Annex E
(Informative)

State tables for operation of class 4 over connection-mode and connectionless-mode network services

E.1 General

This annex has been included as a guide for implementations which have been designed for operation over both the connection-mode network service and the connectionless-mode network service.

The introductory comments given in annex A apply in this annex as well.

E.2 Conventions

Clause A.2 applies in this annex, except for item b) of A.2.3, in which the term "network connection" is to be extended to apply as well to the corresponding instance of communication over a connectionless-mode network service.

E.3 Tables

Clause A.3, including tables 10, 11 and 12, apply in this annex.

E.4 State tables for Class 4

This clause incorporates all of clause A.6 with extensions to cover operation over connectionless-mode network services.

This clause provides a more precise description of a class 4 transport connection.

Tables 38, 39, 40 give the predicates, actions and notes for class 4 respectively.

Table 41 is the state table for a class 4 transport connection.

The following assumption and notations are used:

* : appropriate only for operation over connection-mode network service

** : appropriate only for operation over connectionless-mode network service

a)* the state of every network connection is known as being open or opening (i.e. a NCONreq has been issued and the NCONconf is awaited);

b)* for each transport connection the transport entity maintains the set of network connections to which the transport connection is assigned. A network connection in this set is either in the open or opening states;

c)* when a N-CONNECT confirmation, N-RESET indication or N-DISCONNECT indication is received this event is associated with the transport connection if the network connection belongs to the set;

d)* when an N-DISCONNECT is received, the network connection ceases to exist and is therefore withdrawn from the set. When a NCONconf is received the state of the NC becomes "open";

NOTE – This is not shown by an explicit action in the state table. Conversely adding a network connection to a set and setting its state to "opening" is shown by an explicit action.

e)* when the state goes back to CLOSED or REFWAIT state, it is assumed that all timers are stopped (if running), the count is set to zero and the set becomes empty;

f)* when a PDU is received the network connection on which it has been received is assumed to be known;

g)* the variable ``current-NC'' is used to designate either the network connection on which a TPDU has been received or the network connection which has been choosen for a new assignment (either an existing one or a new one which is created);

h) we also assume the following variables:

local-ref: the reference (local) of the TC is chosen when sending the CR or when accepting a CR;

remote-ref: the reference of the remote entity is initially set to zero and initialised when processing the CC except if the CC is ignored.

SRC-REF: designates the corresponding field of the received TPDU.

DST-REF: designates the corresponding field of the received TPDU.

src-ref, dst-ref: designates the corresponding fields of the sent TPDU.

count: designates the numbers of times a TPDU has been sent (retransmissions);

i) the data transfer phase is not completely described in the state table but refers to the main text;

j)* a spontaneous event called ``new network connection assignment'' has been introduced. It may occur at any time provided P1 or P2 are true (see predicate table 27) and the remote-ref is not zero (i.e. a CR TPDU has been received or a CC TPDU has been received and processed);

k)* when a N-RESET indication is received, an N-RESET response is issued;

l)** it is assumed that the connectionless-mode network service when being used is continuously available. The operations resulting from signalled inaccessibility of the network are a local matter.

Table 38 – Predicates for class 4

Name	Description
P0	T-CONNECT request is acceptable.
P1	An assignment can be done to a suitable network connection (either open or opening).
P2	It is possible to open a new network connection.
P3	Local choice.
P4	A CR TPDU has never been sent.
P5	The transport entity is the initiator and the set of network connections is now empty (i.e. a new assignment shall be done) or a new assignment is decided as a local choice.
P6	Local choice not to perform a new assignment if the set of network connections is empty (for closing state only).
P7	Count = maximum.
P8	Acceptable CR TPDU.
P9	Acceptable class 4 CC TPDU.
P10	Unacceptable class 4 CC TPDU.
P11	CC TPDU not specifying class 4.
P99	Connection-mode network service being used.

NOTE – It is assumed that P99 = false implies only that the connectionless-mode network service is being used.

Table 39 – Specific actions for class 4

Name	Description
[0]	Set reference timer
[1]	Count = count + 1
[2]	Count = 0
[3]	Set retransmission timer
[4]	Stop retransmission timer if running
[5]	Set window timer
[6]	Stop window timer if running
[7]	Set inactivity timer
[8]	Stop inactivity timer if running
[9]	Set initial credit for sending according to the received CR/CC TPDU
[10]	Set initial credit for controlling reception according to the sent CR/CC TPDU
[11]	P99: Send the CR TPDU if there is a network connection in the open state in the set; not P99: send a CR TPDU
[12]	P99: Add the current network connection to the set, if not already included; not P99: no action
[13]	P99: The current network connection is now in the opening state; not P99: no action
[14]	P99: Send the CC TPDU if a network connection in the open state is in the set; not P99: send CC TPDU
[15]	P99: Send the DR TPDU if a network connection in the open state is in the set; not P99: send DR TPDU. In both cases, this DR TPDU is sent with src-ref = local-ref and dst-ref = remote-ref (may be zero)
[16]	P99: Send the DR TPDU if a network connection in the open state is in the set; not P99: send the DR TPDU. In both cases, the DR TPDU is sent with src-ref = 0 and dst-ref = remote-ref
[17]	Send a TPDU according to data transfer procedure
[18]	See state table of the class specified in the CC TPDU (refer to data transfer)
[19]	P99: See state table of the class (refer to release procedure) send a DR TPDU if the class is not 0, otherwise issue a N-DISCONNECT request; not P99: send a DR TPDU
[20]	Store request and exercise flow control to the user
[21]	Send a DR TPDU with src-ref field set to zero
[22]	Send a DC TPDU except if the SRC-REF field of the received DR TPDU is equal to zero
[23]	P99: Send a DR TPDU with src-ref = local-ref and dst-ref = remote-ref (may be zero) if a network connection in the open state is in the set; not P99: send a DR TPDU with src-ref = local-ref and dst-ref = SRC-REF in CC TPDU

Table 40 – Specific notes for class 4

(* appropriate only when operating over connection-mode network service)

Name	Description
(1)*	Not possible as no set of network connections is associated with this transport connection.
(2)*	It is also possible to remain in the same state (T1 is still running) until: • a CC TPDU is received which performs a new assignment, • a new assignment is tried (spontanous event), • T1 runs out and the count is equal to the maximal value.
(3)*	No new assignment was possible: if the set is empty, the transport entity waits until a new assignment is received, or can be locally performed (spontaneous event).
(4)*	It is also possible to perform a new assignment. (This may be done in triggering the event ``new network connection assignment'').
(5)	Not a duplicated CR TPDU.
(6)*	Since a new network connection is now assigned, it is recommended that the appropriate TPDU be sent on this network connection (if open) in order to make the remote entity aware of this assignment. It is also possible to allow the normal retransmission procedures to cause the TPDU to be sent; however the first TPDU available for sending should be sent on the new network connection.
(7)	As a local choice it is also possible to apply the following: [0], TDISind, REFWAIT.
(8)	Association to this transport connection is done regardless of the SRC-REF field. If SRC-REF is not zero, a DC TPDU is set back.
(9)	At least an AK TPDU shall be sent if the transport entity is the initiator in order to ensure that the responder will complete its three-way handshake.
(10)	If association has been made, and DST-REF is zero, then the DC TPDU contains a src-ref field set to zero.
(11)	If the CLOSING state has been entered, coming from WFCC state, the remote-ref is zero. The SRC-REF field of the CC TPDU is ignored (i.e. if the DR TPDU is retransmitted, it will be with the dst-ref field set to zero).
(12)*	If the CLOSING state has been entered, coming from WFCC state, the remote-ref (which is zero) shall be set with SRC-REF in order to comply with the release procedure of the negotiated class.
(13)	The DR TPDU may be either repeated immediately or when T1 will run out.
(14)*	If the set is empty, this event may be used as a criteria for triggering the event ``new network connection assignment''.
(15)	Previously stored T-DATA or T-EXPEDITED-DATA requests are ready for processing according to data transfer procedures.
(16)	See data transfer procedures.
(17)*	When an N-RESET indication is received, an N-RESET response has to be issued at once independent of the state automata.

Table 41 – Class 4 connection/disconnection (1 of 2)

STATE EVENT	REFWAIT	CLOSED	WFCC	WBCL	OPEN	WFTRESP	AKWAIT	CLOSING
TCONreq		not P0: TDISind CLOSED; P0 and ((P1 and P99) or not P99): [12,1,3,10,11] WFCC; P99 and P0 and not P1 and P2: [13,12,1,3,10] NCONreq WFCC; P99 and P0 and (not P1) and not P2: TDISind CLOSED						
TCONresp						[3,2,1,10,14] AKWAIT		
TDISreq			P4: CLOSED; (not P4) and P3: WBCL; (not P4) and (not P3): [4,3,2,1,15] CLOSING		[6,8,4,3,2, 1,15] CLOSING	[16] CLOSED	[4,3,2,1,15] CLOSING	
NDISind	(1)	(1)	P99 and P1: [12] WFCC; P99 and (not P1) and P2: [13,12] NCONreq WFCC; P99 and (not P1) and (not P2): [0] [2] TDISind REFWAIT	P99 and P3: [0] REFWAIT; P99 and (not P3) and P1: [12,11] WBCL; P99 and (not P3) and (not P1) and P2: [13,12] NCONreq WBCL; P99 and (not P3) and (not P1) and (not P2): [0] REFWAIT	P99 and P5 and P1: [12,17] (6) OPEN; P99 and (not P1) and P5 and P2: [13,12] NCONreq OPEN; P99 and (not P1) and P5 and (not P2): OPEN (3); P99 and (not P5): OPEN	P99: WFTRESP (4)	P99 and P5 and P1: [12,14] (6) AKWAIT; P99 and (not P1) and P5 and P2: [13,12] NCONreq AKWAIT; P99 and (not P1) and P5 and (not P2): AKWAIT (3) P99 and (not P5): AKWAIT	P99 and P6: [0] REFWEAIT; P99 and (not P6) and P5 and P1: [12,15] CLOSING (6) P99 and (not P6) and P5 and (not P1) and P2: [13,12] NCONreq CLOSING; P99 and (not P6) and P5 and (not P1) and (not P2): CLOSING (3); P99 and (not P6) and (not P5): CLOSING
NRSTind			(17)	(17)	(17)	(17)	(17)	(17)
TDTreq TEXreq					(16) OPEN		[20] AKWAIT	

Table 41 – Class 4 connection/disconnection (2 of 2)

STATE EVENT	REFWAIT	CLOSED	WFCC	WBCL	OPEN	WFTRESP	AKWAIT	CLOSING
NCONconf	(1)	(1)	P99: CR WFCC (6)	P99: CR WBCL (6)	P99: [17] OPEN (6)	P99: WFTRESP	P99: CC AKWAIT (6)	P99: [15] CLOSING (6)
New Network Connection Assignment					P99 and P1: [12,17] OPEN (6); P99 and P2 and (not P1): [13,12] NCONreq OPEN	P99 and P1: [12] WFTRESP; P99 and P2 and (not P1): [13,12] NCONreq WFTRESP	P99 and P1: [12,14] (6) AKWAIT; P99 and P2 and (not P1): [13,12] NCONreq AKWAIT	P99 and P1: [12,15] (6) CLOSING; P99 and P2 and (not P1): [13,12] NCONreq CLOSING
Retrans-timer			P7 and P3: [0] TDISind REFWAIT; P7 and (not P3): [3,2,1,15] TDISind CLOSING (14); not P7: [1,3,11] WFCC	P7 and P3: [0] REFWAIT; P7 and (not P3): [3,2,1,15] CLOSING (14); not P7: [1,3,11] WBCL	P7: [6,8,3,2,1, 15] TDISind CLOSING (14); not P7: (16) (14) OPEN		P7: [3,2,1,15] TDISind (14) CLOSING; not P7: [1,3,14] (14) AKWAIT	P7: [0] REFWAIT; not P7: [1,3,15] (14) CLOSING
Inactivity-Timer					[6,4,3,2,1,1 5] TDISind CLOSING (7)			
Reference-Time	CLOSED							
CR		not P8: [21] CLOSED (5); P8: [9,12] TCONind WFTRESP (5)			[12,8,7] OPEN	[12] WFTRESP	[12,14] AKWAIT	[12] CLOSING (13)
CC	DR REFWAIT	DR CLOSED	P9: [12,9,2,4,5, 7,17] TCONconf (9) OPEN; (not P9 and not P99) or (P99 and P10): [12,4,3,2,1,2 3] TDISind CLOSING; P99 and P11: [18]	P99 and P11: [19]; (not P99 and P9) or (P99 and not P11): [12,2,4,3, 1,15] CLOSING	[12,17,8,7] (9) OPEN			(P99 and P11): [19] (12); (not P99 and P9) or (P99 and not P11): [12] CLOSING (11)
ER	REFWAIT	CLOSED	[0] TDISind REFWAIT	[0] REFWAIT	[12,6,8,4,3, 2,1,15] TDISind CLOSING		[12,4,3,2,1, 15] TDISind CLOSING	[0] REFWAIT
DR	[22] REFWAIT	[22] CLOSED	(8) TDISind [0] REFWAIT	(8) [0] REFWAIT	DC (10) [0] TDISind REFWAIT	DC (10) TDISind CLOSED	DC (10) [0] TDISind REFWAIT	[0] REFWAIT
DC	REFWAIT	CLOSED						[0] REFWAIT
EA	REFWAIT	CLOSED			[12,8,7] OPEN (16)			[12] CLOSING (13)

DT/AK/ED	REFWAIT	CLOSED			[12,8,7] OPEN (16)		[12,7] OPEN (15) (16)	[12] CLOSING (13)