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Temporary Document 646-E

WORKING PARTY XI/6

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Question: 8/XI

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TITLE: Editorial corrigenda for Recommendation Q.921 based upon
COM XI-R 43-E

1 General

This Recommendation specifies the frame structure, elements of procedure, format of fields and procedures for the proper operation of the Link Access Procedure on the D-channel, LAPD.

The concepts, terminology, overview description of LAPD functions and procedures, and the relationship with other Recommendations are described in general terms in Recommendation Q.920(I.440) [1].

Note 1 - As stated in Recommendation Q.920(I.440), the term "data link layer" is used in the main text of this Recommendation. However, mainly in figures and tables, the terms "layer 2" and "L2" are used as abbreviations. Furthermore, in accordance with Recommendations Q.930(I.450) [2] and Q.931(I.451) [3], the term "layer 3" is used to indicate the layer above the data link layer.

Note 2 - All references within this document to "layer management entity" and/or "connection management entity" refer to those entities at the data link layer.

2 Frame structure for peer-to-peer communication

2.1 General

All data link layer peer-to-peer exchanges are in frames conforming to one of the formats shown in Figure 1/Q.921. Two format types are shown in the figure: format A for frames where there is no information field and format B for frames containing an information field.

2.2 Flag sequence

All frames shall start and end with the flag sequence consisting of one 0 bit followed by six contiguous 1 bits and one 0 bit. The flag preceding the address field is defined as the opening flag. The flag following the Frame Check Sequence (FCS) field is defined as the closing flag. The closing flag may also serve as the opening flag of the next frame, in some applications. However, all receivers must be able to accommodate receipt of one or more consecutive flags. See ISDN User-Network Interfaces: Layer 1 Recommendations (ITU-T Rec. Q.921) [4], [5] for applicability.

2.3 Address field

The address field shall consist of two octets as illustrated in Figure 1/Q.921. The address field identifies the intended receiver of a control frame and the transmitter of a response frame. The format of the address field is defined in § 3.2.

A single octet address field is reserved for LAPB operation in order to allow a single LAPB [6] data link connection to be multiplexed along with link connections.

(1588) The support of a LAPB data link connection within the D-channel is optional at both the network and user side.

Note: All arithmetic operations on state variables and sequence numbers contained in this recommendation are affected by the modulus operation.

- 41 -
COM XI-R 43-E

- 3 -

3.5 Control field parameters and associated state variables

The various parameters associated with the control field formats are described in this section. The coding of the bits within these parameters is such that the lowest numbered bit within the parameter field is the least significant bit.

3.5.1 Poll/Final (P/F) bit

All frames contain the Poll/Final (P/F) bit. The P/F bit serves a function in both command frames and response frames. In command frames the P/F bit is referred to as the P bit. In response frames it is referred to as the F bit. The P bit set to 1 is used by a data link layer entity to solicit (poll) a response frame from the peer data link layer entity. The F bit set to 1 is used by a data link layer entity to indicate the response frame transmitted as a result of a soliciting (poll) command.

The use of the P/F bit is described in § 5.

3.5.2 Multiple frame operation - variables and sequence numbers

3.5.2.1 Modulus

Each I frame is sequentially numbered and may have the value 0 through n minus 1 (where n is the modulus of the sequence numbers). The modulus equals 128 and the sequence numbers cycle through the entire range, 0 through 127.

3.5.2.2 Send state variable V(S)

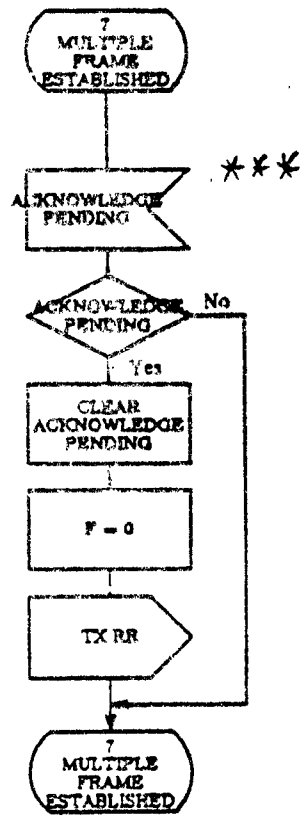
Each point-to-point data link connection endpoint shall have an associated V(S) when using I frame commands. V(S) denotes the sequence number of the next I frame to be transmitted. The V(S) can take on the value 0 through n minus 1. The value of V(S) shall be incremented by 1 with each successive I frame transmission, and shall not exceed V(A) by more than the maximum number of outstanding I frames k . The value of k may be in the range of 0 to n minus 1.

3.5.2.3 Acknowledge state variable V(A)

Each point-to-point data link connection endpoint shall have an associated V(A) when using I frame commands and supervisory frame commands/responses. V(A) identifies the last frame that has been acknowledged by its peer [V(A) + 1 equals the N(S) of the last acknowledged I frame]. V(A) can take on the value 0 through n minus 1. The value of V(A) shall be updated by the valid N(R) values received from its peer (see § 2.5.2.6). A valid N(R) value is one that is in the range $V(S) \leq N(R) \leq V(S)$.

3.5.2.4 Send sequence number N(S)

Only I frames contain N(S), the send sequence number of transmitted frame. At the time that an I frame is designated for transmission, the value of N(S) is set equal to V(S).



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FIGURE B-7/Q.921 (10 of 10)

TABLE D-1/Q.921 (1 of 10)
 State transition table: receiving primitive

STATE	TXI UNASSIGNED	ADDITIONAL ANALYZING TXI	ESTABLISH AWAITING TXI	TXI ASSIGNED	AWAITING ESTABLISHMENT			AWAITING RELEASE
TRANSMITTER CONDITION					Establish	Re-establish	Pending release	
RECEIVER CONDITION							See Note	
STATE NUMBER	1	2	3	4	5.0	5.1	5.2	6
DL-ESTABLISH-REQUEST	NOL-ASS-IND 1		1	RC=0 TX SAME P=1 START T200 5.0	1	DISC. 1 QUEUE 5.0	1	1
DL-RELEASE-REQUEST	1	1	1	DL-REL-COMP	1	5.2	1	1
1-DATA-REQUEST	1	1	1	1	1	DATA DTCO 1 QUEUE	1	1
1 FRAME IN QUEUE (S1)N(A)P	1	1	1	1	1	LEAVE 1 FRAME IN QUEUE		1
1 FRAME IN QUEUE (S1)N(A)P	1	1	1	1	1			1
DL-UNIT DATA-REQUEST	NOL-ASS-IND UNIT DATA INTO UI QUEUE 1	UNIT DATA INTO UI QUEUE						
UI FRAME IN QUEUE	1	LEAVE UI FRAME IN QUEUE		TX UI P=0				
NOL-ASSIGN-REQUEST	STORE TXI VALUE 4		STORE TXI VALUE RC=0 TX SAME P=1 START T200 5.0	1	1	1	1	1
NOL-REMOVE-REQUEST	1	1	1	DISC. UI QUEUE 1	DL-REL-IND DISC. UI QUEUE STOP T200 1	DL-REL-IND DISC. 1 and UI QUEUES STOP T200 1	DL-REL-COMP DISC. 1 and UI QUEUES STOP T200 1	DL-REL-COMP DISC. UI QUEUE STOP T200 1
NOL-ERROR-RESPONSE	1	DISC. UI QUEUE 1	DL-REL-IND DISC. UI QUEUE 1	1	1	1	1	1
PERSISTENT DEACTIVATION	-	DISC. UI QUEUE 1	DL-REL-IND DISC. UI QUEUE 1	DISC. UI QUEUE	DL-REL-IND DISC. UI QUEUE STOP T200 4	DL-REL-IND DISC. 1 and UI QUEUES STOP T200 5	DL-REL-COMP DISC. 1 and UI QUEUES STOP T200 4	DL-REL-COMP DISC. UI QUEUE STOP T200 4

Note - The transmitter condition "pending release" may occur only in cases of layer 2 initiated re-establishment.

COM XI-R 43-E

- 130 -

- 5 -

TABLE 17-Q.921 (9 of 10)

State transition table - internal events (expiry of timers, receiver busy condition)

STATE TRANSITION		MULTIPLE FRAME ESTABLISHED						
TRANSMITTER CONDITION	NORMAL	NORMAL	NORMAL	NORMAL	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY
RECEIVER CONDITION	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ and own REC busy	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ and own REC busy
STATE NUMBER	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7
T200 TIME-OUT RC = M200	RC=0 either V(S)=V(S)-1 TX RR P=1 V(S)=V(S)+1 or TX RR P=1 then RC=RC+1 START T200 8.0	RC=0 either V(S)=V(S)-1 TX RR P=1 V(S)=V(S)+1 or TX RR P=1 then RC=RC+1 START T200 8.1	RC=0 either V(S)=V(S)-1 TX RR P=1 V(S)=V(S)+1 or TX RR P=1 then RC=RC+1 START T200 8.2	RC=0 either V(S)=V(S)-1 TX RR P=1 V(S)=V(S)+1 or TX RR P=1 then RC=RC+1 START T200 8.3	RC=0 TX RR P=1 RC=RC+1 START T200 8.4	RC=0 TX RR P=1 RC=RC+1 START T200 8.5	RC=0 TX RR P=1 RC=RC+1 START T200 8.6	RC=0 TX RR P=1 RC=RC+1 START T200 8.7
T200 TIME-OUT RC = M200	/	/	/	/	/	/	/	/
T203 TIME-OUT	RC=0 TX RR P=1 START T200 8.0	RC=0 TX RR P=1 START T200 8.1	RC=0 TX RR P=1 START T200 8.2	RC=0 TX RR P=1 START T200 8.3	/	/	/	/
SET OWN RECEIVER BUSY (note)	TX RR P=0 7.2	TX RR P=0 7.3	-	-	TX RR P=0 7.6	TX RR P=0 7.7	-	-
CLEAR OWN RECEIVER BUSY (note)	-	-	TX RR P=0 7.0	TX RR P=0 7.1	-	-	TX RR P=0 7.4	TX RR P=0 7.5

COM XI-R 43-E

152
6

→ RNR

Note - These signals are generated outside the procedures specified in this state transition table, and may be generated by the connection management entity.