-network interface between the ISDN and another network providing frame relay services to the ISDN subscriber. This RFHI application is illustrated in figure 2.
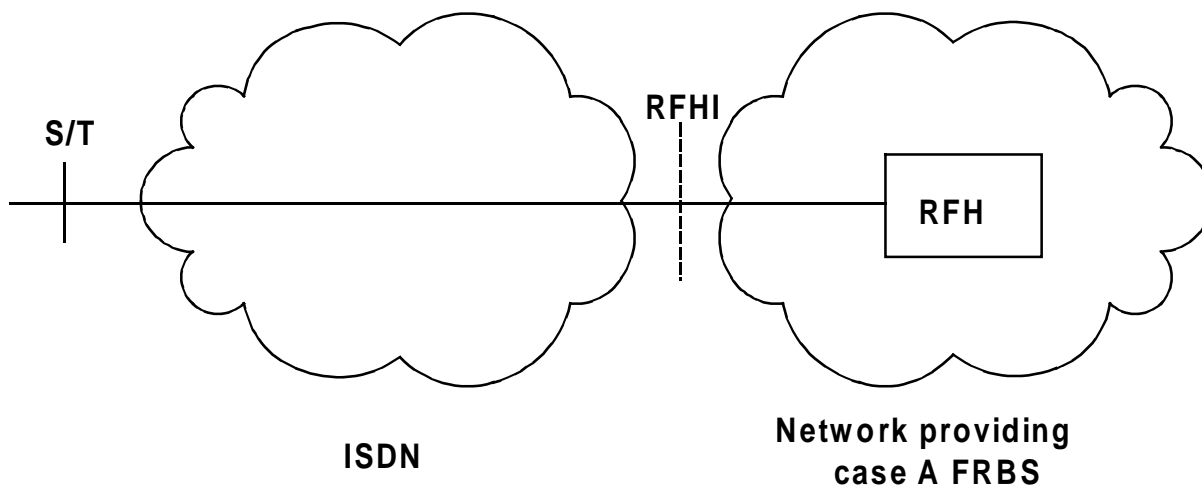
Figure 2: RFHI as inter-network interface

4.1.3 RFHI at T reference point

The RFHI may coincide with the T reference point, in either of the two previous applications. This application is illustrated in figure 3.
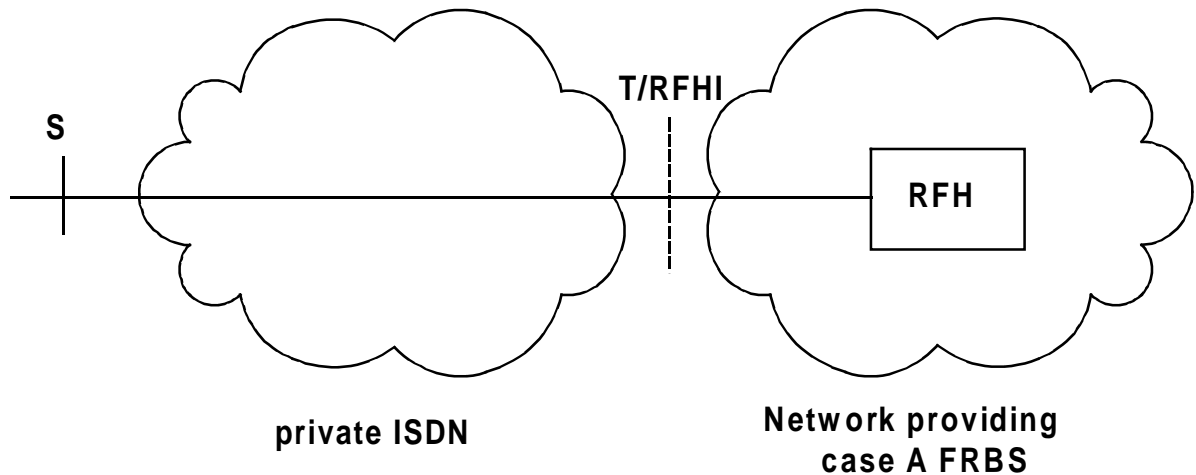
Figure 3: RFHI at T reference point

4.2 Reference configuration

4.2.1 Network configuration

With respect to frame relay services provided by a RFH, the network consists of two parts:

- the RFH;

- the CRFs between the subscriber and the RFH: the access network.

The RFH is a functional entity providing FRBSs remotely for a number of ISDN subscribers. FRBS in an ISDN may be provided by more than one of such RFHs, each serving a subset of ISDN subscribers identified by a CCITT Recommendation E.164 [1] number. A situation where complete CRF-Ss are served by the same RFH is a special case of this.

4.2.2 Access network configuration

Within the access network, some CRFs are identified as having special relevance within the network configuration for frame relay, with respect to a certain ISDN subscriber:

- CRF-S: CRF to which the subscriber is connected (local CRF as defined in CCITT Recommendation I.324 [3]);

- CRF-F: CRF physically connected to the RFH serving the subscriber;

- Transit CRF: CRF between CRF-S and CRF-F, switching the subscribers access channel.

One CRF may have a different function from the point of view of different subscribers: to the local subscribers it acts as a CRF-S, to all subscribers served by a RFH connected to the CRF it acts as a CRF-F, to others as a transit CRF.

Two access network configurations exist:

a)   local RFHI access.

CRF-S and CRF-F are one entity. See figure 4.
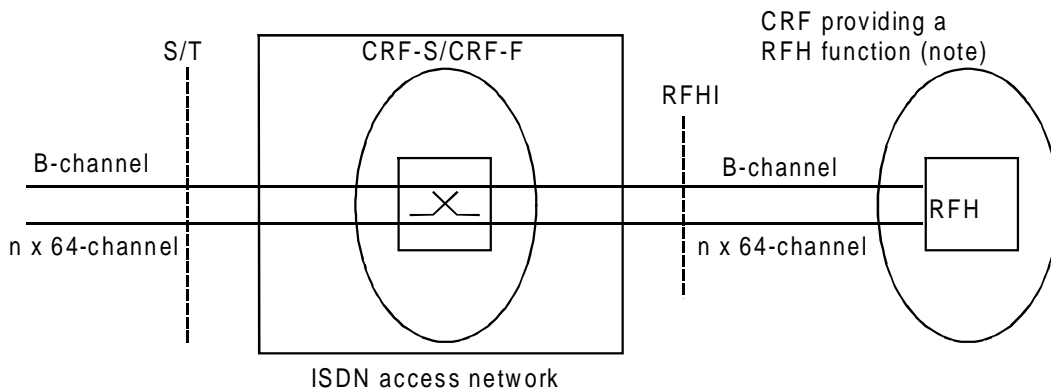
NOTE: The RFH belongs to the ISDN the subscriber is connected to, or to another network.

Figure 4: Local RFHI access

b)   remote RFHI access.

CRF-S and CRF-F are separate entities. Between both CRFs there may be transit CRFs involved which have little relevance to the network configuration. In this case, the RFHI defines only the interface between RFH and CRF-F. Therefore, the interface between CRF-S and CRF-F is not (directly) defined by the RFHI specification (see figure 5).

NOTE: Requirements by the RFHI specification on the common channel signalling system between CRF-S and CRF-F are described in annex A.

NOTE: The RFH belongs to the ISDN the subscriber is connected to, or to another network.

Figure 5: Remote RFHI access

4.3 Functional model

Figure 6 illustrates the functional model for the remote access to the RFHI. Below is the list of identified functions related to the RFHI and a short explanation. The CRF-S as well as the CRF-F may be physically distributed.
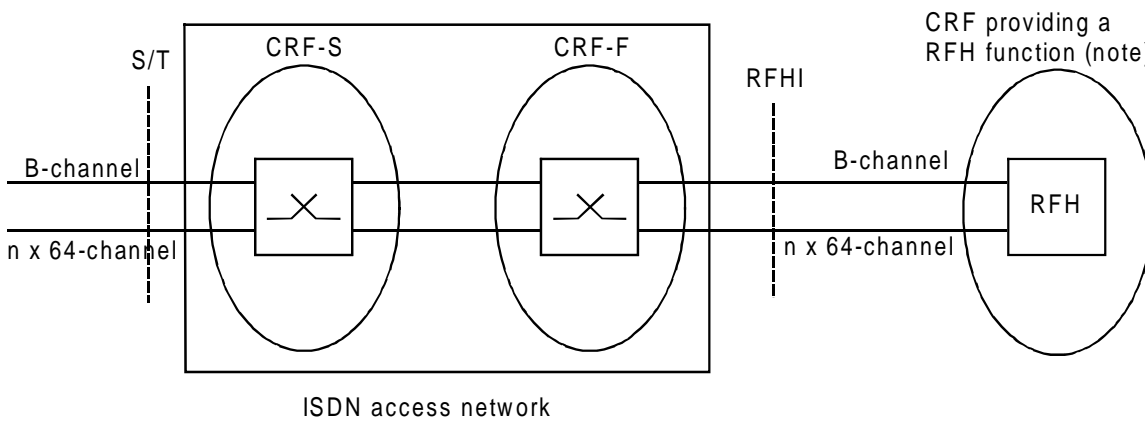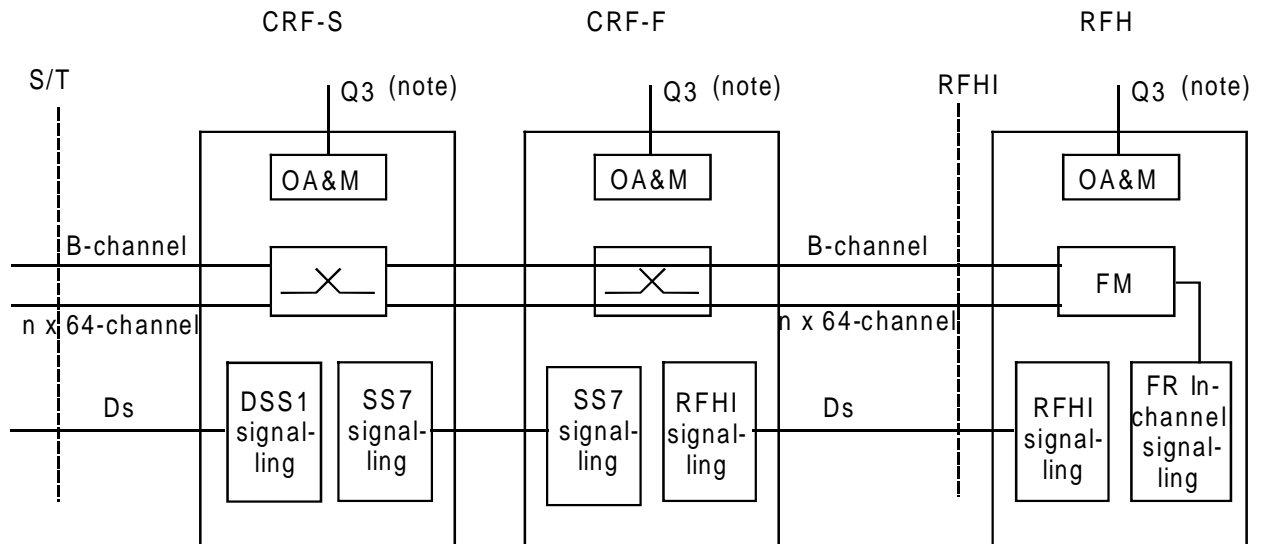
NOTE: As an example, remote subscriber units or ISDN mutliplexers can be considered as part of the CRF-S

NOTE: Q3 is shown as an example for managing the various functions involved in the access to the RFH.

Figure 6: Functional model

In the local connection related function (CRF-S):

Switching matrix.
Circuit switching capability of the local exchange, being used primarily for connecting subscriber B-channels and n x 64-channels used for frame mode services;

Digital Subscriber Signalling System No. one (DSS1) signalling.
Signalling functionality across the user-network interface. This includes call control for access channels and interface management functions;

Signalling System No. 7 (SS7) signalling.
Signalling functionality on intra-network trunk interface. This includes call control for access channels and interface management functions;

CRF-related OA&M functions (CRF OA&M).
OA&M functionality related to the subscriber connection (e.g. administration of user profile data related to the connection and to circuit switching services).

In the remote connection related function (CRF-F):

Switching matrix: see CRF-S;

SS7 signalling: see CRF-S;

RFHI signalling.
Signalling functionality across the RFHI. This includes call control for access channels and interface management functions;

RFHI OA&M.
OA&M functionality related to the RFHI, see clause 8.

In the RFH function:

> **Frame Multiplexer (FM).**
> Layer 2 functionality for multiplexing subscriber links used for frame mode services onto channels of the RFHI;

> **RFHI signalling**: see CRF-F;

> **FR In-channel signalling.**
> Signalling functionality across the user-network interface and RFHI, related to frame mode connections. This takes place inside the access channel. This includes call control for frame mode connections and interface management functions;

> **RFHI OA&M**: see CRF-F.

5 Access methods supported by the RFHI specification

5.1 Services and access methods

The RFHI specification supports case A access methods to the frame relay services as defined by ETS 300 399-2 [10]. The frame services themselves are outside the scope of this ETS since provisioning of such frame relay services is exclusively a matter for the RFH.

A subscriber shall see identical services from the RFH and use the same signalling procedures, as defined in CCITT Recommendation Q.933 [4], regardless of whether the RFHI is accessed locally or remotely, i.e. irrespective of whether CRF-S and CRF-F are identical or not.

The frame mode services are supported by the access methods given in subclauses 5.2 and 5.3. The RFHI may be used to offer a subset of the access methods in this ETS.

5.2 Access via B-channel

A transparent 64 kbit/s physical connection is established between the users Terminal Equipment (TE) and the RFH. The B-channel access connection can be established semi-permanently or on-demand.

5.2.1 Layer 1 permanent

For the permanent layer 1 access method, the physical connection is established at subscription time and maintained. No ITU-T Recommendation Q.931 procedures, as modified by ETS 300 403-1 [13] are used. This covers subclause 7.2.1 of ETS 300 399-1 [9].

5.2.2 Layer 1 on-demand

For the on-demand layer 1 access method, the physical connection is established and released on demand by the RFH or by the TE, using ITU-T Recommendation Q.931 procedures, as modified by ETS 300 403-1 [13]. This covers subclause 7.2.2 of ETS 300 399-1 [9].

5.3 Access via multiple-rate channel

A transparent n x 64 kbit/s physical connection is established between the users TE and the RFH. The multiple-rate channel access connection can be established semi-permanently or on-demand.

5.3.1 Permanent layer 1

For the permanent layer 1 access method, the physical connection is established at subscription time and maintained. No ITU-T Recommendation Q.931 procedures, as modified by ETS 300 403-1 [13] are used. This covers subclause 7.2.1 of ETS 300 399-1 [9].

5.3.2 On-demand layer 1

For the on-demand layer 1 access method, the physical connection is established and released on demand by the RFH or by the TE, using ITU-T Recommendation Q.931 procedures, as modified by ETS 300 403-1 [13]. This covers subclause 7.2.2 of ETS 300 399-1 [9].

6 Numbering, addressing and terminal selection

6.1 Numbering and addressing

For on-demand access connections, ISDN frame mode TEs, as well as the RFH, are identified by a number from the ISDN numbering plan (see CCITT Recommendations E.164 [1] and E.165 [2]) over the RFHI. Calling/called party number and optionally calling/called party subaddress are used for this purpose.

For switched frame mode connections, numbering and addressing principles are defined in CCITT Recommendation Q.933 [4] and are outside the scope of this ETS.

6.2 Terminal selection and compatibility checking

For the purpose of terminal selection and compatibility checking, the RFHI shall support conveyance, during the incoming call establishment, of the called subaddress and the low layer capability.

7 Interface structure

7.1 General

The RFHI in the strict sense is the interface between one RFH and the directly connecting CRF (CRF-F, see subclause 4.2). Via this interface all or a subset of the ISDN subscribers which are physically connected to CRF-Ss are served.

The RFHI consists of one or multiple ISDN Primary Rate Accesses (PRAs), conforming to ETS 300 011 [5], used for B-channels and n x 64-channels. The RFH assumes the user side. This implies that for an RFHI at the T reference point, the private ISDN assumes the network side.

7.2 RFHI channel types

Figure 7 illustrates the various channel types that can be found on the RFHI and the protocol stacks on them, relevant to frame relay services.
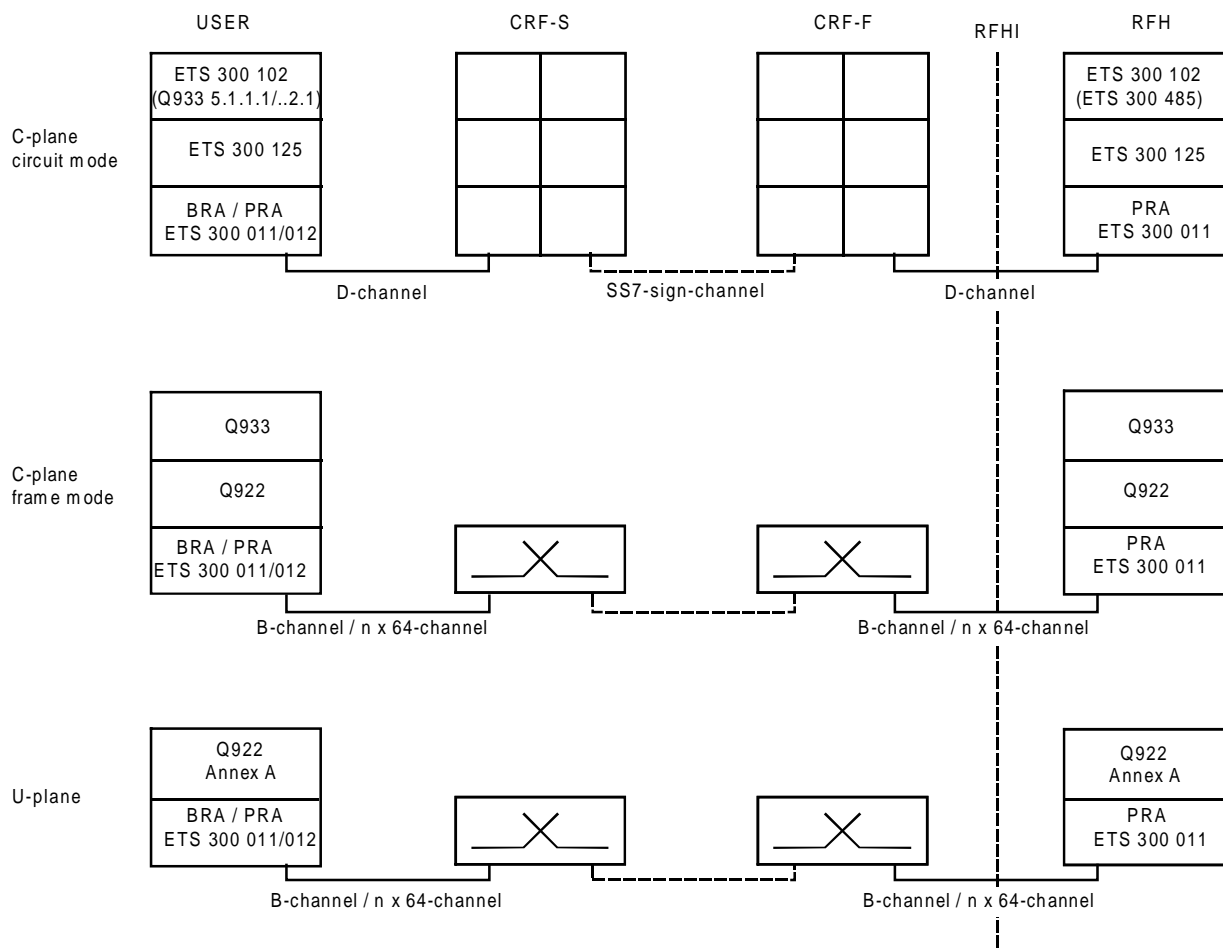
	USER	CRF-S	CRF-F	RFHI	RFH

C-plane circuit mode

ETS 300 102 (Q933 5.1.1.1/..2.1)
ETS 300 125
BRA / PRA ETS 300 011/012

ETS 300 102 (ETS 300 485)
ETS 300 125
PRA ETS 300 011

D-channel   SS7-sign-channel   D-channel

C-plane frame mode

Q933
Q922
BRA / PRA ETS 300 011/012

Q933
Q922
PRA ETS 300 011

B-channel / n x 64-channel   B-channel / n x 64-channel

U-plane

Q922 Annex A
BRA / PRA ETS 300 011/012

Q922 Annex A
PRA ETS 300 011

B-channel / n x 64-channel   B-channel / n x 64-channel

Figure 7: Protocol stacks for frame relay services

7.2.1 D64-channel

As in a regular PRA, the D64-channel is reserved for circuit mode signalling for control of the B-channels and n x 64-channels of this PRA. The layer 2 protocol is a point-to-point signalling data link according to ETS 300 402-2 [12], where the RFH assumes the user side. The signalling information exchange on layer 3 is based on ITU-T Recommendation Q.931, as modified by ETS 300 403-1 [13] and RFHI specific requirements can be found in clause 9. See "C-plane circuit mode" in figure 7.

If only the permanent layer 1 access method is supported, no D64-channel signalling is required and a 30 channel Pulse Code Modulation (PCM 30) system may be used instead of a PRA.

7.2.2 B-channel and n x 64-channel

The B-channel and n x 64-channel on the RFHI are used for two purposes:

- (in-channel) frame mode signalling for control of Switched Virtual Calls/Permanent Virtual Circuits (SVCs/PVCs), according to CCITT Recommendation Q.933 [4] (layer 3) on CCITT Recommendation Q.922 (layer 2). See "C-plane frame mode" in figure 7.

- frame transmission (SVC/PVC), according to CCITT Recommendation Q.922 Annex A (layer 2 core). See "U-plane" in figure 7.

As these channels are circuit switched through the access network, requirements on these in-channel protocols are outside the scope of this ETS.

8 OA&M

8.1 General

8.1.1 OA&M scope

The RFHI specification deals only with those RFHI-related OA&M aspects that require the coordination of CRF-F/S and RFH. These aspects are called "RFHI OA&M". OA&M requirements that are local to the CRF-F/S side or the RFH side are not within its scope.

8.1.2 Principles

RFHI OA&M shall follow some general principles:

- RFHI OA&M requirements should be kept to a minimum. To achieve this, interdependencies of network related service information between the CRF-F/S and the RFH side (e.g. knowledge of configuration data of the other side) should be minimized;

- RFHI OA&M requirements should align as much as possible with what is already defined for the User-Network PRA OA&M;

- in any case, administrative procedures separately activated on both sides of the RFHI, should be supported. Consistency has then to be ensured externally.

8.2 RFHI administration

The administration of the RFHI is very similar to the administration of a PABX with PRAs.

> NOTE: The RFHI should administer following objects:
> - other side (RFH/CRF-F), with its supplementary services, directory number, etc.;
> - PRA, with its physical, data link and network layer parameters;
> - semi-permanent channel, with its preallocated time slot(s).

8.3 RFHI operations and maintenance

Operations and maintenance of the RFHI is identical to that for user-network interface PRAs. The physical layer specification can be found in ETS 300 011 [5], data link layer specification in ETS 300 402-2 [12] and network layer specification in ITU-T Recommendation Q.931, as modified by ETS 300 403-1 [13] .

8.4 RFHI accounting

Accounting for connections established over the RFHI is performed by the access network and/or the RFH.

9 RFHI signalling

9.1 General

This clause lists the RFHI-specific layer 3 requirements on the signalling in the D64-channel of the RFHI. The RFHI signalling is completely conform to normal ITU-T Recommendation Q.931 procedures, as modified by ETS 300 403-1 [13], messages and information elements but may define some option reductions.

> NOTE: Some networks may not support all options in ITU-T Recommendation Q.931, as modified by ETS 300 403-1 [13] .

In the CRF-F, most option reductions can be realized by giving the RFH, which is perceived as a PABX with PRAs, subscriptions to specific supplementary services. Apart from these subscriptions, a few other RFHI-specific requirements may exist on the CRF-F. All remaining option reductions need to be realized by the RFH and are a matter either local to the RFH, or between the RFH and the subscriber.

9.2 Essential requirements

The RFHI shall support some essential requirements for incoming and outgoing B-channel and n x 64-channel establishment.

9.2.1 General

- For all RFHI procedures, the RFH assumes the user side, the CRF-F the network side.

- The RFH is always responsible for the time slot allocation on the PRA of the RFHI.

- The originator of a circuit switched connection at the RFHI is responsible for selecting the PRA, in a multi-PRA environment.

9.2.2 Outgoing call (CRF-F to RFH)

Normal ITU-T Recommendation Q.931 procedures, as modified by ETS 300 403-1 [13] apply. In particular:

- the SETUP to the RFH always contains the calling party number information element with a screening indicator coded as "network provided" or "user provided, verified and passed". This is achieved by subscription of the RFH to the Calling Line Identification Presentation (CLIP), and Calling Line Identification Restriction (CLIR), with override category, supplementary services (see ETS 300 089 [6] and ETS 300 090 [7] respectively). A SETUP without calling party number or with a screening indicator coded otherwise is rejected by the RFH;

- the procedures for channel selection as specified in ITU-T Recommendation Q.931 procedures, as modified by ETS 300 403-1 [13] apply with the following restriction: the indication "channel is indicated, no acceptable alternative" is not allowed. This enables the RFH to perform the time slot allocation on the PRA;

- the CRF-F shall select the PRA interface in a multi-PRA environment. This is achieved by subscription of the RFH to the line hunting and trunk hunting supplementary services (see DE/NA-010003 and DE/NA-010028);

- the RFH shall accept in the SETUP a bearer capability information element as coded in CCITT Recommendation Q.933 [4] § 5.1.1.1.

9.2.3   Incoming call (RFH to CRF-F)

Normal ITU-T Recommendation Q.931 procedures, as modified by ETS 300 403-1 [13] apply. In particular:

-        the SETUP to the CRF-F always contains the Called Party Number information element, indicating the ISDN subscriber to whom the circuit connection is to be established;

-        the procedures for channel selection as specified in ITU-T Recommendation Q.931 procedures, as modified by ETS 300 403-1 [13] apply with the following restriction: only the encoding "channel is indicated, no acceptable alternative" is allowed. This enables the RFH to perform the time slot allocation on the PRA;

-        the RFH shall send the SETUP with a bearer capability information element as coded in CCITT Recommendation Q.933 [4] § 5.1.1.1.

9.2.4   Call clearing

Normal ITU-T Recommendation Q.931 procedures, as modified by ETS 300 403-1 [13] apply. In particular:

-        the cause location field is set to "user" by the RFH;

-        in case of RFH congestion, the RFH may reject an outgoing establishment with cause "switching equipment congestion" (value 42).

9.3   Signalling reductions

The RFH may apply a subset of the normal ITU-T Recommendation Q.931 procedures, messages and information elements as modified by ETS 300 403-1 [13] (e.g. no overlap sending, not sending ALERTING, not accepting SEGMENT) but these simplifications are considered purely implementation matters and also depend on the support of additional features by the RFH (see below).

The RFH may support features, in addition to the essential requirements (e.g. to cooperate with call forwarding on the subscribers side, to accept User-to-User Signalling, service 1 (UUS1)) but these capabilities are network options and are part of the access method definition. When such features are supported, the RFH should also apply the related ITU-T Recommendation Q.931 procedures, messages and information elements, as modified by ETS 300 403-1 [13]. Appropriate subscriptions should then be given to the RFH. These additional features need not be specified by the RFHI since they belong anyway to the set of features supported by the access network and hence need no agreement between CRF-F and RFH.

Annex A (informative): Requirements on common channel signalling system

The requirements on the common channel signalling system can be derived from the signalling requirements on the user-network interface. They are determined by the services that need to be supported for the connection between subscriber and RFH:

- bearer service (B/n x 64 rate);

- bearer service type (demand/semipermanent);

- supplementary services applicable between RFH and subscriber (UUS1, CLIP, etc.).

    NOTE: The common channel signalling system puts restrictions on the use of n x 64 kbit/s access channels.

Annex B (informative): Bibliography

The following references are provided for information.

1)   CCITT Recommendation I.233.1 (1992): "ISDN frame relaying bearer service".

2)   CCITT Recommendation Q.72 (1992): "Stage 2 description for packet mode".

3)   ITU-T Recommendation Q.920: "Digital Subscriber Signalling System No.1 (DSS1) - ISDN user-network interface data link layer - General aspects".

4)   ITU-T Recommendation Q.921: "ISDN user-network interface - Data link layer specification".

5)   CCITT Recommendation Q.922: "ISDN data link layer specification for frame mode bearer services".

6)   ITU-T Recommendation Q.931: "Digital Subscriber Signalling System No.1 (DSS1) - ISDN user-network interface layer 3 3 specification for basic call control".

7)   DE/NA-010003: "Integrated Services Digital Network (ISDN); Line Hunting (LH) supplementary service; Service description".

8)   DE/NA-010028: "Integrated Services Digital Network (ISDN); Trunk Hunting (TH) supplementary service; Service description".

9)   ETS 300 289: "Business TeleCommunications (BTC); 64 kbit/s digital unrestricted leased line with octet integrity (D64U); Connection characteristics".

10)   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".

History

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