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MAINTENANCE: ISDN

MANAGEMENT OF THE D-CHANNEL – DATA LINK LAYER AND NETWORK LAYER



Recommendation M.3640

FOREWORD

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CCITT NOTE

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

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Recommendation M.3640**MANAGEMENT OF THE D-CHANNEL – DATA LINK LAYER AND NETWORK LAYER***(1992)**Abstract*

This Recommendation contains a prosaic description of the management aspects of the data link layer and network layer of the access to ISDNs. Besides it also defines managed objects, by using OSI-management principles.

Keywords

- fault Management;
- performance management;
- management of ISDN D-channel;
- management of ISDN.

1 Introduction

The purpose of this Recommendation is to describe the management capabilities¹⁾ for the data link (layer 2) and the network (layer 3) layer associated with the access to Integrated Services Digital Networks (ISDNs). These management capabilities are specified as functions in the Exchange Termination (ET). These functions may either be visible to an TMN Operations System (OS) via a Q-interface or visible to local maintenance personnel via an F-interface. The principles of Recommendation M.20 [3] and M.3600 Series Recommendations [5], [6] are adhered.

This Recommendation pertains to management of the data link layer and network layer of the access-protocols between the exchange termination (ET) and subscriber installation (see Figure 1/M.3640). The management, as viewed only by the ET of the data link and network protocols, is specified.

Section 2 provides definitions of terms introduced in this Recommendation. Section 3 outlines a reference configuration for management of the data link layer and network layer. In section 4 a prosaic description is given of the capabilities for management of the data link layer and network layer. In section 5 a list of abbreviations is given.

In Appendix II, an informal description of the management information is given. Appendix III gives the semi-formal specification of the candidate managed objects for the data link layer and network layer of the D-channel. In Annex A, the management support functions are referenced.

Appendix I lists the management capabilities which are to be considered to be included in future versions of this Recommendation.

2 Definitions**2.1 autonomous management**

The management operations which are local to the network element and which are not controlled by an external operations system or by a human operator. Autonomous management operations are supported by internal mechanisms which monitor a certain object and which decide by analysing the results of the monitoring which action should be implemented. The whole process is automated.

¹⁾ Management capabilities refer to operation, maintenance and administration and also to e.g. configuration and performance management and possibly other management areas.

2.2 human machine interface

The management operations which are locally performed by a human operator. These operations are visible at the F-interface of TMN.

2.3 management information

Management information refers to the management view of resources. This management view consists of the management characteristics of the resources, the actions which may be performed upon the resources and the notifications which may be emitted, due to internal events.

2.4 managed object

See ISO/IEC 7498/4.

2.5 attributes

See Recommendation X.710.

2.6 systems management operations

See CCITT Rec. X.701 | ISO/IEC 10040.

2.7 notification

See CCITT Rec. X.701 | ISO/IEC 10040.

2.8 invalid frame

See § 2.9 of Recommendation Q.921.

3 Reference configuration for management of the access protocol

The ISDN-access protocols are defined between the ISDN and the user (see Figure 1/M.3640). The protocol entities of the data link layer and network layer are located in the exchange termination (ET) and in the subscriber installation (SI). The SI is composed of the terminal equipment (TE) and/or the network termination type 2 (NT2)²⁾. The ET is part of an ISDN local exchange.

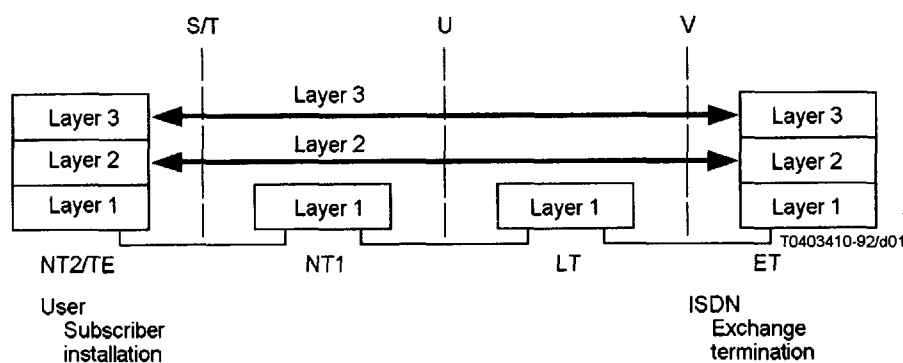


FIGURE 1/M.3640

Peer relationships between the exchange termination and subscriber installation

²⁾ In the United States-standards the NT1 will also be part of the SI. However, this has no effect on this Recommendation.

In Figure 2/M.3640, a reference configuration for management of the access protocol is presented. This reference configuration is a refinement of Figure 9/M.3600 and is based upon the Telecommunication Management Network (TMN) concept (see Recommendation M.3010) [4]. TMN defines a structure which contains, among other things, Operations Systems (OSs) and Network Elements (NEs). In this Recommendation, the ISDN local exchange is considered to be the NE. The interface between the OS and NE is, in TMN-terminology, called the Q3-interface.

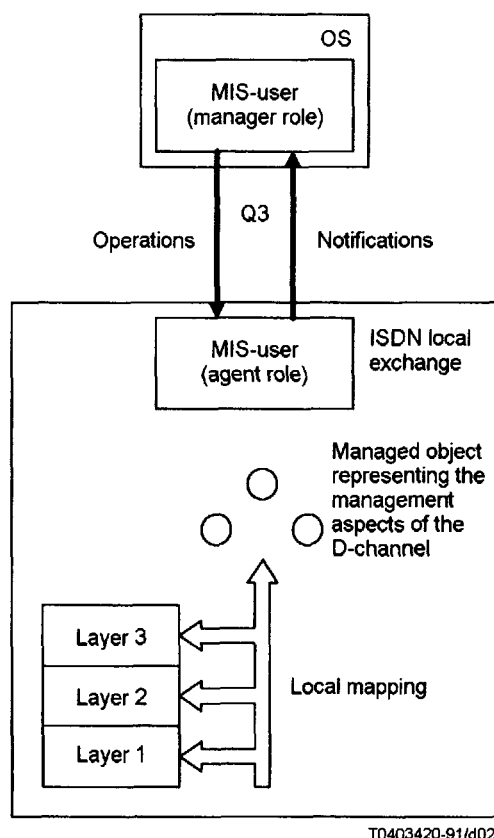


FIGURE 2/M.3640

Reference configuration for management of the access protocol

Management of a communication environment is an information processing application. Because the environment being managed is distributed, the individual components of the management activities are themselves distributed. The interactions which take place between management applications (manager and agent) are abstracted in terms of operations and notifications issued by one entity to the other. The management activities are effected through the manipulation of managed objects. These managed objects are the management view of a system resource that is subject to management, such as a data link layer entity. Thus, a managed object is the abstracted view of such a resource that represents its properties as seen by and for the purposes of management.

With the definition of managed objects the possible management activities are described.

The local mapping of the managed objects upon the resources they represent is a matter of implementation and is not subject to standardization.

For a more detailed description of the concepts of OSI-management and TMN, see CCITT Rec. X.701 | ISO/IEC DIS 10040 and Recommendation M.3010.

4 Prosaic description of management of the data link layer and network layer

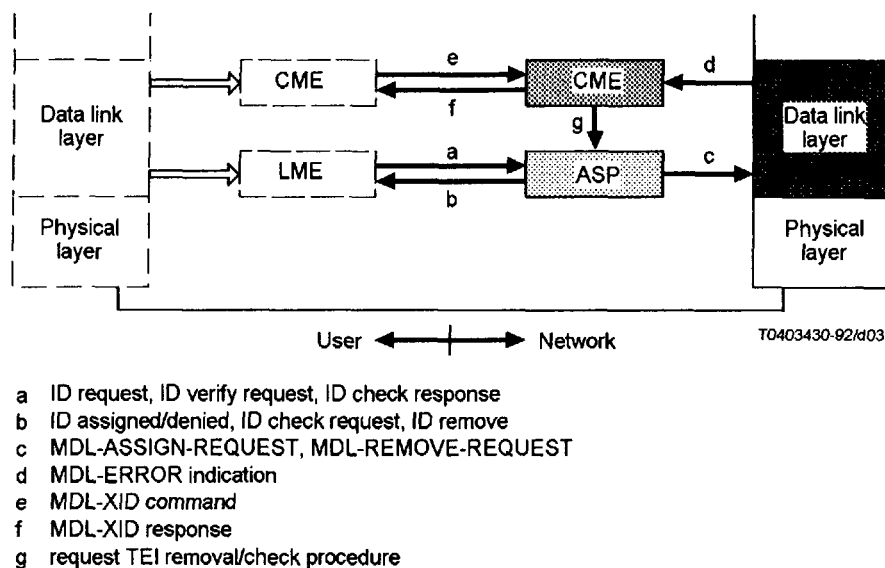
This section provides a prosaic description of the management capabilities relevant to management of the data link layer and network layer of the D-channel.

The data link layer and network layer peer relationships considered here are the signalling data on the D-channel and packet data on the D-channel. The management capabilities include the following management functions:

- counts (with associated thresholds) for performance monitoring;
- counts (and associated thresholds) or logs for protocol abnormalities;
- an on-demand log of all protocol activity on a given D-channel over a specified time interval;
- the counters for the performance monitoring and protocol abnormality parameters shall be readable and resettable on demand;
- other support management functions are listed in Appendix III.

4.1 Management information relating to the data link layer

In the data link layer, several entities have been identified. See Figure 3/M.3640.



Note – For abbreviations see § 5.

FIGURE 3/M.3640
Composition of layer 2

4.1.1 *Protocol error detection and logging*

The following data link layer errors shall be logged per D-channel:

- 1) the frames received with a control field that is undefined or not implemented;
- 2) the frames received with an information field that is not permitted;
- 3) the supervisory or unnumbered frame with incorrect length;
- 4) the frames received with an invalid receive sequence number [i.e. invalid N(R)];
- 5) the frames received with an information field that exceeds the maximum established length;
- 6) the Frame Reject (FRMR) frames received;
- 7) the Disconnect Mode (DM) frames in response to a Set Asynchronous Balanced Mode Extended (SABME) frame³⁾;
- 8) the proper responses (i.e. unnumbered acknowledgement or disconnect mode frames) not received to establish or restore the link after N200 SABME frames were sent;
- 9) the DM frames sent in response to a SABME frame.

4.1.2 *Layer 2 performance monitoring*

The ET shall keep counts for the following layer 2 parameters for each D-channel (it is optionally possible to specify measurements for these counters, for which scheduling is allowed):

- the number of frames with Frame Check Sequence (FCS) errors at the ET;
- the total number of frames received at the ET;
- the number of frames retransmitted by the ET;
- the total number of frames transmitted by the ET.

The occurrence of invalid frames (see § 2.9 of Recommendation Q.921); except those with FCS-errors are counted per D-channel or logged. The unexpected frames (see Table 9/Q.921) are logged.

4.2 *Management information relating to Recommendation Q.931*

This subsection describes the management information of the basic call control function of the network layer. Both the opportunities and the requirements are listed here.

4.2.1 *Incorrect messages*

The messages defined for layer 3 in § 5.8 of Recommendation Q.931 should obey specified rules. The error conditions are handled by the protocol itself. In Recommendation Q.931 a number of message faults are defined. For instance, a message may contain an information element which represents an invalid bearer capability (or a missing bearer capability information element).

The following incorrect messages are defined in Recommendation Q.931:

- messages received containing a protocol discriminator coded other than “Q.931 user-network call control message” (see § 5.8.1 of Recommendation Q.931);
- messages which are too short to contain a complete message type (see § 5.8.2 of Recommendation Q.931);
- general information element errors (see § 5.8.5 of Recommendation Q.931);
- mandatory information element errors (see § 5.8.6 of Recommendation Q.931).

On occurrence of these incorrect messages a counter will be incremented. If the counter exceeds a certain threshold, the OS shall be notified. The OS may initiate a procedure to disconnect the connection with the subscriber installation or send a message to the user.

³⁾ The reception of this frame indicates that the exchange termination did not establish a link successfully.

4.2.2 Call reference errors

In the protocol a call reference is used to specify a call. If in a message the call reference value is not correct (see Table 1/M.3640), than a counter shall be raised or this message shall be logged. If the messages are being counted, the OS shall be informed after a threshold is crossed.

TABLE 1/M.3640
Messages with call reference errors

Messages	Call reference value
All messages except: SETUP, STATUS, RESUME	which is not relating to an active call or a call in progress
SET-UP, RESUME	which is not relating to an active call or a call in progress and with a call reference flag set to "1"
SET-UP	which is relating to an active call or a call in progress
All messages except: RESTART, RESTART ACK, STATUS	which is the global call reference

4.2.3 Layer 3 performance monitoring and signalling abnormalities

For the purpose of performance management and detection of signalling abnormalities the following message types will be counted per D-channel or logged:

- STATUS messages received;
- RESTART messages received;
- STATUS messages transmitted;
- RESTART messages transmitted.

The following messages will be logged:

- DISCONNECT, RELEASE and RELEASE COMPLETE messages received, with a cause value other than normal event;
- DISCONNECT, RELEASE and RELEASE COMPLETE messages transmitted, with a cause value other than normal event.

4.2.4 Expiry of system timers

Upon expiry of the following system timers, the OS should be informed by means of a notification:

- T308: After the second expiry the B-channel will be placed in a maintenance condition;
- T309: The data link failure has not been recovered;
- T316: After "n" expiries the OS shall be notified;
- T317: The restart procedure did not work, the OS shall be notified.

The following expiries of protocol timers will be counted. After exceeding the threshold associated with this counter the OS shall be informed:

- T303: After the second expiry (which implies that the user did not respond) management could be informed, because it indicates a faulty situation;
- T310: After reception of call proceeding, no response has reached the network.