Annex B

(normative)

Network connection management subprotocol

B.1 Introduction

The objectives of this annex are to

a) Provide for more flexibility in the use of the network connections established between two cooperating transport entities, thus enlarging the field of application of the transport protocol as presently defined in the main body of this International Standard. In particular it allows for an optimization of the use of the network connections by allowing both transport entities at each end of a network connection to assign and reassign transport connections to a network connection;

b) Allow more information to be sent explaining why a network connection is released in order to be able to optimize recovery;

The protocol described in this annex is called the network connection management subprotocol (NCMS).

The procedures defined in this annex are optional extensions to the main body of this International Standard.

B.2 Scope

The procedures specified in this annex are an extension of the basic procedure defined in the main body of this International Standard and therefore do not prevent communication between transport entities conforming to this International Standard (ISO/IEC 8073) with this annex and those conforming to this International Standard without this annex.

The basic network connection management that is specified in the main body of this International Standard allows for assignment or reassignment of transport connections on an existing network connection by its owner, who is currently restricted to be the transport entity that initiated this network connection. This addendum describes the procedures necessary to extend this basic management to permit the peer transport entity (i.e. the acceptor of a network connection) to become also the owner of the network connection and consequently to be able to assign or reassign transport connections to it.

When performing multiplexing of transport connection this feature allows a network connection to be fully shared, thus increasing the scope of the multiplexing classes of the transport protocol (i.e. classes 2, 3 and 4).

In order to control the number of shared network connections that peer entities are willing to use simultaneously (one or more), a mechanism is provided to resolve collisions when simultaneous network connection establishments occur, especially in the case of recovery after network failure.

B.3 Definitions

For the purposes of this annex, the following definitions apply.

NOTE – The definitions contained in this clause make use of abbreviations defined in clause B.4.

B.3.1 owner (of a network connection): The transport entity that issued the N-CONNECT request leading to the creation of the network connection if the NCM TPDU is not used or the transport entity (possibly both) which is designated to have the right of performing assignment in accordance with the NC-RIGHT field of the NCM TPDU when the NCM TPDU is used (see B.6.2.2).

NOTE – This definition extends the definition of the owner of the network connection given in 3.2.28.

B.3.2 network connection reference (or nc-reference): An identifier which is associated with a network connection and used to resolve collisions when network connections are reopened.

B.4 Symbols and abbreviations

B.4.1 Types of transport-protocol-data-units

NCM TPDU	Network connection management TPDU
DIAG TPDU	Diagnostic TPDU
NCMC TPDU	Network connection management confirmation TPDU

The following TPDU is used by this annex and is defined by ISO/IEC 11570, Transport protocol identification mechanism:

UN TPDU	Use of network connection TPDU

B.4.2 TPDU fields

NC-REF	Network connection reference (field)
NC-TYPE	Network connection type (field)
NC-RIGHT	Network right (field)
LI	Length indicator (field)
NC-PREF	Network connection preference (field)
NC-COL	Network connection collision indicator
NC-REC	Network connection recovery indicator

The following fields of the UN TPDU are used by this annex and are defined by ISO/IEC 11570:

SHARE	Sharing option (field)
PRT-ID	Protocol identifier (field)

B.4.3 Timers

TTR-NC	Time to try to reopen a network connection using a given NC-REF
TPD-NC	Time to consider a given NC-REF as pending
TFR-NC	Time to consider a given NC-REF as frozen

B.4.4 Miscellaneous

NCMS	Network connection management subprotocol
NSAP	Network-service-access-point
AA	Assignment right to all
SA	Sender has assignment right
RA	Receiver has assignment right
AFI	Authority and Format Identifier (of the NSAP address)
IDI	Initial Domain Identifier (of the NSAP address)
DSP	Domain specific part (of the NSAP address)

B.5 Overview of the protocol

NCMS allows for:

a) identification of the protocol to be used on top of a given network connection;

NOTE – The use of NSAP addresses as it is defined is ISO/IEC 7498-3 provides greater flexibility in distinguishing between OSI and non-OSI users of the network service. If however the use of NSAPs incurs unacceptable penalties, for example where each NSAP is charged for by the network provider, then the protocol identification mechanism (see ISO/IEC 11570) is available.

b) Explicit designation of the transport entity (or entities) which has the right to assign transport connection(s) to a specific network connection and is therefore considered as the (co-)owner of the network connection;

c) Resolution of connection establishment collisions when a network connection is first established or recovered after failure.

NCMS assumes the use of the network service defined in ISO/IEC 8348.

When operating NCMS the transport entities use only the network service primitives listed in table 28 (the other network service primitives are used as defined in 5.2).

Table 28 – Network Service Primitives Used for NCMS Operation

Primitives		Parameters	A/B/C
N-CONNECT	request	Called address	A
	indication	Calling address	A
	response	NS user-data	B
	confirm	QOS parameter set	A
		Responding address	A
		Receipt confirmation selection	A
N-DISCONNECT	request	NS user-data	C
	indication	Originator	C
		Reason	A

Key
A: This parameter is used in accordance with the procedures specified in the main body of this International Standard.
B: When operating NCMS this parameter is used in request and indication and in response and confirmation if the NCMC TPDU is used.
C: This parameter may be optionally used when operating NCMS.

B.6 Elements of procedure

B.6.1 TPDU transfer

The transport-protocol-data-units (TPDUs) defined for this annex are listed in B.4.1.

The transport entities shall transmit and receive the UN (see ISO/IEC 11570) and NCM TPDU in the NS-user data parameter of the N-CONNECT request and indication primitive only.

The sending transport entity shall:

a) Either not transmit any TPDU in the NS-user data parameter of the N-CONNECT request primitive;

b) Or transmit the UN TPDU (see ISO/IEC 11570) followed by the NCM TPDU in the NS-user data parameter of the N-CONNECT request primitive.

When used the DIAG TPDU is transmitted in the NS-user data parameter of N-DISCONNECT primitive.

When used the NCMC TPDU is transmitted in the NS-user data parameter of N-CONNECT response and confirmation primitive.

B.6.2 Network connection management

B.6.2.1 General

When the procedure described in B.6.1 b) is used

a) The sending transport entity shall use the procedure described below together with the procedure defined in the main body of this International Standard;

b) The receiving transport entity shall

1) either ignore the NCM TPDU and operate the procedure described in the main body of this International Standard;

2) or recognize and process the NCM TPDU and therefore operate the procedure described below together with those defined is the main body of this International Standard.

When a transport entity has processed an NCM TPDU received from a given NSAP [see B.6.2.1 b)2)] it shall process further NCM TPDUs received from the same NSAP.

B.6.2.2 Assignment right

When an N-CONNECT request primitive is issued by a transport entity to request the opening of a new network connection, the transport entity may choose whether or not to include the NCM TPDU in the NS-user data parameter of the primitive. The recipient may choose not to process the NCM TPDU and to operate the procedures defined in the main body of this International Standard instead.

The owner(s) may use the network connection for assigning or reassigning transport connections with the following restrictions:

a) a transport entity which is the owner of the network connection shall not assign a transport connection with a preferred class 0 or 1 if its peer is also the owner of the network connection (see note 2);

b) a transport entity which is the owner of the network connection can assign a transport connection with an alternative class 0 or 1, but shall not, when receiving a CR TPDU proposing 0 or 1 as an alternative class, select one of these classes (see note 3).

A transport entity shall be designated the "owner" of a network connection according to the table 29.

Table 29 – Determination of assignment rights

Entity Event	Network connection initiator	Network connection responder
No NCM sent	Y	N
NCM sent but not processed Right = SA or AA	Y	N
NCM sent but not processed Right = RA	N (see note 4)	N (see note 4)
NCM sent and processed Right = SA	Y	N
NCM sent and processed Right = RA	N	Y
NCM sent and processed Right = AA	Y	Y

Key Y: owner
N: not owner

NOTES

1 The use of a network connection by a called transport entity to initiate new transport connections should only be made when the called transport entity is adequately assured of the true identity of the calling transport entity (i.e. there is trust in the calling NSAP identification provided by the Network Layer) or the data to be transferred is not sensitive.

2 This gives the guarantee that transport connections of classes 0 or 1 cannot be opened simultaneously at both ends of a network connection.

3 This allows a transport entity which has sent the NCM TPDU to still propose classes 0 or 1 as an alternative class. If the peer transport entity has not processed the NCM TPDU it may still select class 0 or class 1.

4 Use of NC-RIGHT with the NCM TPDU allows explicit control of assignment rights whilst also permitting both entities to be able to recover a failed network connection. This is not possible when the NCM is used.

Provided that the restriction stated in B.6.2.2 a) and B.6.2.2 b) are respected, both transport entities at each end of the network connection shall follow the procedures defined in the main body of this International Standard, except that the owner of the network connection is defined as in B.6.2.2.

NOTE – The transport protocol defined in the main body of this International Standard makes use of the definition of owner of a network connection for defining the entity which can perform assignment and reassignment.

B.6.2.3 Network connection reference (nc-reference) management

When a transport entity elects to use the NCM TPDU it shall keep track of the nc-references used in the NCM TPDUs sent or received in the NS-user data parameter of the N-CONNECT request or indication primitives.

An nc-reference is associated with

a) the pair of NSAPs addresses involved in the network connection on which the NCM TPDU has been transferred;

b) the source of the allocation: the nc-reference has been remotely or locally allocated.

The nc-reference is exchanged as the NC-REF parameter of the NCM TPDU. The NC-TYPE parameter of the NCM TPDU indicates the source of allocation:

1) NC-TYPE set to NEW indicates a new nc-reference allocated by the sender of the NCM TPDU,

2) NC-TYPE set to MY indicates a recovery using an nc-reference previously allocated by the sender of the NCM TPDU,

3) NC-TYPE set to YOURS indicates a recovery using an nc-reference previously allocated by the receiver of the NCM TPDU;

NOTE – Use of the NC-TYPE MY permits the explicit distinction between the two cases where the NC initiator either has or has not received the N-CONNECT confirm.

c) the state of the nc-reference which can be

1) OPEN: There is one network connection associated with the nc-reference and for which an N-CONNECT confirm has been received or an N-CONNECT response sent, and no subsequent N-DISCONNECT primitive exchanged,

2) OPENING: There is one network connection for which an N-CONNECT confirm is awaited and the nc-reference has never been previously in the OPEN state,

3) RECOVER: There is one network connection associated with the nc-reference for which an N-CONNECT confirm is awaited and the nc-reference has previously been in the OPEN state,

4) PENDING: There is no network connection associated with the nc-reference;

d) the assignment right allocated for the use of the network connection associated with the nc-reference. It can be

1) my-side: The local transport entity is the only owner of the network connection,

2) remote-side: The remote transport entity is the only owner of the network connection,

3) both-sides: Both the local and the remote transport entities are the owners of the network connection;

NOTE – Due to the collision and recovery mechanisms, it is possible that different network connections – initiated either by the local or the remote transport entity – be consecutively associated to the same nc-reference. The assignment rights are attached with the nc-reference and remain unchanged independent of whichever transport entity is the initiator of the network connection currently used.

e) The preference to be used in the collision resolution mechanism (see B.6.2.5). This value is equal to the value of the field of the last NCM TPDU sent and is only significant when an N-CONNECT confirm is awaited (i.e. the nc-reference is either in the OPENING or in the RECOVERY state).

When an nc-reference which has been locally allocated is no longer needed, the nc-reference shall not be reused before a TFR-NC period of time. No information is associated with this frozen reference other than the TRF-NC timer and will be considered unknown if received in an NCM TPDU.

NOTE – In order to prevent that, in collision cases, two nc-references have the same value, it is required to allocate values at random, for example based on the time of their allocation.

B.6.2.4 Timers

The network connection management procedure makes use of the following timers:

a) the TTR-NC timer defines the period of time that shall not be exceeded when reopening a network connection associated with a given nc-reference after the receipt of an N-DISCONNECT indication in OPENING or RECOVERY state, TTR NC shall be less than TPD-NC by at least the sum of the maximum disconnection and maximum connection propagation delays of the network service;

b) the TPD-NC timer defines the minimum time a transport entity shall maintain an nc-reference in the PENDING state. A value of 2 min is used for TPD-NC;

c) the TFR-NC timer defines the minimum time that shall elapse before an entity may reuse a locally allocated nc-reference. A value of 2 min is used for TFR-NC.

B.6.2.5 Association of a received NCM TPDU with a known nc-reference

When an NCM TPDU is received according to