ANNEX A THROUGH F FOR AX.25 LEVEL 3 PROTOCOL

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Description

This is the fourth of four papers that make up a recommendation for the AX.25 Network Sublayer protocol.

This paper contains the annexes for the previous three papers. These annexes are based on the CCITT X.25 document, modified as necessary to operate in the amateur enviroment.

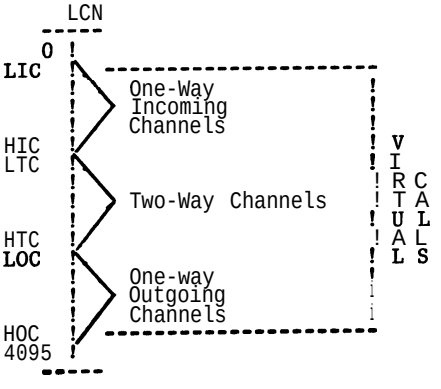
This paper is a draft, and subject to change. Anyone wishing to offer comments or suggestions should write the author at the above address, or write to the AMRAD Newsletter for publication.

ANNEX A

Range of logical channels used for virtual calls

In the case of a single logical channel DTE, logical channel number 1 will be used.

For each multiple logical channel DTE/DCE interface, a range of logical channels will be agreed upon with the Network Adminidtration according to Figure A-1/AX.25.



Where:

LCN = Logical channel number
LIC = Lowest Incoming call number
HIC = Highest Incoming call number
LTC = Lowest Two-way call number
HTC = Highest Two-way call number
LOC = Lowest Outgoing call number
HOC = Highest Outgoing call number

Figure A-1/AX.25

LIC to HIC: range of logical channels assigned to one-way incoming channels for virtual calls.

The present recommendation is to assign 1 as the LIC, and 3 as the HIC.

LTC to HTC: range of logical channels which are assigned to two-way logical channels for virtual calls.

The present recommendation is to assign 4 as the LTC, and 4079 as the HTC.

LOC to HOC: range of logical channels assigned for use as one-way outgoing channels for virtual calls.

The present recommendation is to assign 4080 as the LOC, and 4095 as the HOC.

Note 1: The reference to the number of logical channels is made according to a set of contiguous numbers from 0 (lowest) to 4095 (highest) using 12 bits made up of the logical channel group number (LCGN) (see 6.1.2) and the 8 bits of the logical channel number (see 6.1.3). The numbering is binary coded using bit positions 4 to 1 of octets 1 followed by bit positions 8 through 1 of octet followed by bit positions 8 through 1 of octet 2 with bit 1 of octet being the low order bit.

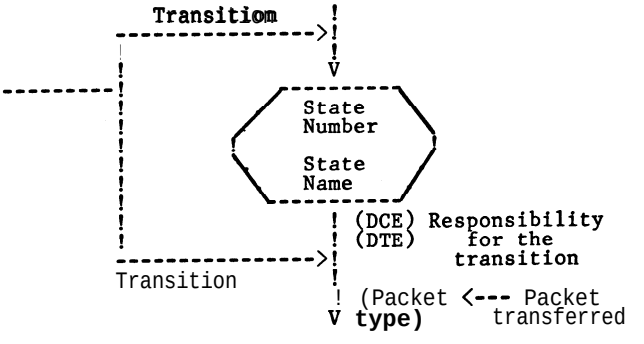
Note 2: All logical channel boundaries are agreed to for a period of time.

Note 3: DCE search algorithm for a logical channel for a new incoming call will be to use the lowest logical channel in the ready state in the range of LIC to HIC or LTC to HTC, depending on whether the call is one-way incoming or two-way, respectively.

Note 4: In order to minimize the risk of call collision, the DTE search algorithm is suggested to start with the highest numbered logical channel in the ready state.

ANNEX B

B.l Symbol definition of the state diagram



Note 1. Each state is represented by an ellipse wherein the state name and number are indicated.

Note 2. Each state transition is represented by an arrow. The responsibility for the transition (DTE or DCE) and the packet that has been transferred as indicated beside the arrow.

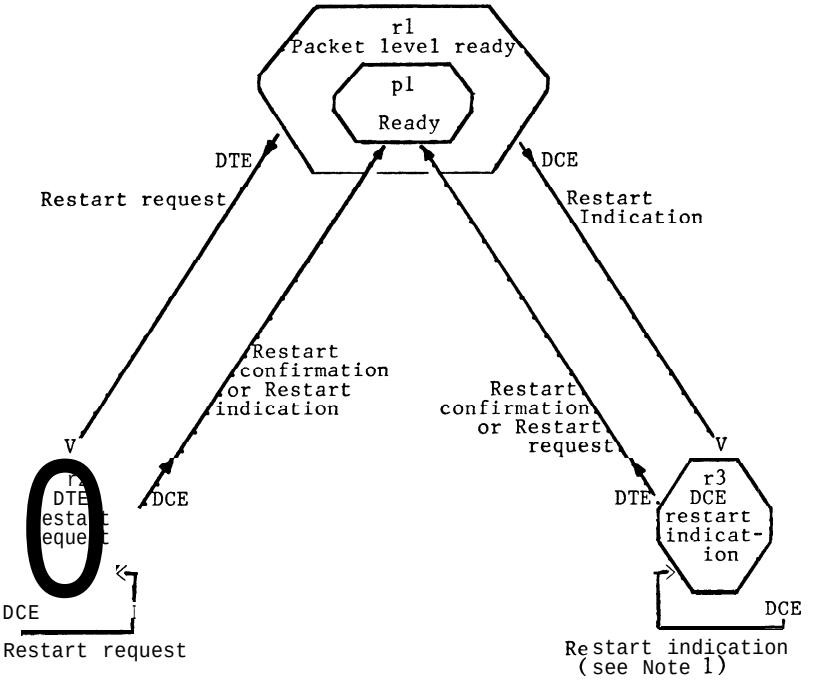
B.2 Order definition of the state diagram

For the sake of clarity, the normal procedure at the interface is described in a number of small state diagrams. In order to describe the normal procedure fully, it is necessary to allocate a

priority co the different figures and to relate a higher order diagram with a lower one. This has been done by one of the following means:

The figures have been arranged in order of priority with Figure B-l/AX.25 (restart) having the highest priority and subsequent figures having lower priority. Priority means that when a packet belonging to a higher order diagram is transferred, that diagram is applicable and the lower one is not.

The relation with a state in a lower order diagram is given by including that state inside an ellipse in the higher order diagram.



Note 1. This transition may take place sfter time-out T10.

Figure B-l/AX.25

Diagram of states for the transfer of restart packets

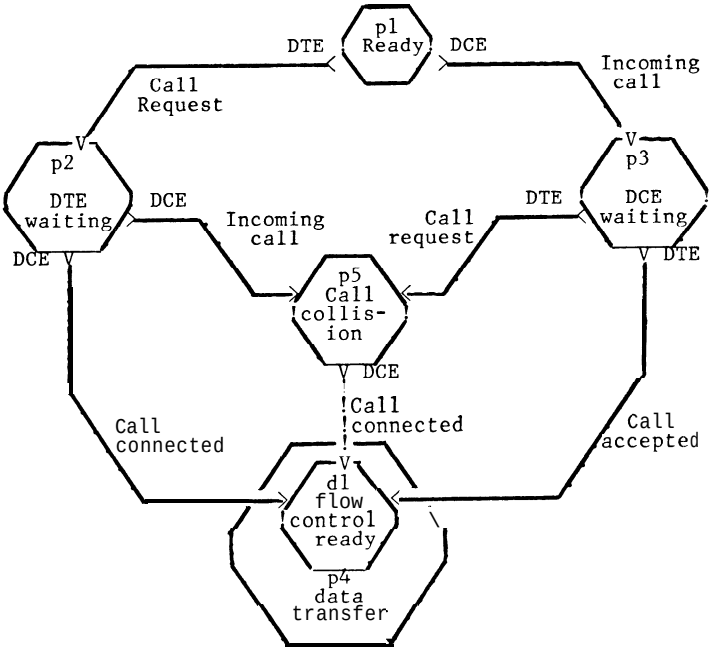
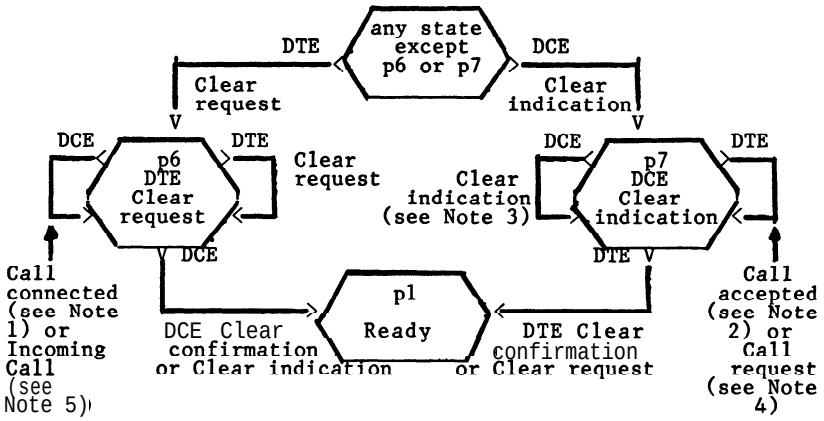


Figure B-2AfAX.25
Call set-up phase



Note 1. This transition is possible only if the previous state was DTE waiting (p2).

Note 2. This transition is only possible if the previous state was DCE waiting (p3).

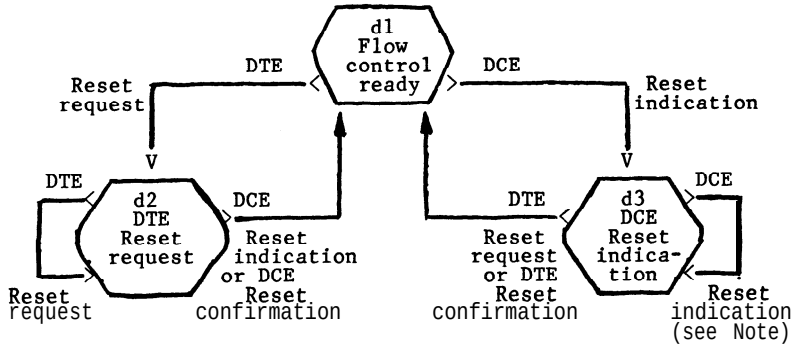
Note 3. This transition may take place after time-out T13.

Note 4. This transition is possible only if the previous state was Ready (p1) or DCE waiting (p3).

Note 5. This transition is possible only if the previous state was Ready (p1) or DTE waiting (p2).

Figure B-2B/AX.25
call clearing phase

Diagrams of states for the transfer of call set-up and call clearing packets within the packet level ready (p1) state.



Note: this transition may take place after time-out T12

Figure B-3/AX.25

Diagram of states for the transfer of reset packets within the data transfer (p4) state

ANNEX C

Actions taken by the DCE on receipt of packets in a given state of the packet level DTE/DCE as perceived by the DCE

INTRODUCTION

This Annex specifies the actions taken by the DCE on receipt of packets in a given state of the packet level DTE/DCE interface as perceived by the DTE.

It is presented as a succession of chained tables.

The following rules are valid for all these tables:

1) There may be more than one error associated with a packet. The network will stop normal processing of a packet when an error is encountered. Thus, only one diagnostic code is associated with an error indication by the DCE. The order of packet decoding and checking on networks is NOT standardized.

2) The detection of the non-octet alignment shall be made at the frame level.

3) In each table, tha actions taken by the DCE are indicated in the following way:

A) Discard: The DCE discards the received packet and takes no subsequent action as a direct result of receiving that packet, the DCE remains in the same state.

B) DIAG # x: The DCE discards the received packet and, for networks which implement the diagnostic packet, transmits to the DTE a diagnostic packet containing the diagnostic # x.

C) NORMAL or ERROR: The corresponding action is specified behind each table.

4) Annex E gives a list of the diagnostic codes which may be used.

Table C-l/AX.25
Special Cases

Packet from the DTE	Any State
Any packet with packet length shorter than two octets	DTAG #38
Any packet with an incorrect general format identifier (GFI)	DIAG #40
Any packet with an unassigned logical channel	DIAG #36
Any packet with correct GFI and assigned logical channle or with bits 1 to 4 of octet 1 and bits 1 to 8 of octet 2 equal to zero	See Table C-2/AX.25

State of the interface as perceived by the DTE / Packet from the DTE with assigned logical channel	Packet Level Ready r1	DTE Restart Request r2	DCE Restart Indication r3
Restart Request	Normal (r2)	Discard	Normal (r1)
DTE Restart Confirmation	Error #17 (r3)	Error #18 (r3)	Normal (r1)
Data, interrupt, call set-up and clearing, flow control or reset	see Table C-3/AX.25	Error #18 (r3)	Discard
Restart request or DTE restart confirmation with bits 1 to 4 of octet 1 or bits 1 to 8 octet 2 unequal to zero	see Table C-3/AX.25	Error #41 (r3)	Discard
Packets having a packet type identifier which is shorter than 1 octet or is not supported by the DTE	see Table C-3/AX.25	Error #33 (r3)	Discard
Packet other than restart request and DTE restart confirmation with bits 1 to 4 of octet 1 and bits 1 to 8 of octet 2 equal to 0	DIAG # 36	DIAG # 36	DIAG # 36

TABLE C-2/AX.25
Action taken by the DCE on receipt of packets in a given state of the packet level DTE/DCE interface as perceived by the DCE: restart procedure for assigned logical channels.

Where:

Error (r3): The DCE discards the received packet, indicates a # x restarting by sending to the DTE a restart indication packet with the cause "Local procedure error" and the diagnostic # x, and enters state r3. If connected through a virtual call, the distant DTE is also informed of the restarting by a clear indication packet, with the cause "Remote procedure error" (same diagnostic).

If a restart indication is issued as a result of an error condition in state r2, the DCE should eventually (after a time which does not exceed 120 seconds) consider the DTE/DCE interface to be in the packet level ready state (r1).

NORMAL (r1): Provided none of the following error conditions has occured, the action taken by the DCE follows the procedure as defined by in section 3, and the DTE/DCE interface enters state rl:

a) If a restart request packet or DTE restart confirmation packet received in state r3 exceeds the maximum permitted length or is too short, the DCE will invoke the ERROR #39 or #38 procedure, respectively.

b) If a restart request packet received in state rl exceeds the maximum permitted length, is too short, or the restarting cause field is not "DTE originated", the DCE shall invoke the DIAG #32, 838, or #81.

State of the interface as perceived by the DTE / Packet from the DTE with logical assigned to the virtual call	Ready p1	DTE Waiting p2	DCE Waiting p3	Data Transfer p4	Call Collision p5	DTE Clear request p6	DTE Clear indication p7
Call Request	Normal (p2)	Error #27 (p7)	Normal (p5)	Error #23 (p7)	Error #24 (p7)	Error #25 (p7)	Discard
Call Accepted	Error #20 (p7)	Error #21 (p7)	Normal (p4)	Error #23 (p7)	Error #24 (p7)	Error #25 (p7)	Discard
Clear Request	Normal (p6)	Normal (p6)	Normal (p6)	Normal (p6)	Normal (p6)	Discard	Normal (p6)
DTE Clear Confirmation	Error #20 (p7)	Error #21 (p7)	Error #22 (p7)	Error #23 (p7)	Error #24 (p7)	Error #25 (p7)	Normal (p1)
Data, Interrupt, Reset or Flow Control	Error #20 (p7)	Error #21 (p7)	Error #22 (p7)	see Table C-4/AX.25	Error #24 (p7)	Error #25 (p7)	Discard
Restart request, or DTE restart confirmation with bits 4 to 1 of octet 1 or bits 1 to 8 of octet 2 unequal to zero	Error #41 (p7)	Error #41 (p7)	Error #41 (p7)	see Table C-4/AX.25	Error #41 (p7)	Error #41 (p7)	Discard
Packets having a packet type identifier which is shorter than one octet or is not supported by the DCE	Error #38 #33 (p7)	Error #38 #33 (p7)	Error #38 #33 (p7)	see Table C-4/AX.25	Error #38 #33 (p7)	Error #38 #33	Discard

TABLE C-3/AX.25

Action taken by the DCE on repeipt of packets in a given state of the packet level **DTE/DCE** interface as **perceived by** the DCE: call set-up and clearing on **logical channel** assigned to the virtual call.

Where:

Error (p7): The DCE discards the received packet, indicates a clearing by transmitting to the DTE a clear # X indication packet, with the "Local procedure error" and the diagnostic # x, and enters state p7. If connected through a virtual call, the distane DTE is also informed of the clearing by a clear indication packet, with the cause "Remote procedure error" (same diagnostic).

It is required that in the absence of an appropriate DTE response to a clear indication packet issued as a result of an error condition in state p6, the DCE should eventually consider (after a time which does not exceed 120 seconds) the DTE/DCE interface to be in the ready state (p1).

Normal (p1): Provided none of the following error conditions has occured, the action taken by the DCE follows the procedures as defined in section 4 and the DTE/DCE interface enters state pl. In all the cases specified hereunder, the DCE will transmit to the DCE a clear indication with the appropriate cause and diagnostic, and enter state p7; if connected through a virtual call, the distant DTE is also informed of the clearing by a clear indication packet with the cause "Remote procedure error" (same diagnostic).

a) Call request packet

Error Condition	Cause	Specific diagnostics (see Note 3 of ANNEX E)
1. Not applicable		
2. not applicable		
3. Address contains a non-BCD digit	Local procedure error	# 67,68
4. Prefix digit not supported	Local procedure error	# 67,68
5. National address smaller than national address format permits	Local procedure error	# 67,68
6. National address larger than national address format permits	Local procedure error	# 67,68
7. DNIC less than four digits	Local procedure error	# 67,68
8. bits 7 or 8 of octet which indicates the facility field length not set to zero	Local procedure error	# 69
9. no combination of facilities could equal facility length	Local procedure error	# 69
10. Facility length larger than remainder of packets	Local procedure error	# 38
11. Facility values conflicts (ex. a particular combination not supported).	Invalid facility request	# 66
12. Facility code not allowed.	Invalid facility request	# 65
13. Facility value not allowed	Invalid facility request	# 66
14. Packet too short	Local procedure error	# 38
15. Address length larger than remainder of packet	Local procedure error	# 38
16. Call user data larger than 16, or 128 in case of fast select facility	Local procedure error	# 39
17. Class coding of the facility corresponding to a length of parameter larger than remainder of packet	Local procedure error	# 69
18. Facility code repeated	Local procedure error	# 73

If a virtual call cannot be established by the network, the DCE should use a call progress signal and diagnostic code among those listed hereunder:

Error Condition	Cause	Specific diagnostics (see Note 3 of ANNEX E)
19. Unknown station	Not obtainable	# 67
20. Not applicable		
21. Not applicable		
22. Reverse charging rejected	Reverse charging acceptance not subscribed	# 0
23. Fast select rejected	Fast select acceptance not subscribed	# 0
24. Called DTE out of order	Out of order	# 0 # greater than 128
25. No logical channel available	Number busy	# 71
26. Call collision	Number busy	# 71,72
27. RPOA out of order	RPOA out of order	# 0
28. Temporary network congestion of fault condition within the network	Network congestion	# 0
29. The remote DTE/DCE interface or the transit network does not support a function or a facility requested	Incompatible destination	# 0
30. Procedure error at the remote DTE/DCE interface	Remote procedure error	see b and c and ANNEX D

b) Call accepted packet

Error condition	Cause	Specific Diagnostics (see Note 3 of Annex E)
1. Not applicable		
2. Address contains a non-BCD digit	Local procedure error	# 67,68
3. Prefix digit not supported	Local procedure error	# 67,68
4. National address smaller than national address format permits	Local procedure error	# 67,68
5. National address larger than national address format permits	Local procedure error	# 67,68
6. DNIC less than four digits	Local procedure error	# 67,68
7, bits 7 or 8 of octet which indicates the facility field length not set to zero	Local procedure error	# 69
8. no combination of facilities could equal facility length	Local procedure error	# 69
9. Facility length larger than remainder of packets	Local procedure error	# 38
10. Facility values conflicts (ex. a particular combination not supported).	Invalid facility request	# 66
11, Facility code not allowed.	Invalid facility request	# 65
12, Facility value not allowed or invalid	Invalid facility request	# 66
13. Address length larger than remainder of packet	Local procedure error	# 38
14, Call user data larger than 128 in case of fast select facility	Local procedure error	# 39
15. Class coding of the facility corresponding to a length of parameter larger than remainder of packet	Local procedure error	# 69

16. Facility code repeated	Local procedure error	# 73
17. The incoming call packet indicated fast select with restriction on response	Local procedure error	# 42

c) Clear request packet

Error condition	Cause	Specific Diagnostics (see Note 3 of Annex E)
1. Not applicable		
2. Packet too short	Local procedure error	# 38
3. Packet length larger than 5 octets (if fast select facility not requested)	Local procedure error	# 39
4. Non zero address length field (if fast select facility requested)	Local procedure error	# 74
5. Non zero facility field (if fast select facility requested)	Local procedure error	# 75
14. Call user data larger than 128 in case of fast select facility (if fast select facility requested)	Local procedure error	# 39
15. Clearing cause field is not "DTE originated" in the clear request packet	Local procedure error	# 81

d) DTE clear confirmation

Error Condition	Cause	Specific diagnostics (see Note 3 of ANNEX E)
1. Not applicable		
2. Packet length larger than 3 octets	Local procedure error	# 39

State of the interface as perceived by the DCE / Packet from the DTE with assigned logical channel	Data Transfer p4		
	Flow Control Ready d1	DTE Reset Request d2	DCE Reset Indication d3
Reset Request	Normal (d2)	Discard	Normal (d1)
DTE Reset Confirmation	Error #27 (d3)	Error #28 (d3)	Normal (d1)
Data, interrupt, or flow control	Normal (d1)	Error #28 (d3)	Discard
Restart request or DTE restart confirmation with bits 1 to 4 of octet 1 or bits 1 to 8 octet 2 unequal to zero	Error #41 (d3)	Error #41 (d3)	Discard
Packets having a packet type identifier which is shorter than 1 octet or is not supported by the DCE	Error #38 Error #33 (d3)	Error #38 Error #33 (d3)	Discard

TABLE C-4/AX.25
Action taken by the DCB on receipt of packets in a given state of the packet level DTE/DCE interface as perceived by the DCE: data transfer (flow control) on assigned logical channels

Error (d3): The DCE discards the received packet, indicates a reset bytransmittingto the DTE a reset indication packet with the cause "Local procedure error* and the diagnostic # x, and enter state d3. For virtual calls, the distant DTE is also informed of the reset by a reset indication packet, with the cause "Remote procedure error" (same diagnostic).

If a reset indication is issued as a result of an error condition in state d2, the DCE should eventually consider (after a time not to exceed 120 seconds) the DTE/DCE interface to be in the flow control ready state (dl).

Provided none of the following error conditions has occured, the action taken by the DCE follows the procedure as described in sections 4 and 5:

a) If the packet exceeds the maximum permitted length, or is too short, the DCE will invoke the Error # 39 or # 38 procedure, respectively.

b) If the P(S) or P(R) received is not valid, the DCE will invoke the Error # 1 or # 2 procedure, respectively.

c) The DCE will consider the receipt of a DTE interrupt confirmation packet which does not correspond to a yet unconfirmed DCE interrupt packet as an error and will invoke the Error # 43 procedure. The DCE will either discard or consider as an error a DTE interrupt packet received before a previous DTE interrupt packet has been confirmed (Error # 44 procedure).

d) Not applicable

e) If the resetting cause field is not "DTE originated" in a reset request packet, the error procedure is invoked. A reset indication packet will be* transmitted with the cause "Local procedure error" and the diagnostic # 81.

ANNEX D

Packet level DCE time-outs and **DTE** time-outs

D.1 DCE time-outs

Under certain circumstances, this recommendation requires the DTE to respond to a packet issued from the DCE within a stated maximum time.

Table D-1/AX.25 covers these circumstances and the actions that the DCE will initiate upon the expiration of that time.

D.2 **DTE** time-outs

Under certain cirmstances, this Recommendation requires the DCE to respond to a packet from the DTE within a stated maximum time. Table D-Z/AX.25 gives these maximum times. The actual DCE response times should be well within the specified time limits. The rare situation where a time-limit is exceeded should only occur when there is a fault condition.

To facilitate recovery from such fault conditions, the DTE may incorporate timers. The time-limits given in Table D-2/AX.25 are the lower limits of the times a DTE should allow for proper operation. Suggestions on possible DTE actions upon expiration of the time-limits are given in Table D-2/AX.25.

Time-out No.	Time-out value	State of the logical channel	Started When	Normally Terminated when	Actions to be taken when the time-out expires: Local side	Actions to be taken when the time-out expires: Remote side
T10	60 secs.	r3	DCE issues a restart indication packet	DCE leaves the r3 state (ex: the restart confirmation or restart request is received)	DCE remains in r3 and may issue a diagnostic packet	DCE enters the d3 state signalling a reset indication (remote procedure error)
T11	180 secs.	p3	DCE issues an incoming call packet	DCE leaves the p3 state (ex: the call accepted, clear request, or call request is received	DCE enters the p7 state signalling a clear indication (local procedure error)	DCE enters the p7 state signalling a clear indication (remote procedure error)
T12	60 secs.	d3	DCE issues a reset indication packet	DCE leaves the d3 state (ex: the reset confirmation or reset request is received)	For virtual calls, the DCE enters the p7 state signalling a clear indication (local procedure error)	For virtual calls, DCE enters the p7 state signalling a clear indication (remote procedure
T13	60 secs.	p7	DCE issues a clear indication packet	DCE leaves the p7 state (ex: the clear confirmation or clear request is received)	DCE remains in p7 and may issue a diagnostic packet	

Table **D-1/AX.25.** DCE Time-limits

Time-out number	Time-limit value	State of the logical Channel	Started When	Normally terminated When	Preferred action to be taken when time-limit expires
T20	180 secs.	r2	DTE issues a restart request packet	DTE leaves the r2 state (ex: the restart confirmation or restart indication is received)	To retransmit the restart request packet (see Note 1)
T21	200 secs.	p2	DTE issues a call request packet	DTE leaves the p2 state (ex: the call connected, clear indication, or incoming call is received	To transmit a clear request packet
T22	180 secs.	d2	DTE issues a reset request packet	DTE leaves the d2 state (ex: the reset confirmation or reset indication is rcvd)	For virtual calls, to retransmit the reset request or to transmit a clear request packet
T23	180 secs.	P6	DTE issues a clear request packet	DTE leaves the p6 state (ex: the clear confirmation or clear indication is rcvd)	To retransmit the clear request packet (see Note 2)

Note 1: After unsuccessful retries, recovery decisions should be taken at higher levels.

Note 2: After unsuccessful retries, the logical channel should be considered out-of-order. The restart procedure should only be invoked for recovery if reinitialization of all logical channels is acceptable.

Table **D-2/AX.25.** DTE Time-limits

ANNEX E

Coding of AX.25 network generated diagnostic fields in clear, reset, and restart indication and diagnostic packets (see Notes 1, 2, and 3)

Diagnostics	Bits 8 7 6 5 4 3 2 1	Decimal	Hex
No additional information	0 0 0 0 0 0 0 0	0	00
Invalid P(S)	0 0 0 0 0 0 0 1	1	01
Invalid P(R)	0 0 0 0 0 0 1 0	2	02
Packet type invalid	0 0 0 1 0 0 0 0	16	10
For state r1	0 0 0 1 0 0 0 1	17	11
For state r2	0 0 0 1 0 0 1 0	18	12
For state r3	0 0 0 1 0 0 1 1	19	13
For state p1	0 0 0 1 0 1 0 0	20	14
For state p2	0 0 0 1 0 1 0 1	21	15
For state p3	0 0 0 1 0 1 1 0	22	16
For state p4	0 0 0 1 0 1 1 1	23	17
For state p5	0 0 0 1 1 0 0 0	24	18
For state p6	0 0 0 1 1 0 0 1	25	19
For state p7	0 0 0 1 1 0 1 0	26	1A
For state d1	0 0 0 1 1 0 1 1	27	1B
For state d2	0 0 0 1 1 1 0 0	28	1C
For state d3	0 0 0 1 1 1 0 1	29	1D
(not implemented)	0 0 0 1 1 1 1 0	30	1E
	0 0 0 1 1 1 1 1	31	1F
Packet not allowed	0 0 1 0 0 0 0 0	32	20
Unidentifiable packet	0 0 1 0 0 0 0 1	33	21
(not implemented)	0 0 1 0 0 0 1 0	34	22
(not implemented)	0 0 1 0 0 0 1 1	35	23
Packet on unassigned logical channel	0 0 1 0 0 1 0 0	36	24
(not implemented)	0 0 1 0 0 1 0 1	37	25
Packet too short	0 0 1 0 0 1 1 0	38	26
Packet too long	0 0 1 0 0 1 1 1	39	27
Invalid General Format Ident	0 0 1 0 1 0 0 0	40	28
Restart with non-zero in bits in LCGN or LCN	0 0 1 0 1 0 0 1	41	29
Packet type not compatible with facility	0 0 1 0 1 0 1 0	42	2A
Unauthorized interrupt confirmation	0 0 1 0 1 0 1 1	43	2B
Unauthorized interrupt	0 0 1 0 1 1 0 0	44	2C
(not implemented)	0 0 1 0 1 1 0 1	45	2D
(not implemented)	0 0 1 0 1 1 1 0	46	2E
	0 0 1 0 1 1 1 1	47	2F
Time expired	0 0 1 1 0 0 0 0	48	30
For incoming call	0 0 1 1 0 0 0 1	49	31
For clear indication	0 0 1 1 0 0 1 0	50	32
For reset indication	0 0 1 1 0 0 1 1	51	33
For restart indication	0 0 1 1 0 1 0 0	52	34
	0 0 1 1 1 1 1 1	63	3F
Call set-up or clearing problems-	0 1 0 0 0 0 0 0	64	40
Facility code not allowed	0 1 0 0 0 0 0 1	65	41
Facility parameter not allowed	0 1 0 0 0 0 1 0	66	42
Invalid called address	0 1 0 0 0 0 1 1	67	43
Invalid calling address	0 1 0 0 0 1 0 0	68	44
Invalid facility length	0 1 0 0 0 1 0 1	69	45
(not implemented)	0 1 0 0 0 1 1 0	70	46
No logical channel available	0 1 0 0 0 1 1 1	71	47
Call collision	0 1 0 0 1 0 0 0	72	48
Duplicate facility requested	0 1 0 0 1 0 0 1	73	49
Non-zero address length	0 1 0 0 1 0 1 0	74	4A
Non-zero facility length	0 1 0 0 1 0 1 1	75	4B
non-assigned up to:	0 1 0 0 1 1 1 1	79	4F
Miscellaneous	0 1 0 1 0 0 0 0	80	50
Improper cause code from DTE	0 1 0 1 0 0 0 1	81	51
(not implemented)	0 1 0 1 0 0 1 0	82	52
Inconsistant Q bit setting	0 1 0 1 0 0 1 1	83	53
Maintenance action	0 1 0 1 0 1 0 0	84	54
non-assigned up to:	0 1 0 1 1 1 1 1	95	5F
Not assigned from :	0 1 1 0 0 0 0 0	96	60
to:	0 1 1 1 1 1 1 1	127	7F
Reserved for network specific diagnostic information	1 0 0 0 0 0 0 0 to 1 1 1 1 1 1 1 1	128 to 255	80 to FF

Note 1: Not all diagnostic codes need apply to a specific network, but those used are coded as shown in the table.

Note 2: A given diagnostic need not apply to all packet types (ex: reset indication, clear indication, restart indication, and diagnostic packets)

Note 3: The first diagnostic in each grouping is a generic diagnostic and is used when more specific diagnostics are not defined within the grouping. The decimal 0 diagnostic code can be used in situations where no other diagnostic applies.

ANNEX F

Address coding techniques for AX.25

Background

The following information will be called Appendix 1 of AX.25 in the future, in order to prevent conflicts with CCITT additions.

Address field description in AX.25

The following restrictions apply to the address field of X.25 packets (Section 5.2.3.2.2).

When present, octet 7 and the following octets consist of the called DTE address when present, then the calling DTE address when present.

Each digit of an address is coded in a semi-octet in binary-coded-decimal (BCD) with bit 5 or bit 1 being the low order bit of the digit.

Starting from the high order digit, the address is coded in octet 7 and consecutive octets with two digits per octet. In each octet, the higher order digit is coded in bits 8, 7, 6, and 5.

The address field shall be rounded up to an integral number of octets by inserting zeros in bits 4, 3, 2, and 1 of the last octet of the field when necessary.

Data Network Identification Code

CCITT recommendation X.121 specifies a method of creating an international numbering plan for public data networks. Part of this recommendation specifies the assignment of a four digit number to identify public data networks. This number is called the Data Network Identification Code, or DNIC.

The first three digits of the DNIC is used as a country code, and is called the Data Country Code (DCC). The fourth digit is used to identify the public network within the country, and is called the network digit.

The CCITT has the responsibility for assigning the DCC, a list of assigned DCC numbers is listed in X.121. The first DCC for the United States is 310.

The responsibility for assigning network digits is left to the responsible body within the country in question. The Federal Communications Commission is the responsible authority in the United States. Unfortunately, the FCC is not assigning network digits at the moment, so the amateurs are unable to have assigned a DNIC code to us for now. We will attempt to have assigned to the amateur network a DNIC number when possible.

For now, room should be left for the DNIC number, primarily to allow internetworking with existing public data networks.

Original DTE address techniques for AX.25

When the AX.25 draft committee originally met a method of coding the amateur station calisign into the DTE calling and DTE called fields of call request, incoming call, call accepted, and call connected packets. This involved coding the Data Network Identification Code (DNIC), a station subaddress, and the amateur call of each DTE into seven octets as follows.

The DNIC is a four digit number, and as such, would fit into the first two octets. The first semi-octet of the first octet would carry the first digit, with the three succeeding digits in the next three semi-octets.

The third octet would contain a five bit field used as a substation address. This field would be binary coded in bit positions 1 thru 5, with bit 1 being the LSB. Bits 6, 7, and 8 are reserved at this time, and set to zero.

The fourth through seventh octets contain the amateur station callsign. Since there is not enough room to contain the callsign directly, is was recommended that the callsign be coded so that up to six callsign characters could be fit into the four octets using Radix 50 coding. Radix 50 coding allows three upper-case alpha or numeric characters to fit into a six octal digit field. The fourth octet would contain the first portion of the radix-50 encoded characters, with succeeding octets carrying the rest of the information in order. If a callsign contained less than six ASCII characters, trailing ASCII space characters would be added as necessary.

It should be noted that the above method of coding could create illegal (not BCD)addressing information, which could cause problems at an interface to a public data network.

New method of addressing in AX.25 packets

Information has just reached me (as I am printing this paper) that at a recent meeting, the CCITT has added new methods of coding address information into X.25 packets. Some of the additions follow immediately, then comments by the author on how to use these new methods.

AX.25 Additions

Facility Markers

In the third paper of this series, under section 7.4.1, delete the last four paragraphs, and add the following:

In addition to the facility/registration codes defined in section 7, other codes may be used for :

-non-AX.25 facilities possibly provided by some network(s) (call set-up packets)

-CCITT-specified DTE facilities as described in Annex G of this recommendation (call set-up, clear request and clear indication packets).

Facility/registration markers, consisting of a single octet pair, are used to separate requests for AX.25 facilities as defined in sections 6 and 7 from other categories as defined above, and, when several categories of facilities are simultaneously present, to separate these categories from each other.

The first octet of the marker is a facility/registration code and is set to zero. The second octet is a facility/registration parameter field.

The facility registration parameter field of a marker is set to zero when the marker precedes requests for:

-non-AX.25 facilities provided by the network in case of intranetwork calls (call set-up packets).

-non-AX.25 facilities provided by the network to which the calling DTE is connected, in case of intranetwork calls.

The facility parameter field of a marker is set to all ones when the marker precedes requests for non-AX.25 facilities provided by the network to which the called DTE is connected, in case of intranetwork calls (call set-up packets).

The facility parameter field of a marker is set to 00001111 when the marker precedes requests for CCITT-specified DTE facilities.

All networks will support the facility markers with a facility parameter field set to all ones or 00001111.

DTEs should not use a facility marker with a facility parameter field set to all ones in case of intranetwork calls. however, if a DTE uses such a marker in an intranetwork call, the DCE is not obliged to clear the call, and the marker, with the corresponding facility requests, may be transmitted to the remote DTE.

Facility/registration codes for AX.25 facilities and for the other categories of facilities may be simultaneously present. However, requests for AX.25 facilities must

precede the other requests, and requests for CCITT-specified DTE facilities must follow the other requests.

The coding of CCITT-specified DTE facilities should comply with the description in Annex G. However, it is not required for the DCE to verify that compliance. If the network verifies that compliance and finds an error, it may clear the call. The CCITT-specified DTE facilities are passed unchanged between the two packet-mode DTEs.

(end of addition to 7.4.1)

ANNEX G

CCITT-specified DTE facilities to support the OSI network service

G.1 Introduction

The facilities described in this Annex are intended to support end-to-end signalling required by the OSI network service. They follow the CCITT-specified DTE facility marker defined in section 7.4. These facilities are passed are passed unchanged between the two packet mode DTEs involved.

Procedures for use of these facilities by DTEs require definition by international user bodies. Subsequent provision of X.25 facilities to be acted on by public data networks is for further study. Coding for these facilities is defined here in order to facilitate a consistent facility coding scheme in such future evolution.

G.2 Coding of the CCTTT-specified facilities

G.2.1 Calling address extension facility

The calling address extension facility is used in call request and incoming call packets to convey additional calling DTE address information.

G.2.1.1 Coding of the facility code field

The coding of the facility code field for the calling address extension facility is:

bits:	8	7	6	5	4	3	2	1
code:	1	1	0	0	1	0	0	0

Coding of the facility parameter field

The octet following the facility code field indicates the length in octets of the facility parameter field and has a value of n + 1, where n may be a maximum of 16 octets in order to hold the calling address extension.

The first octet of the facility parameter field indicates, in bits 6, 5, 4, 3, 2, and 1, the number of semi-octets (up to 32) in the calling address extension. This address length indicator is binary coded, and bit 1 is the low order bit. Bits 8 and 7 of this octet are set to zero.

The following octets (up to 16) contain the calling address extension.

Each digit of an address is coded in a semi-octet in binary coded decimal, where bit 5 or 1 is the low order bit of the digit.

Starting from the high-order digit, the address is coded in octet 2 and consecutive octets of the facility parameter field with two digits paer octet. In each octet, the higher order digit is coded in bits 8, 7, 6, and 5.

When necessary, the facility parameter field shall be rounded up to an integral number of octets by inserting zeros in bits 4, 3, 2, and 1 of the last octet of the field.

G.2.2 Called address extension facility

The called address extension facility is used in call request, incoming call, call accepted, call connected, clear indication, and clear request packets to convey additional called DTE address information.

G.2.2.1 Coding of the facility code field

The coding of the facility code field for the called address extension facility is:

bits:	8	7	6	5	4	3	2	1
code:	1	1	0	0	1	0	0	1

Coding of the facility parameter field

The octet following the facility code field indicates the length in octets of the facility parameter field and has a value of n + 1, where n may be a maximum of 16 octets in order to hold the called address extension.

The first octet of the facility parameter field indicates, in bits 6, 5, 4, 3, 2, and 1, the number of semi-octets (up to 32) in the called address extension. This address length indicator is binary coded, and bit 1 is the low order bit. Bits 8 and 7 of this octet are set to zero.

The following octets (up to 16) contain the called address extension.

Each digit of an address is coded in a semi-octet in binary coded decimal, where bit 5 or 1 is the low order bit of the digit.

Starting from the high-order digit, the address is coded in octet 2 and consecutive octets of the facility parameter field with two digits paer octet. In each octet, the higher order digit is coded in bits 8, 7, 6, and 5.

When necessary, the facility parameter field shall be rounded up to an integral number of octets by inserting zeros in bits 4, 3, 2, and 1 of the last octet of the field.

AX.25 marker definitions

In order to make clear the various markers that might be in the facility field, they are listed below. Once again these markers are used to separate the various types of facilities that might appear in call generation packets.

Facility marker for calling network facilities

This marker signifies facilities following it are to be provided by the calling DTE network.

bits:	8	7	6	5	4	3	2	1
octetl:	0	0	0	0	0	0	0	0
octet2:	0	0	0	0	0	0	0	0

Facility marker for called DTE network facilities

This marker signifies facilities following it are to be provided by the called DTE network.

bits:	8	7	6	5	4	3	2	1
octetl:	0	0	0	0	0	0	0	0
octet2:	1	1	1	1	1	1	1	1

Facility marker for CCITT-specified facilities

This marker signifies facilities following it are CCITT-specified facilities.

bits:	8	7	6	5	4	3	2	1
octetl:	0	0	0	0	0	0	0	0
octet2:	0	0	0	0	1	1	1	1

Facility marker for amateur network facilities

This marker signifies facilities following it are amateur radio network provided facilities.

bits:	8	7	6	5	4	3	2	1
octetl:	0	0	0	0	0	0	0	0
octet2:	1	1	1	1	1	1	1	0

Note: The amateur facility marker has been changed, since the CCITT has added a marker using the original code that the AX.25 draft committee used. The choice of 11111110 is being made in hopes that the CCITT will stay away from this code, since the code 11111111 has been used.

Coding of amateur addresses in AX.25

The following is a recommendation on coding of the calling and called DTE address fields and using the calling and called extension facilities in an amateur AX.25 network.

Coding of the DTE address fields

If the actual DTE addresses are conveyed in the newly created calling and called address extension facilities, this leaves the DTE calling and DTE called address fields available for other uses. One use for these fields might be to convey geographical location information of the DTEs involved, which might help call routing decisions.

If we leave the first two octets for the DNIC number (four digits coded per AX.25 section 6.2), this leaves room for up to 5 octets (10 digits) of additional information. One recommendation would be to use the VHF grid location system.

One of the problems with the VHF grid system is that it uses alpha characters in the first two characters, and numeric characters of the last two characters of the coarse location, and two more alpha caharacters in the two additional characters used in the fine grid location system. Since AX.25 specifies binary coded decimal format digits in the address fields, ASCII characters could create invalid DTE addresses.

A suggestion to avoid this problem is to break up the alpha characters into two portions, each representable in binary coded decimal format. If an ASCII character (upper case alpha, or numeric only) is divided so that bits 1, 2, and 3 are conveyed in the low order digit, and bits 4, 5, and 6 are conveyed in the high order digit, an ASCII character could be represented in one octet, while still keeping to the letter of X.25.

Using this technique, the first two octets would convey the DNIC number, the third octet would convey the first alpha character of the VHF grid system, the fourth octet would have the second alpha character, the fifth octet would have both digits of the grid system identifier. The sixth and seventh octets would carry the fine resolution alpha characters of the grid information.

Address extension field coding

The addition of the calling and called address extension facilities has allowed a re-thinking of amateur address coding. As the description of these facilities above shows, the CCITT is still considering addressing information to be numeric only. The United States contigent is hoping that this linitation can be eliminated, however.

Anticipating this loosening-up of the restriction, I recommend that the extended address coding consist of the amateur callsign of the station involved, consisting of the six upper-case alpha or numeric characters, followed by an additional octet carrying a substation identification number. this substation identification number should be five bits long, binary coded, and reside in bits 5, 4, 3, 2, and 1 of the seventh octet of the address field. Bits 8, 7, and 6 are reserved at this time, and set to zero.

This coding scheme will allow the amateur callsign to be used as a unique station identifier, just as it is in Level 2 of AX.25