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ISDN USER-NETWORK INTERFACE LAYER 3 – GENERAL ASPECTS

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NOTES

1   CCITT Recommendation Q.930 was published in Fascicle VI.11 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).

2   In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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Recommendation Q.930[1]

ISDN USER-NETWORK INTERFACE LAYER 3 – GENERAL ASPECTS

1   General

1.1   *Introduction*

This Recommendation describes in general terms the D-channel layer 3 functions and protocol employed across an ISDN user-network interface. Details are provided in Recommendation Q.931(I.451) [1] and in Recommendation Q.932(I.452) [2].

The term "Layer 3" is a general term used in these Recommendations to refer to the procedures described in Recommendation Q.931(I.451) and in Recommendation Q.932(I.452).

The layer 3 protocol provides the means to establish, maintain and terminate network connections across an ISDN between communicating application entities. In addition, it provides generic procedures which may be used for the invocation and operation of supplementary services. The detailed description of the layer 3 protocol in Recommendation Q.931(I.451) and Recommendation Q.932(I.452) make use of the definition and terminology concepts of the ISDN protocol reference model given in Recommendation I.320 [3]. Recommendation Q.931(I.451) and Recommendation Q.932(I.452) do not at present cover all functions which may be specified for layer 3. Recommendation Q.931(I.451), Recommendation Q.932(I.452) and Recommendation I.320 are not presently completely consistent in their structure of protocols. Further study is required to enhance these Recommendations in order to resolve these inconsistencies.

Alignment/interworking between facilities defined in the Q.930-series Recommendations and the services defined in the I.250-series Recommendations is for further study.

The application of Recommendations Q.931 and Q.932 to the detailed operation of each individual supplementary service will be the subject for the future Recommendations in the Q.930 series.

1.2   Connection control by the user of an ISDN requires:

a)   application of layer 3 protocol for control of circuit-switched connections and/or packet-switched connections, in combination with;

b)   application of an appropriate data link layer service (supported by an appropriate physical layer service).

Layer 3 provides to the user the functions associated with the establishment and operation of a network connection. Layer 3 makes invisible to the user how it utilizes underlying resources such as data link connections to provide a network connection.

1.3   *Services provided by the data link layer*

Layer 3 utilizes functions and services provided by the data link as defined in Recommendations Q.920(I.440) [4] and Q.921(I.441) [5]. These services are summarized below:

a)   establishment of data link connections;

b)   error-protected transmission of data;

c)   re-establishment of data link connection (indicating loss of information).

1.4   *Symmetry of the layer 3 protocol*

It is intended that the layer 3 protocol is fully symmetrical to enable direct user-to-user communication (e.g., PABX-to-PABX communication over a leased circuit).

In order to achieve this objective, several options are incorporated in Recommendation Q.931. They are described in Annex D to Recommendation Q.931.

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[1]   This Recommendation appears in the I-series of Recommendations as Recommendation I.450.

2   Structure of layer 3

2.1   *Categories of functions*

There are two categories of functions performed at layer 3 and services provided by layer 3 in the establishment of network connections. The first category contains those functions which directly control the connection establishment.

The second category contains those functions relating to the transport of messages additional to the functions provided by the data link layer. An example of the additional layer 3 functions is the provision of re-routing of signalling messages on an alternate D-channel (where provided) in the event of D-channel failure. Other possible functions in this category may include multiplexing and message segmenting and blocking.

It is intended that the communications between these two categories will be aligned as far as possible with the primitives used between the user parts and the message transfer part in Signalling System No. 7.

Further study is required to determine the functions to be included in each category.

2.2   *Layer 3 functions*

The layer 3 protocol described in this Recommendation is designed to effect the establishment and control of circuit-switched and packet-switched connections. The functions support procedures for both basic call and call control in conjunction with network-provided supplementary facilities. Furthermore, services involving the use of connections of different types, according to user's specification, may be effected through "multi-media" call control procedures.

Functions performed by layer 3 include the following:

a)   processing of primitives for communicating with the data link layer;

b)   generation and interpretation of layer 3 messages for peer-level communication;

c)   administration of timers and logical entities (e.g., call-references) used in the call control procedures;

d)   administration of access resources including B-channels and packet-layer logical channels (e.g., Recommendation X.25 [6]);

e)   checking to ensure that services provided are consistent with user requirements (e.g., as expressed by bearer capability, addresses, low layer and high layer compatibilities).

This list of layer 3 functions is not exhaustive, and it is not intended to imply that all functions are provided on both the terminal and the network side of the user-network interface.

The following general functions may also be performed by layer 3:

a)   routing and relaying;

b)   network connection control;

c)   conveying user-to-network and network-to-user information;

d)   network connection multiplexing;

e)   segmenting and reassembly;

f)   error detection;

g)   error recovery;

h)   sequencing;

i)   congestion control and user data flow control; and

j)   restart.

2.2.1   *Routing and relaying*

Network connections exist either between users or between users and ISDN exchanges. Network connections may involve intermediate systems which provide relays to other interconnecting subnetworks and which facilitate interworking with other networks. Routing functions determine an appropriate route between layer 3 addresses.

2.2.2   *Network connection control*

This function includes mechanisms for providing network connections making use of data link connections provided by the data link layer.

2.2.3   *Conveying user information*

This function may be carried out with or without the establishment of a circuit-switched connection.

2.2.4   *Network connection multiplexing*

Layer 3 provides multiplexing of call control information for multiple calls onto a single data link connection.

2.2.5   *Segmenting and reassembly*

Layer 3 may segment and reassemble Recommendation Q.931 messages for the purpose of facilitating their transfer across local user-network interface.

2.2.6   *Error detection*

Error detection functions are used to check for procedural errors in the layer 3 protocol. Error detection in layer 3 uses, among other information, error notification of loss of information from the data link layer.

2.2.7   *Error recovery*

This function includes mechanisms for recovering from detected errors.

2.2.8   *Sequencing*

This function includes mechanisms for providing the service of sequenced delivery of layer 3 information over a given network connection when requested. In normal conditions layer 3 ensures the delivery of information in the sequence it is submitted by the user.

2.2.9   *Congestion control and user data flow control*

Layer 3 may indicate rejection or unsuccessful indication for connection establish requests to control congestion within a network. Flow control for the user-to-user signalling messages is described in Recommendation Q.931(I.451).

2.2.10   *Restart*

This function is used to return channels and interfaces to an idle condition to recover from certain abnormal conditions.

3   Structure of layer 3 Recommendations

The following is the structure of the layer 3 Recommendations:

Q.930(I.450) – ISDN user-network interface layer 3 - General aspects

Q.931(I.451) – ISDN user-network interface layer 3 specification for basic call control

Q.932(I.452) – Generic procedures for the control of ISDN supplementary services

4   Interface between layer 3 and the adjacent layers

4.1   *Overview of the interfaces*

ISDN user-network interface layer 3 provides its services to the upper layer via layer 3 service access point (SAP), and receives services from the data link layer via data link layer SAP, as is shown in Figure 1/Q.930. A particular service is provided to the upper layer, or received from the data link layer, by exchanging a corresponding sequence of primitives across the SAP.

4.2   *Interface between layer 3 and data link layer*

Overview of the interface between ISDN user-network interface layer 3 and the data link layer from the view point of the data link layer is given in § 2 of Recommendation Q.920(I.440). Primitives and primitive procedures for this interface are specified in § 4 of Recommendation Q.921(I.441).

4.3   *Interface between layer 3 and upper layer*

Primitives and primitive procedures for this interface are left for further study.
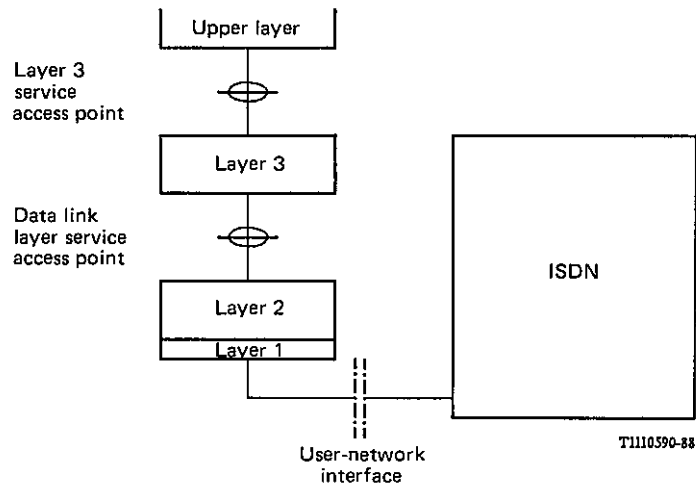
FIGURE 1/Q.930

Overview of interfaces between layer 3 and adjacent layers

References

[1]   CCITT Recommendation ISDN user-network interface layer 3 specification for basic call control, Vol, VI(III), Rec. Q.931(I.451).

[2]   CCITT Recommendation Generic procedures for the control of ISDN supplementary services, Vol. VI(III), Rec. Q.932(I.452).

[3]   CCITT Recommendation ISDN protocol reference model, Vol. III, Rec. I.320.

[4]   CCITT Recommendation ISDN user-network interface data link layer - General aspects, Vol. VI(III), Rec. Q.920(I.440).

[5]   CCITT Recommendation ISDN user-network interface data link layer specification, Vol. VI(III), Rec. Q.921(I.441).

[6]   CCITT Recommendation Interface between data terminal equipment (DTE) and data circuit terminating equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit, Vol. VIII, Rec. X.25.

Abbreviations used in Recommendations Q.930(I.450) and Q.931(I.451)

See list at the end of Recommendation Q.931.

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