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Information technology — Telecommunications and information exchange between systems — Elements of Management Information Related to OSI Transport Layer Standards

*Technologies de l'information — Télécommunications et échange
d'information entre systèmes — Éléments d'information de gestion
concernant les normes de la couche Transport OSI*



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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

International Standard ISO/IEC 10737 was prepared by joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 6, *Telecommunications and information exchange between systems*.

Annex A forms an integral part of this International Standard. Annexes B and C are for information only.

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Introduction

This document is one of a set of International Standards produced to facilitate the interconnection of open systems. The set of International Standards covers the services, protocols and management information required to achieve such interconnection.

This International Standard is positioned with respect to other related International Standards by the layers defined in the *Reference Model for Open Systems Interconnection* (ISO 7498). In particular, it is concerned with the definition of Transport Layer management information.

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Information technology — Telecommunications and information exchange between systems — Elements of Management Information Related to OSI Transport Layer Standards

1 Scope

This International Standard provides the specification of management information within an Open System related to those operations of the OSI Transport Layer specified by CCITT Recommendations and International Standards. Specifics on how Transport layer management is accomplished is beyond the scope of this document. Transport Layer management information is defined by specifying:

- the managed object class definition of Transport Layer Managed Objects following guidelines put forth by the *Structure of Management Information* (ISO/IEC 10165 and CCITT Recommendations X.720 - X.723),
- the relationship of the Managed Objects and attributes to both the operation of the layer and to other objects and attributes of the layer, and
- the action type operations on the attributes of Transport Layer Managed Objects that are available to OSI Systems Management.

2 Normative references

The following CCITT Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All Recommendations and Standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the Recommendations and Standards listed below. Members of IEC and ISO maintain registers of currently valid international standards. The CCITT Secretariat maintains a list of the currently valid CCITT Recommendations.

2.1 Identical Recommendations | International Standards

CCITT Recommendation X.701 (1992) | ISO/IEC 10040:1992, *Information technology — Open Systems Interconnection — Systems management overview*.

CCITT Recommendation X.720 (1992) | ISO/IEC 10165-1:1993, *Information technology — Open Systems Interconnection — Structure of management information: Management information model*.

CCITT Recommendation X.721 (1992) | ISO/IEC 10165-2:1992, *Information technology — Open Systems Interconnection — Structure of management information: Definition of management information*.

CCITT Recommendation X.722 (1992) | ISO/IEC 10165-4:1992, *Information technology — Open Systems Interconnection — Structure of management information: Guidelines for the definition of managed objects*.

CCITT Recommendation X.723 (1991) | ISO/IEC 10165-5:—¹⁾, *Information technology — Open Systems Interconnection — Structure of Management Information: Generic management information*.

1) To be published.

CCITT Recommendation X.730 (1992) | ISO/IEC 10164-1:1993, *Information technology — Open Systems Interconnection — Systems Management: Object Management Function*.

CCITT Recommendation X.731 (1992) | ISO/IEC 10164-2:1993, *Information technology — Open Systems Interconnection — Systems Management: State management function*.

CCITT Recommendation X.732 (1992) | ISO/IEC 10164-3:1993, *Information technology — Open Systems Interconnection — Systems Management: Attributes for representing relationships*.

CCITT Recommendation X.733 (1992) | ISO/IEC 10164-4:1992, *Information technology — Open Systems Interconnection — Systems Management: Alarm reporting function*.

CCITT Recommendation X.734 (1992) | ISO/IEC 10164-5:1993, *Information technology — Open Systems Interconnection — Systems Management: Event report management function*.

2.2 Paired Recommendations | International Standards equivalent in technical content

CCITT Recommendation X.200 (1988), *Reference Model of Open Systems Interconnection for CCITT Applications*.

ISO 7498:1984, *Information processing systems — Open Systems Interconnection — Basic Reference Model*.

CCITT Recommendation X.208 (1988), *Specification of Abstract Syntax Notation One (ASN.1)*.

ISO/IEC 8824:1990, *Information technology — Open Systems Interconnection — Specification of the Abstract Syntax Notation One (ASN.1)*.

CCITT Recommendation X.214 (1988), *Transport service definition for Open Systems Interconnection for CCITT applications*.

ISO 8072:1994, *Information technology — Open Systems Interconnection — Transport service definition*.

CCITT Recommendation X.224 (1988), *Transport protocol specification for Open Systems Interconnection for CCITT applications*.

ISO/IEC 8073:1992, *Information technology — Telecommunications and information exchange between systems — Open Systems Interconnection — Protocol for providing the connection-mode transport service*.

CCITT Recommendation X.700 (1992), *Management Framework for Open Systems Interconnection for CCITT applications*.

ISO 7498-4:1989, *Information processing systems — Open Systems Interconnection — Basic Reference Model — Part 4: Management Framework*.

CCITT Recommendation X.710 (1991), *Common Management Information Service Definition for CCITT applications*.

ISO 9595:1991, *Information technology — Open Systems Interconnection — Common management information service definition*.

CCITT Recommendation X.711 (1991), *Common Management Information Protocol Specification for CCITT applications*.

ISO 9596-1:1991, *Information technology — Open Systems Interconnection — Common management information service protocol — Part 1: Specification*.

2.3 Additional reference

ISO 8602:1987, *Information processing systems — Open Systems Interconnection — Protocol for providing the connectionless-mode Transport Service*.

3 Definitions

3.1 Basic reference model

This International Standard makes use of the following terms defined in ISO 7498.

- a) Open System
- b) (N)-service-access-point
- c) Transport Layer
- d) Transport Protocol
- e) Layer Management
- f) Systems management

3.2 Information model

This International Standard makes use of the following terms defined in ISO/IEC 10165-1.

- a) Attributes
- b) Attribute type
- c) Containment
- d) Distinguished Name
- e) Inheritance
- f) Managed Object
- g) Management Operations
- h) Notifications
- i) Object Class
- j) Relative Distinguished Name
- k) Subclass
- l) Superclass

3.3 GDMO

This International Standard makes use of the following terms defined in ISO/IEC 10165-4.

- a) Managed Object Class Definition
- b) Template
- c) Parameter

3.4 Management Framework

This International Standard makes use of the following term defined in ISO 7498-4.

Management Information

4 Symbols and Abbreviations

Within the Managed Object definitions and GDMO templates the following abbreviations are used in the standard-name element of a document-identifier when making references to other documents.

DMI	CCITT Rec X.721 (1992) ISO/IEC 10165-2: 1992
GMI	CCITT Rec X.723 ISO/IEC 10165-5

This International Standard makes use of the following symbols and abbreviations.

AK TPDU	Data Acknowledge TPDU
CMIP	Common Management Information Protocol
CMIS	Common Management Information Service
DR TPDU	Disconnect Request TPDU
EA TPDU	Expedited Acknowledge TPDU
ED TPDU	Expedited Data TPDU
ER TPDU	Error TPDU
GDMO	Guidelines for Definition of MOs
IVMO	Initial Values Managed Object
MO	Managed Object
OSI	Open Systems Interconnection
PM	Protocol machine
RDN	Relative Distinguished Name
TC	Transport Connection
TPDU	Transport Protocol Data Unit
TSAP	Transport Service Access Point

5 Elements of Transport Layer Management Information

5.1 Managed Object Hierarchy

5.1.1 Summary of managed objects

The following set of managed objects are defined for the Transport Layer:

- a) Transport Subsystem managed object (transportSubsystem, see 5.3)
- b) Transport Entity managed object (transportEntity, see 5.4)
- c) Connectionless Transport Protocol Machine managed object (clmodeTPM, see 5.5)
- d) Connection-Oriented Transport Protocol Machine managed object (comodeTPM, see 5.6)
- e) Transport SAP managed object (tSAP, see 5.7)
- f) Transport Connection managed object (transportConnection, see 5.8.1)
- g) Transport Connection Initial Values managed object (transportConnectionIVMO, see 5.8.2)

These Managed Objects represent OSI Management's view of those elements of an Open System which support the OSI Transport Service subject to OSI management operations. The containment hierarchy is illustrated in figure 1. Managed objects which can have multiple instances are illustrated by multiple boxes. These objects are defined in detail in the following subclauses.

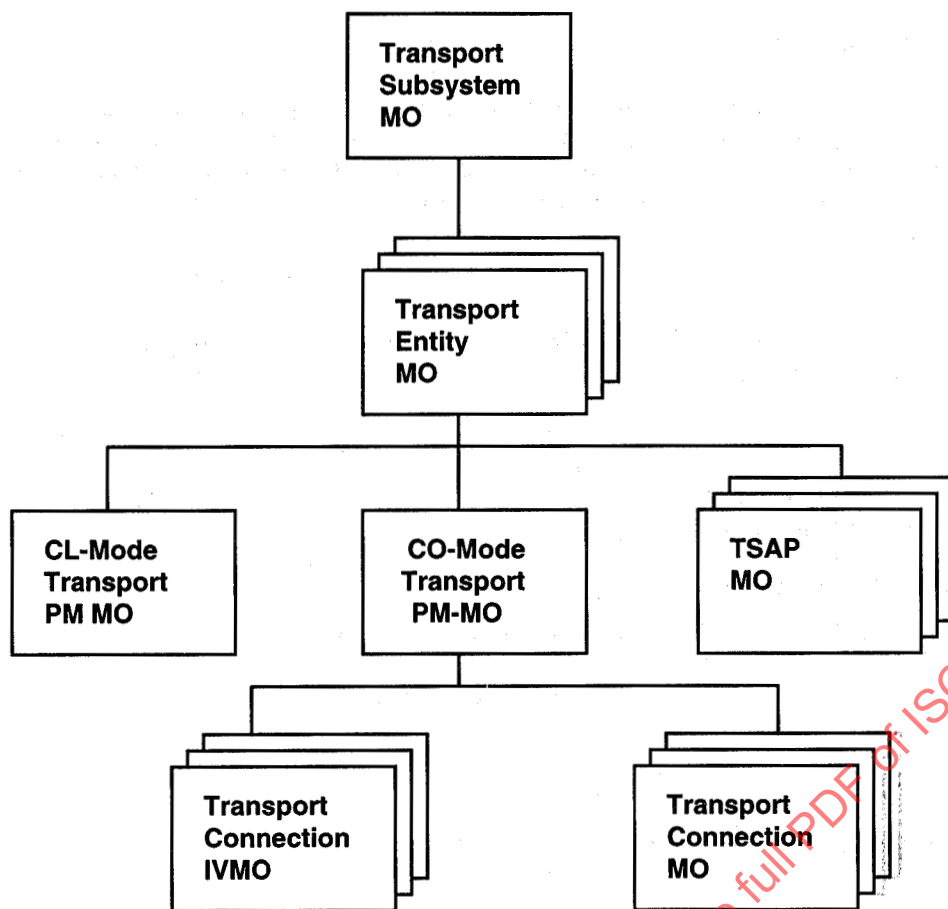


Figure 1 - Transport Layer Containment Hierarchy

5.1.2 Relationships

5.1.2.1 General description

The use of Relationship attributes is illustrated by examples in Annex C of this International Standard. The following describes the individual relationships for Transport layer in more detail.

5.1.2.2 Layer n-1 Services

The Transport Layer Entity has a relation (actualNSAP) to the NSAP MO.

5.1.2.3 Connections

There is a relationship (underlyingConnectionNames) between a Transport Connection MO and its underlying Network LayerConnection MO (if one exists).

5.1.3 Minimum Event Filtering Capabilities

The transport layer management definitions embodied in this specification imply the frequent and possibly excessive generation of notifications of notifications during regular layer operation. These notifications are especially useful for effective fault management where they facilitate the tracing and pinpointing of error situations. To avoid the excessive dissemination of these event reports under normal operating conditions, it is advisable for a managed system to have as a minimum the capability to perform discrimination based on

- a) the source managed object class;
- b) the object Identifier values in the probable cause and specific problems field of Communication alarms, and the communication type field of Communication informations.

5.1.4 Use of Optional Fields

Where reference is made in this International Standard to ASN.1 syntax defined in Rec. X.723 | ISO/IEC 10165-5 or Rec. X.721 | ISO/IEC 10165-2, only the following fields shall be employed:

- a) those which are not OPTIONAL in the ASN.1 syntax;
- b) those which are OPTIONAL, but whose use is explicitly required by this International Standard;
- c) those which are OPTIONAL, but whose ASN.1 type is SET OF MngmntExtension.

The use of any other field is prohibited.

5.2 Common Transport Layer GDMO Definitions

commonCreationDeletion-B BEHAVIOUR
DEFINED AS

!Managed object class imports the 10165-2 objectCreation and objectDeletion notifications. Used as follows:

ObjectCreation - Generated whenever an instance of the managed object class is created. Implementations may optionally include the sourceIndicator parameter in the notification. If creation occurred as a result of internal operation of the resource, the value 'resourceOperation' is used. If creation occurred in response to a management operation, the value 'managementOperation' is used. A value of 'unknown' may be returned if it is not possible to determine the source of the operation. None of the other optional parameters are used.

ObjectDeletion - Generated whenever an instance of the managed object class is deleted. Implementations may optionally include the sourceIndicator parameter in the notification. If deletion occurred as a result of internal operation of the resource, the value 'resourceOperation' is used. If deletion occurred in response to a management operation, the value 'managementOperation' is used. A value of 'unknown' may be returned if it is not possible to determine the source of the operation. None of the other optional parameters are used.!!;

commonStateChange-B BEHAVIOUR
DEFINED AS

!Managed object class imports the 10165-2 stateChange notification. Used to report the changes to the operationalState attribute, and where present, the administrativeState attribute. A single parameter set is included in the State change definition field. Only the (mandatory) attributeId and (optional) newAttributeValue parameters are used.!!;

octetsSentReceivedCounter-B BEHAVIOUR
DEFINED AS

!The octetsSentCounter and octetsReceivedCounter shall count only user data octets in valid data TPDUs. They shall not count user data octets in data TPDUs which are rejected for any reason, nor user data octets in non-data TPDUs.!!;

successfulConnectionEstablishment-B BEHAVIOUR**DEFINED AS**

!This Package imports the communicationsInformation notification from "GMI". It is used to report the following events :
 successfulConnectionEstablishment: Generated when a connection is successfully established. However the precise synchronization between the notification and the corresponding protocol and service interface interactions is not defined by this Specification
 The value TLM.successfulConnectionEstablishment shall be reported in the informationType field.!

deactivateConnection-B BEHAVIOUR**DEFINED AS**

!The deactivate action causes the connection to be terminated. The termination should occur as rapidly as practical, but no particular time constraints are implied. Typically, this action simulates a disconnect request received across the service interface. If a more rapid means for terminating the connection exists, then this should be used. The termination shall occur in conformance to the protocol standard. The Managed Object remains in existence after completion of the Deactivate Action. It is subsequently deleted when the connection is terminated, in the same way as if the connection has been terminated by other means. A Deactivate action may fail (with the ProcessingError response) if it is temporarily not possible to terminate the connection.!

resettingTimer-B BEHAVIOUR**DEFINED AS**

!This attribute specifies the interval between certain events in the operation of the protocol state machine. If the value of the attribute is changed to a new value while the protocol state machine is in operation, the implementation shall take the necessary steps to ensure that for any time interval which was in progress when the corresponding attribute was changed, the next expiration of that interval takes place no later than the expiration of the interval in progress or the specified interval whichever is the sooner. The precision with which this time shall be implemented shall be the same as that associated with the basic operation of the timer attribute.!

5.3 The transport subsystem managed object

-- Managed Object for Transport Layer Subsystem

- There is exactly one of these MOs within
- a system. It exists to provide a container for the layer entity MOs.
-
- The transportSubsystem managed object cannot be created or deleted
- explicitly by management operation. It exists inherently in a system;
- created and deleted as part of system operation.

transportSubsystem MANAGED OBJECT CLASS

DERIVED FROM "GMI":subsystem;

-- which is derived from "DMI":top

CHARACTERIZED BY transportSubsystem-P PACKAGE

ATTRIBUTES

"GMI":subsystemId

INITIAL VALUE TLM.transportSubsystemId-Value

GET;

;;

REGISTERED AS {TLM.moi transportSubsystem (1)};

-- Name Bindings**transportSubsystem-system NAME BINDING**

SUBORDINATE OBJECT CLASS transportSubsystem AND SUBCLASSES;

NAMED BY

SUPERIOR OBJECT CLASS "DMI":system AND SUBCLASSES;

```
WITH ATTRIBUTE "GMI":subsystemId;
REGISTERED AS {TLM.nboi transportSubsystem-system (1)};
```

5.4 The transport entity managed object

- There may be multiple instances of these MOs within a system.
- Its definition permits it to be deleted and created explicitly by
- management operation, or to be created and deleted automatically
- as part of system operation.

```
transportEntity MANAGED OBJECT CLASS
DERIVED FROM "GMI":communicationsEntity;
-- which is derived from "DMI":top
CHARACTERIZED BY transportEntity-P PACKAGE
  BEHAVIOUR tEPackageImportedNotifications-B,
  commonCreationDeletion-B;
ATTRIBUTES
  actualNSAP GET,
  checksumErrorsDetected GET,
  protocolErrors GET,
  targetNSAP GET-REPLACE ADD-REMOVE,
  undecodedNSDUs GET;
```

ATTRIBUTE GROUPS

- The following attribute group is present in each of the transport
- MOs which define counters. It allows all of the
- counters to be retrieved in a single request.

```
"GMI":counters
  checksumErrorsDetected
  protocolErrors
  undecodedNSDUs;
```

NOTIFICATIONS

- protocolErrorNotification;
- The following notification is issued by the entity MO
- because in some cases it may be impossible to associate the
- protocol Error with any of the protocol Machines.

```
"DMI":communicationsAlarm
  tEProtocolErrorPDUHeader
  tEProtocolErrorSourceAddress
  tEProtocolErrorReasonCode,
```

```
"DMI":objectDeletion,
```

```
"DMI":objectCreation;;
```

```
REGISTERED AS {TLM.moi transportEntity (2)};
```

-- Behaviours

- Definition of the tEPackageImportedNotifications and of the mapping
- of specific protocol error parameters into the fields of
- communicationsAlarm Notification.

```
tEPackageImportedNotifications-B BEHAVIOUR
```

DEFINED AS

!Notification issued when a Transport Entity receives a PDU which is invalid or contains a protocol error. The notification includes the header of the invalid PDU, the source N-Address, and the reason why the PDU is considered to be in error. The Reason code appears only if the protocol error relates to the connection-mode protocol, and if it has been possible to relate the PDU to a particular connection. The reason code is the value placed in the corresponding parameter of the ER TPDU, if sent. The tEPackage imports the communicationsAlarm Notification from DMI, in order to report the ProtocolError event. The probableCause shall be set to TLM.communicationsProtocolError. The tEProtocolErrorPDUHeader, tEProtocolErrorSourceAddress and tEProtocolErrorReasonCode are reported as parameters in the additionalInformation field of the communicationsAlarm. The significance subparameter of each item of the problemData shall be set to the value 'False' (i.e. not significant) so that a managing system receiving the event will be less likely to reject it. The perceivedSeverity shall be set to Minor. A

subsequent communicationsAlarm with a perceivedSeverity value of 'Cleared' shall not be generated. No other fields or parameters shall be used, with the exception of further parameters in the additionalInformationfield.!!;

-- Name Bindings

transportEntity-transportSubsystem-Automatic NAME BINDING
 SUBORDINATE OBJECT CLASS transportEntity AND SUBCLASSES;
 NAMED BY
 SUPERIOR OBJECT CLASS transportSubsystem AND SUBCLASSES;
 WITH ATTRIBUTE "GMI":communicationsEntityId;
 BEHAVIOUR transportEntity-transportSubsystem-Automatic-B BEHAVIOUR
 DEFINED AS
 !This name binding shall be used when the transportEntity MO is created automatically by the operation of the system. The details of this operation are outside the scope of this Specification.!!;
 REGISTERED AS {TLM.nboi transportEntity-transportSubsystem-Automatic (11)};

transportEntity-transportSubsystem-Management NAME BINDING
 SUBORDINATE OBJECT CLASS transportEntity AND SUBCLASSES;
 NAMED BY
 SUPERIOR OBJECT CLASS transportSubsystem AND SUBCLASSES;
 WITH ATTRIBUTE "GMI":communicationsEntityId;
 BEHAVIOUR transportEntity-transportSubsystem-Management-B BEHAVIOUR
 DEFINED AS
 !This name binding shall be used when the transportEntity MO is created by management.!!;
 CREATE;
 DELETE;
 REGISTERED AS {TLM.nboi transportEntity-transportSubsystem-Management (12)};

-- Attributes

actualNSAP ATTRIBUTE
 WITH ATTRIBUTE SYNTAX TLM.LocalDistinguishedNames;
 MATCHES FOR EQUALITY, SET-INTERSECTION;
 BEHAVIOUR actualNSAP-B BEHAVIOUR
 DEFINED AS
 The actual MO name(s) of the NSAP(s)
 in use by this Transport Entity;;
 REGISTERED AS {TLM.aoi actualNSAP (4)};

checksumErrorsDetected ATTRIBUTE
 DERIVED FROM "GMI":nonWrapping64BitCounter;
 BEHAVIOUR clChecksumErrorsDetected-B BEHAVIOUR
 DEFINED AS
 The number of PDUs received with an incorrect checksum;;
 REGISTERED AS {TLM.aoi checksumErrorsDetected (6)};

protocolErrors ATTRIBUTE
 DERIVED FROM "GMI":nonWrapping64BitCounter;
 BEHAVIOUR protocolErrors-B BEHAVIOUR
 DEFINED AS
 Counter associated to protocol errors;;
 REGISTERED AS {TLM.aoi protocolErrors (7)};

targetNSAP ATTRIBUTE
 WITH ATTRIBUTE SYNTAX TLM.LocalDistinguishedNames;
 MATCHES FOR EQUALITY, SET-INTERSECTION;
 BEHAVIOUR targetNSAP-B BEHAVIOUR
 DEFINED AS
 The MO name(s) of the NSAP(s) to be used
 by this Transport Entity. The value of this attribute cannot be changed
 unless the Operational State of the entity is Off. An implementation may

permit it to be set only at creation of the transportEntity MO. An implementation may permit the size of the set to be restricted to 1. An implementation may permit a null value (empty set) to be specified, in which case some system-dependent auto configuration takes place;;

REGISTERED AS {TLM.aoi targetNSAP (3)};

undecodedNSDUs ATTRIBUTE
 DERIVED FROM "GMI":nonWrapping64BitCounter;
 BEHAVIOUR undecodedNSDUs-B BEHAVIOUR
 DEFINED AS
 Number of NSDUs that cannot be attributed
 to any protocol machines;;

REGISTERED AS {TLM.aoi undecodedNSDUs (5)};

-- Parameters

tEProtocolErrorPDUHeader PARAMETER
 CONTEXT EVENT-INFO;
 WITH SYNTAX TLM.PDUHeaderSyntax;
 BEHAVIOUR pduHeader-B BEHAVIOUR
 DEFINED AS
 Header of the invalid PDU that caused the event.
 Returned in the problemData field of a communicationsAlarm notification;;

REGISTERED AS {TLM.proi tEProtocolErrorPDUHeader(1)};

tEProtocolErrorSourceAddress PARAMETER
 CONTEXT EVENT-INFO;
 WITH SYNTAX TLM.SourceAddressSyntax;
 BEHAVIOUR sourceAddress-B BEHAVIOUR
 DEFINED AS
 Source N-Address of the invalid PDU that caused the event. Returned in the
 problemData field of a communicationsAlarm notification;;

REGISTERED AS {TLM.proi tEProtocolErrorSourceAddress(2)};

tEProtocolErrorReasonCode PARAMETER
 CONTEXT EVENT-INFO;
 WITH SYNTAX TLM.ReasonCodeSyntax;
 BEHAVIOUR reasonCode-B BEHAVIOUR
 DEFINED AS
 Reason why the PDU is in error
 as placed in the corresponding parameter of the ER TPDU. Returned in the
 problemData field of a communicationsAlarm notification This parameter is
 optional;;

REGISTERED AS {TLM.proi tEProtocolErrorReasonCode(3)};

5.5 The connectionless-mode transport protocol Machine MO

- There is no more than one of these MOs per Transport Entity.
- Its definition permits it to be created and deleted explicitly by
- management operation, but in some systems it will exist inherently
- and neither creation nor deletion by management operation
- will be possible. Name bindings are defined for both cases.
-
- When the protocol machine is operable, the operationalState shall
- have the value 'enabled'; otherwise it shall have the value
- 'disabled'
-
- Transitions of operationalState shall be reported using the
- stateChange notification. An clmodeTPM MO may be created in the
- 'enabled' operational state.


```

clmodeTPM MANAGED OBJECT CLASS
DERIVED FROM "GMI":clProtocolMachine;
-- which is derived from "DMI":top
CHARACTERIZED BY clmodeTPM-P PACKAGE
BEHAVIOUR
    clPackageImportedNotifications-B,
    commonStateChange-B,
    commonCreationDeletion-B;
ATTRIBUTES
    "DMI":administrativeState GET-REPLACE,
    "GMI":clProtocolMachineId
        INITIAL VALUE TLM.clmodeTPMid-Value
        GET,
    clChecksumOption REPLACE-WITH-DEFAULT GET-REPLACE,
    "DMI":octetsSentCounter GET,
    "DMI":octetsReceivedCounter GET,
    "DMI":pdusSentCounter GET,
    "DMI":pdusReceivedCounter GET,
    undeliverablePDUsCounter GET;
ATTRIBUTE GROUPS
    "DMI":state
        "DMI":administrativeState
        "DMI":operationalState,
    "GMI":counters
        "DMI":octetsSentCounter
        "DMI":octetsReceivedCounter
        "DMI":pdusSentCounter
        "DMI":pdusReceivedCounter
        undeliverablePDUsCounter ;
ACTIONS
    "GMI":activate,
    "GMI":deactivate;
NOTIFICATIONS
    "DMI":objectCreation,
    "DMI":objectDeletion,
    "DMI":stateChange,
    "DMI":communicationsAlarm
        clPMPDUHeader
        clPMSourceAddress;
;;
REGISTERED AS {TLM.moi clmodeTPM (3)};

```

-- Behaviours

```

-- Definition of the clPackageImportedNotifications and
-- of the mapping of specific parameters into the fields
-- of communicationsAlarm Notification.
--

```

```

clPackageImportedNotifications-B BEHAVIOUR
DEFINED AS

```

!The clmodeTPM-P package imports communicationsAlarm from DMI, in order to report the Undeliverable PDU event. The probableCause is set to TLM.communicationsProtocolError. The clPMPDUHeader and clPMSourceAddress are reported as parameters in the additionalInformation field of the communicationsAlarm. The significance subparameter of each item of the additionalInformation shall be set to the value 'False' (ie not significant) so that a managing system receiving the event will be less likely to reject it. The perceivedSeverity shall be set to Minor. A subsequent communicationsAlarm with a perceived Severity value of 'Cleared' shall not be generated. No other fields or parameters shall be used, with the exception of further parameters in the additionalInformationfield.!

-- Name Bindings

```

clmodeTPM-transportEntity-Management NAME BINDING
SUBORDINATE OBJECT CLASS clmodeTPM AND SUBCLASSES;
NAMED BY
    SUPERIOR OBJECT CLASS transportEntity AND SUBCLASSES;
    WITH ATTRIBUTE "GMI":clProtocolMachineId;
BEHAVIOUR clmodeTPM-transportEntity-Management-B BEHAVIOUR
DEFINED AS
    The name binding that applies when the clmodeTPM managed object can be
    explicitly created and deleted by management;;
CREATE;
DELETE ONLY-IF-NO-CONTAINED-OBJECTS;
REGISTERED AS {TLM.nboi clmodeTPM-transportEntity-Management (3)};

```

```

clmodeTPM-transportEntity-Automatic NAME BINDING
SUBORDINATE OBJECT CLASS clmodeTPM AND SUBCLASSES;
NAMED BY
    SUPERIOR OBJECT CLASS transportEntity AND SUBCLASSES;
    WITH ATTRIBUTE "GMI":clProtocolMachineId;
BEHAVIOUR clmodeTPM-transportEntity-Automatic-B BEHAVIOUR
DEFINED AS
    The name binding that applies when the clmodeTPM managed object cannot be
    explicitly created and deleted by management;;
REGISTERED AS {TLM.nboi clmodeTPM-transportEntity-Automatic (9)};

```

-- Attributes

```

clChecksumOption ATTRIBUTE
WITH ATTRIBUTE SYNTAX TLM.Boolean;
MATCHES FOR EQUALITY;
BEHAVIOUR clChecksumOption-B BEHAVIOUR
DEFINED AS
    Enables use of the checksum option in 8602 PDUs
    (in the absence of over-riding local controls) use (TRUE) or non-use
    (FALSE);;
REGISTERED AS {TLM.aoi clChecksumOption (9)};

```

```

undeliverablePDUsCounter ATTRIBUTE
DERIVED FROM "GMI":nonWrapping64BitCounter;
BEHAVIOUR undeliverablePDUsCounter-B BEHAVIOUR
DEFINED AS
    Counter associated with the notification
    as recommended in GDMO Clause 9.8.5 ( the notification may be suppressed );;
REGISTERED AS {TLM.aoi undeliverablePDUsCounter(10)};

```

-- Parameters

```

clPMPDUHeader PARAMETER
CONTEXT EVENT-INFO;
WITH SYNTAX TLM.PDUHeaderSyntax;
BEHAVIOUR clPMPDUHeader-B BEHAVIOUR
DEFINED AS
    Header of the PDU that cannot be delivered.
    Returned in the problemData field of a communicationsAlarm notification;;
REGISTERED AS {TLM.proi clPMPDUHeader(4)};

```

```

clPMSourceAddress PARAMETER
CONTEXT EVENT-INFO;
WITH SYNTAX TLM.SourceAddressSyntax;
BEHAVIOUR clPMSourceAddress-B BEHAVIOUR
DEFINED AS
    Source N-Address.
    Returned in the problemData field of a communicationsAlarm notification;;
REGISTERED AS {TLM.proi clPMSourceAddress(5)};

```

5.6 The Connection-Oriented Transport Protocol Machine MO

```
-- There is no more than one of these MOs per Transport entity.
-- Its definition permits it to be created and deleted explicitly by
-- management operation, but in some systems it will exist inherently
-- and neither creation nor deletion by management operation
-- will be possible. Name bindings are defined for both cases.
--
-- When the protocol machine is operable, the operationalState shall
-- have the value 'enabled'; otherwise it shall have the value
-- 'disabled'.
--
-- Transitions of operationalState shall be reported using the
-- stateChange notification. An comodeTPM MO may be created in the
-- 'enabled' operational state.
```

comodeTPM MANAGED OBJECT CLASS

DERIVED FROM "GMI":coProtocolMachine;

-- which is derived from "DMI":top

CHARACTERIZED BY comodeTPM-P PACKAGE

BEHAVIOUR

commonStateChange-B,
commonCreationDeletion-B,
comodeTPMImportedNotifications-B;

ATTRIBUTES

"DMI":administrativeState GET-REPLACE,
"DMI":octetsReceivedCounter GET,
"DMI":octetsSentCounter GET,
"GMI":coProtocolMachineId
INITIAL VALUE TLM.comodeTPMId-Value GET,
localErrorDisconnects GET,
localSuccessfulConnections GET,
localUnsuccessfulConnections GET,
maxConnections REPLACE-WITH-DEFAULT GET-REPLACE,
maxOpenConnections REPLACE-WITH-DEFAULT GET,
openConnections GET,
remoteErrorDisconnects GET,
remoteSuccessfulConnections GET,
remoteUnsuccessfulConnections GET,
unassociatedTPDUs GET;

ATTRIBUTE GROUPS

"DMI":state
"DMI":administrativeState
"DMI":operationalState,

```
-- The following attribute group is present in each of the transport
-- MOs which define counters. It allows all of the
-- counters to be retrieved in a single request.
```

"GMI":counters
"DMI":octetsSentCounter
"DMI":octetsReceivedCounter
openConnections
localSuccessfulConnections
remoteSuccessfulConnections
localUnsuccessfulConnections
remoteUnsuccessfulConnections
localErrorDisconnects
remoteErrorDisconnects
unassociatedTPDUs
maxOpenConnections;

ACTIONS

"GMI":activate,
"GMI":deactivate;

NOTIFICATIONS

"DMI":objectCreation,
"DMI":objectDeletion,
"DMI":stateChange,

```
-- incomingConnectionRejected
```

```

"GMI":communicationsInformation
    rejectionCause
    callingNSAPAddress-PAR
    calledNSAPAddress-PAR
    callingTSelector-PAR
    calledTSelector-PAR
    networkConnectionIDs-PAR;;;
REGISTERED AS {TLM.moi comodeTPM (4)};

```

-- Behaviours

```

comodeTPMImportedNotifications-B BEHAVIOUR
    DEFINED AS

```

The comodeTPM-P package imports the communicationsInformation notification from "Rec. X723 | ISO/IEC 10165-5" in order to report when an incoming connection is rejected. The value TLM.incomingConnectionRejected shall be reported in the informationType field. The rejection Cause, Calling NSAP Address, Called NSPA Address, Calling TSelector, Called TSelector and Network ConnectionId shall be reported as parameters in the informationData field;

-- Name Bindings

```

comodeTPM-transportEntity-Management NAME BINDING
    SUBORDINATE OBJECT CLASS comodeTPM AND SUBCLASSES;
    NAMED BY
        SUPERIOR OBJECT CLASS transportEntity AND SUBCLASSES;
        WITH ATTRIBUTE "GMI":coProtocolMachineId;
    BEHAVIOUR comodeTPM-transportEntity-Management-B BEHAVIOUR
        DEFINED AS
            The name binding that applies when the comodeTPM managed object can be
            explicitly created and deleted by management;;
    CREATE;
    DELETE ONLY-IF-NO-CONTAINED-OBJECTS;
    REGISTERED AS {TLM.nboi comodeTPM-transportEntity-Management(4)};

```

```

comodeTPM-transportEntity-Automatic NAME BINDING
    SUBORDINATE OBJECT CLASS comodeTPM AND SUBCLASSES;
    NAMED BY
        SUPERIOR OBJECT CLASS transportEntity AND SUBCLASSES;
        WITH ATTRIBUTE "GMI":coProtocolMachineId;
    BEHAVIOUR comodeTPM-transportEntity-Automatic-B BEHAVIOUR
        DEFINED AS
            The name binding that applies when the comodeTPM managed object cannot be
            explicitly created and deleted by management;;
    REGISTERED AS {TLM.nboi comodeTPM-transportEntity-Automatic (10)};

```

-- Attributes

```

localErrorDisconnects ATTRIBUTE
    DERIVED FROM "GMI":nonWrapping64BitCounter;
    BEHAVIOUR localErrorDisconnects-B BEHAVIOUR
        DEFINED AS
            The number of transport disconnects initiated by the local entity upon
            issuing a DR TPDU with an error code other than "Normal disconnect initiated
            by Service User", or upon issuing an ER TPDU;;
    REGISTERED AS {TLM.aoi localErrorDisconnects (18)};

```

```

localSuccessfulConnections ATTRIBUTE
    DERIVED FROM "GMI":nonWrapping64BitCounter;
    BEHAVIOUR localSuccessfulConnections-B BEHAVIOUR
        DEFINED AS
            Number of transport connections initiated by the local entity which have
            reached the Open state;;
    REGISTERED AS {TLM.aoi localSuccessfulConnections (14)};

```

localUnsuccessfulConnections ATTRIBUTE

DERIVED FROM "GMI":nonWrapping64BitCounter;

BEHAVIOUR localUnsuccessfulConnections-B BEHAVIOUR

DEFINED AS

The number of (local) unsuccessful transport connections initiated by the local Transport Entity which failed to reach the Open State. (Retransmission of CR TPDUs is not included in this counter);;

REGISTERED AS {TLM.aoi localUnsuccessfulConnections (16)};

maxConnections ATTRIBUTE

WITH ATTRIBUTE SYNTAX TLM.Integer;

MATCHES FOR EQUALITY, ORDERING;

BEHAVIOUR maxConnections-B BEHAVIOUR

DEFINED AS

The maximum number of simultaneously open transport connections allowed by the transport entity. There may be a period during which the openConnection attribute has a value which is greater than maxConnections. During this period, it shall not be permitted to initiate or accept new connections. It is a local matter whether action is taken to reduce the number of open connections to a value less than or equal to maxConnections by terminating connections chosen in an implementation-dependent manner. Whether or not such action is taken, there may be a period during which the openConnections attribute has a value which is greater than maxConnections.;;

REGISTERED AS {TLM.aoi maxConnections (13)};

maxOpenConnections ATTRIBUTE

WITH ATTRIBUTE SYNTAX TLM.Integer;

MATCHES FOR EQUALITY, ORDERING;

BEHAVIOUR maxOpenConnections-B BEHAVIOUR

DEFINED AS

The highest number of simultaneously open Transport connections which has occurred since the last REPLACE-WITH-DEFAULT operation. The effect of the this operation is to set the attribute to the number of currently open connections. Multiple managers need to coordinate their actions to avoid confusion;;

REGISTERED AS {TLM.aoi maxOpenConnections (21)};

openConnections ATTRIBUTE

WITH ATTRIBUTE SYNTAX TLM.Integer;

MATCHES FOR EQUALITY, ORDERING;

BEHAVIOUR openConnections-B BEHAVIOUR

DEFINED AS

The number of transport connections which are in the open state as defined in the state tables for IS8073. Updated upon each connection establishment and release;;

REGISTERED AS {TLM.aoi openConnections (12)};

remoteErrorDisconnects ATTRIBUTE

DERIVED FROM "GMI":nonWrapping64BitCounter;

BEHAVIOUR remoteErrorDisconnects-B BEHAVIOUR

DEFINED AS

The number of disconnects initiated by a peer Transport entity upon issuing a DR TPDU with an error code other than "Normal disconnect initiated by Session Entity" or upon issuing an ER TPDU;;

REGISTERED AS {TLM.aoi remoteErrorDisconnects (19)};

remoteSuccessfulConnections ATTRIBUTE

DERIVED FROM "GMI":nonWrapping64BitCounter;

BEHAVIOUR remoteSuccessfulConnections-B BEHAVIOUR

DEFINED AS

Number of transport connections initiated by a remote entity which have reached the Open state;;

REGISTERED AS {TLM.aoi remoteSuccessfulConnections (15)};

remoteUnsuccessfulConnections ATTRIBUTE

```

DERIVED FROM "GMI":nonWrapping64BitCounter;
BEHAVIOUR remoteUnsuccessfulConnections-B BEHAVIOUR
  DEFINED AS
    The number of (remote) unsuccessful transport connections initiated by a
    remote Transport Entity which failed to reach the open state;;
REGISTERED AS {TLM.aoi remoteUnsuccessfulConnections (17)};

unassociatedTPDUs ATTRIBUTE
  DERIVED FROM "GMI":nonWrapping64BitCounter;
  BEHAVIOUR unassociatedTPDUs-B BEHAVIOUR
    DEFINED AS
      The number of TPDUs received which could not be associated
      with a Transport Connection. This counter is incremented only for such TPDUs
      received over the CONS;;
REGISTERED AS {TLM.aoi unassociatedTPDUs (20)};

-- Parameters

rejectionCause PARAMETER
  CONTEXT EVENT-INFO;
  WITH SYNTAX TLM.DeletionCauseSyntax;
  BEHAVIOUR rejectionCause-B BEHAVIOUR
    DEFINED AS Reason why the incoming Connection was rejected;;
REGISTERED AS {TLM.proi rejectionCause (7) };

```

5.7 The TSAP Managed Object

```

-- There is one tSAP MO for each TSAP currently
-- recognised by the containing Transport Entity.
-- Its definition permits it to be created and deleted by Management
-- operation or to be created and deleted automatically as part
-- of system operation.
-- Some implementations may require TSAP MOs to be created
-- explicitly through management before they can be used.
-- Others may create them automatically when a user entity attaches
-- itself to them (in some implementation-dependent fashion).
-- In this case, it is recommended that the naming convention
-- be used whereby the name of the Managed Object
-- is the representation in hexadecimal of the Transport Selector of
-- the TSAP, so that it is possible to configure Transport Users
-- without system specific knowledge.

```

```

tSAP MANAGED OBJECT CLASS
  DERIVED FROM "GMI":sap1;
-- which is derived from "DMI":top;
  CHARACTERIZED BY tSAP-P PACKAGE
    BEHAVIOUR commonCreationDeletion-B;
  ATTRIBUTES
    "GMI":sap1Address
      INITIAL VALUE DERIVATION RULE tSAPAddress-B GET;
  NOTIFICATIONS
    "DMI":objectCreation,
    "DMI":objectDeletion;
  ;;
REGISTERED AS {TLM.moi tSAP (5)};

```

-- Behaviours

```

tSAPAddress-B BEHAVIOUR
  DEFINED AS
    If the package is created using the tSAP-transportEntity-Automatic name binding,
    it is recommended that the naming convention be used whereby the name of the MO
    is the representation in Hexadecimal of the Transport Selector of the TSAP. If

```


the package is created using the tSAP-transportEntity-Management name binding, the initial value shall be specified in the CMIP create;

-- Name Bindings

```
tSAP-transportEntity-Automatic NAME BINDING
SUBORDINATE OBJECT CLASS tSAP AND SUBCLASSES;
NAMED BY
    SUPERIOR OBJECT CLASS transportEntity AND SUBCLASSES;
    WITH ATTRIBUTE "GMI":sapId;
BEHAVIOUR tSAP-transportEntity-Automatic-B BEHAVIOUR
DEFINED AS
    This Name Binding corresponds to the use of TSAPs which are automatically
    created;;
REGISTERED AS {TLM.nboi tSAP-transportEntity-Automatic (5)};

tSAP-transportEntity-Management NAME BINDING
SUBORDINATE OBJECT CLASS tSAP AND SUBCLASSES;
NAMED BY
    SUPERIOR OBJECT CLASS transportEntity AND SUBCLASSES;
    WITH ATTRIBUTE "GMI":sapId;
BEHAVIOUR tSAP-transportEntity-management-B BEHAVIOUR
DEFINED AS
    This Name Binding corresponds to the use of TSAPs which are explicitly
    created by management. The value of the tsapID attribute shall be included in
    the Create operation, otherwise the create operation will fail ;;
CREATE;
DELETE;
REGISTERED AS {TLM.nboi tSAP-transportEntity-Management (6)};
```

5.8 The Transport Connection Managed Object and IVMO

5.8.1 The Transport Connection Managed Object

```
-- There may be multiple instances of these Managed Objects
-- within a connection-oriented protocol machine. Each corresponds
-- to a Transport connection. A transportConnection is created
-- automatically as part of system operation. A transportConnection may
-- be deleted automatically as part of system operation or
-- may be deleted as a result of the deactivate management operation. A
-- transportConnectionIVMO may be used as the source
-- of initial values of attributes of a transportConnectionMO.
--
-- This section defines the Transport Connection Managed Object. The
-- Transport Connection Managed Object contains the set of attributes
-- characterizing the manageable aspects of a
-- Transport Layer Protocol Connection.

-- An MO of this class exists corresponding to each active Transport
-- Connection, i.e. for which a CR
-- TPDU has been sent or received and which has not yet been
-- terminated. An MO may also exist prior to transmission of a CR TPDU,
-- corresponding to interactions across the service interface.
-- The precise synchronization of the creation and deletion of the MO
-- with the protocol exchanges corresponding to the Transport Connection
-- is not however defined by this standard. For example,
-- there may be a visible delay after transmission or reception of a CR
-- TPDU or interaction at the service interface before the MO is created
-- and becomes visible to management). A Transport
-- Connection MO is not required for terminated connections whose
-- References have been placed in the Frozen state (for Class 4
-- operation), although according to the above the MO may remain
-- visible for some time after the connection has in other respects been
```

```
-- terminated.
--
```

```
transportConnection MANAGED OBJECT CLASS
  DERIVED FROM "GMI":singlePeerConnection;
-- which is derived from "DMI":top
  CHARACTERIZED BY transportConnection-P PACKAGE
    BEHAVIOUR
      initialValues-B,
      connectionCreationDeletion-B,
      successfulConnectionEstablishment-B,
      deactivateConnection-B,
      transportConnection-B BEHAVIOUR
      DEFINED AS
```

The following point should be noted with regard to items inherited from elsewhere: octets sent/received counters count only octets of user data, not protocol control information.;;

ATTRIBUTES

```
"DMI":octetsReceivedCounter GET,
"DMI":octetsSentCounter GET,
"DMI":pdusReceivedCounter GET,
"DMI":pdusRetransmittedErrorCounter GET,
"DMI":pdusSentCounter GET,
calledNSAPAddress GET,
calledTSelector GET,
callingNSAPAddress GET,
callingTSelector GET,
connectionDirection GET,
localReference GET,
maxTPDUSize GET,
networkConnectionIDs GET,
protocolClass GET,
protocolErrors GET,
remoteReference GET,
respondingNSAPAddress GET;
```

ATTRIBUTE GROUPS

```
"GMI":counters
  "DMI":octetsReceivedCounter
  "DMI":octetsSentCounter
  "DMI":pdusReceivedCounter
  "DMI":pdusSentCounter
  "DMI":pdusRetransmittedErrorCounter
  protocolErrors;
```

NOTIFICATIONS

```
"DMI":objectCreation
  transportConnectionName
  protocolClass-PAR
  maxTPDUSize-PAR
  callingTSelector-PAR
  calledTSelector-PAR
  callingNSAPAddress-PAR
  calledNSAPAddress-PAR
  respondingNSAPAddress-PAR
  connectionDirection-PAR
  networkConnectionIDs-PAR,
"DMI":objectDeletion
  transportConnectionName
  protocolClass-PAR
  maxTPDUSize-PAR
  callingTSelector-PAR
  calledTSelector-PAR
  callingNSAPAddress-PAR
  calledNSAPAddress-PAR
  respondingNSAPAddress-PAR
  connectionDirection-PAR
  networkConnectionIDs-PAR
  objectDeletionCause,
```

```
-- successfulConnectionEstablishment
```



```

"GMI":communicationsInformation
-- The following parameters are reported in the informationData field
  transportConnectionName
  protocolClass-PAR
  maxTPDUSize-PAR
  callingTSelector-PAR
  calledTSelector-PAR
  callingNSAPAddress-PAR
  calledNSAPAddress-PAR
  respondingNSAPAddress-PAR
  connectionDirection-PAR
  networkConnectionIDs-PAR;
;;
CONDITIONAL PACKAGES
  transportConnectionClass1-P
    PRESENT IF
      ! At the initiating side, present if class 1 is requested or can be
      accepted following class negotiation procedures. At the responding side,
      present if class 1 is chosen!,
  transportConnectionClass2-P
    PRESENT IF
      ! At the initiating side, present if class 2 is requested or can be
      accepted following class negotiation procedures. At the responding side,
      present if class 2 is chosen!,
  transportConnectionClass3-P
    PRESENT IF
      ! At the initiating side, present if class 3 is requested or can be
      accepted following class negotiation procedures. At the responding side,
      present if class 3 is chosen!,
  transportConnectionClass4-P
    PRESENT IF
      ! At the initiating side, present if class 4 is requested or can be
      accepted following class negotiation procedures. At the responding side,
      present if class 4 is chosen!,
  transportConnectionNCMS-P
    PRESENT IF !NCMS is implemented!;
REGISTERED AS {TLM.moi transportConnection (7)};

```

5.8.2 Transport Connection IVMO

```

-- There may be multiple instances of the transportConnectionIVMO
-- in a system. A transportConnectionIVMO may be used to supply initial
-- values for the attributes of automatically created
-- transportConnection MOS.
--
-- The values supplied in an IVMO may be overridden by values
-- supplied in an implementation-specific manner across the service
-- interface.
--
-- Its definition permits it to be created and deleted explicitly by
-- management operation.

```

```

transportConnectionIVMO MANAGED OBJECT CLASS
  DERIVED FROM "DMI":top;
  CHARACTERIZED BY transportConnectionIVMO-P PACKAGE
    BEHAVIOUR use-of-initialValues-B;
  ATTRIBUTES
    transportConnectionIVMOId GET,
    protocolClasses REPLACE-WITH-DEFAULT GET-REPLACE,
-- DEFAULT VALUE is implementation dependent
    maxTPDUSize REPLACE-WITH-DEFAULT GET-REPLACE;
-- DEFAULT VALUE is implementation dependent
  ;;
CONDITIONAL PACKAGES
  transportConnectionIVMOClass1-P
    PRESENT IF Transport Class 1 is implemented,
  transportConnectionIVMOClass2-P

```

```

PRESENT IF Transport Class 2 is implemented,
transportConnectionIVMOClass3-P
PRESENT IF Transport Class 3 is implemented,
transportConnectionIVMOClass4-P
PRESENT IF Transport Class 4 is implemented;
REGISTERED AS {TLM.moi transportConnectionIVMO (6)};

```

5.8.3 Elements of management Information for transportConnection MO and transportConnection IVMO

-- Conditional Packages

```

transportConnectionIVMOClass1-P PACKAGE
  BEHAVIOUR transportConnectionIVMOClass1-P-B BEHAVIOUR
    DEFINED AS When Class 1 is implemented;;
  ATTRIBUTES
    networkExpeditedData REPLACE-WITH-DEFAULT GET-REPLACE,
-- DEFAULT VALUE is implementation dependent
    receiptConfirmation REPLACE-WITH-DEFAULT GET-REPLACE,
-- DEFAULT VALUE is implementation dependent
    reassignmentTime REPLACE-WITH-DEFAULT GET-REPLACE,
-- DEFAULT VALUE is implementation dependent
    transportExpeditedService REPLACE-WITH-DEFAULT GET-REPLACE;
-- DEFAULT VALUE is implementation dependent
REGISTERED AS {TLM.poi transportConnectionIVMOClass1-P (1)};

```

```

transportConnectionIVMOClass2-P PACKAGE
  BEHAVIOUR transportConnectionIVMOClass2-P-B BEHAVIOUR
    DEFINED AS When Class 2 is implemented;;
  ATTRIBUTES
    explicitFlowControl REPLACE-WITH-DEFAULT GET-REPLACE,
-- DEFAULT VALUE is implementation dependent
    extendedFormat REPLACE-WITH-DEFAULT GET-REPLACE,
-- DEFAULT VALUE is implementation dependent
    maximumWindow REPLACE-WITH-DEFAULT GET-REPLACE,
-- DEFAULT VALUE is implementation dependent
    transportExpeditedService REPLACE-WITH-DEFAULT GET-REPLACE;
-- DEFAULT VALUE is implementation dependent
REGISTERED AS {TLM.poi transportConnectionIVMOClass2-P (2)};

```

```

transportConnectionIVMOClass3-P PACKAGE
  BEHAVIOUR transportConnectionIVMOClass3-P-B BEHAVIOUR
    DEFINED AS When Class 3 is implemented;;
  ATTRIBUTES
    extendedFormat REPLACE-WITH-DEFAULT GET-REPLACE,
-- DEFAULT VALUE is implementation dependent
    reassignmentTime REPLACE-WITH-DEFAULT GET-REPLACE,
-- DEFAULT VALUE is implementation dependent
    maximumWindow REPLACE-WITH-DEFAULT GET-REPLACE,
-- DEFAULT VALUE is implementation dependent
    transportExpeditedService REPLACE-WITH-DEFAULT GET-REPLACE;
REGISTERED AS {TLM.poi transportConnectionIVMOClass3-P (3)};

```

```

transportConnectionIVMOClass4-P PACKAGE
  BEHAVIOUR transportConnectionIVMOClass4-P-B BEHAVIOUR
    DEFINED AS When Class 4 is implemented;;
  ATTRIBUTES
    checksumNonuse REPLACE-WITH-DEFAULT GET-REPLACE,
-- DEFAULT VALUE is implementation dependent
    extendedFormat REPLACE-WITH-DEFAULT GET-REPLACE,
-- DEFAULT VALUE is implementation dependent
    inactivityTime REPLACE-WITH-DEFAULT GET-REPLACE,

```

-- DEFAULT VALUE is implementation dependent
maxTransmissions REPLACE-WITH-DEFAULT GET-REPLACE,
-- DEFAULT VALUE is implementation dependent
retransmissionTime REPLACE-WITH-DEFAULT GET-REPLACE,
-- DEFAULT VALUE is implementation dependent
windowTimer REPLACE-WITH-DEFAULT GET-REPLACE,
-- DEFAULT VALUE is implementation dependent
maximumWindow REPLACE-WITH-DEFAULT GET-REPLACE,
-- DEFAULT VALUE is implementation dependent
transportExpeditedService REPLACE-WITH-DEFAULT GET-REPLACE;
REGISTERED AS {TLM.poi transportConnectionIVMOClass4-P (4)};

transportConnectionClass1-P PACKAGE
BEHAVIOUR transportConnectionClass1-P-B BEHAVIOUR
DEFINED AS When Class 1 is implemented;;
ATTRIBUTES
networkExpeditedData GET,
reassignmentsAfterFailure GET,
reassignmentTime GET,
receiptConfirmation GET,
transportExpeditedService GET;
REGISTERED AS {TLM.poi transportConnectionClass1-P (5)};

transportConnectionClass2-P PACKAGE
BEHAVIOUR transportConnectionClass2-P-B BEHAVIOUR
DEFINED AS When Class 2 is implemented;;
ATTRIBUTES
extendedFormat GET,
explicitFlowControl GET,
transportExpeditedService GET;
REGISTERED AS {TLM.poi transportConnectionClass2-P (6)};

transportConnectionClass3-P PACKAGE
BEHAVIOUR transportConnectionClass3-P-B BEHAVIOUR
DEFINED AS When Class 3 is implemented;;
ATTRIBUTES
extendedFormat GET,
reassignmentTime GET,
reassignmentsAfterFailure GET,
transportExpeditedService GET;
REGISTERED AS {TLM.poi transportConnectionClass3-P (7)};

transportConnectionClass4-P PACKAGE
BEHAVIOUR transportConnectionClass4-P-B BEHAVIOUR
DEFINED AS When Class 4 is implemented;;
ATTRIBUTES
acknowledgeTime GET,
checksumNonuse GET,
extendedFormat GET,
inactivityTime GET,
maxTransmissions GET,
retransmissionTime GET,
transportExpeditedService GET,
windowTimer GET;
REGISTERED AS {TLM.poi transportConnectionClass4-P (8)};

transportConnectionNCMS-P PACKAGE
BEHAVIOUR transportConnectionNCMS-P-B BEHAVIOUR
DEFINED AS When NCMS is implemented;;
ATTRIBUTES
relatingNCCMONames GET;
REGISTERED AS {TLM.poi transportConnectionNCMS-P(9)};

-- Behaviours**initialValues-B BEHAVIOUR****DEFINED AS**

! When an instance of the transportConnection MO is created using the transportConnection-comodeTPM name binding, the initial values for some of the attributes of the transportConnection MO may be supplied by an instance of the transportConnectionIVMO MO. The means by which an instance (if any) of the transportConnectionIVMO are identified are a local matter.!

use-of-initialValues-B BEHAVIOUR**DEFINED AS**

! The creation of an instance of the transportConnection MO using the transportConnection-comodeTPM name binding may reference an instance of the transportConnectionIVMO MO under the conditions specified by the transportConnection MO. When this occurs, some of the initial values of the attributes of the instance of the transportConnection MO may be supplied by the values of the attributes in the specified instance of the transportConnectionIVMO. However any such value may be overridden by a value supplied by local means (for example across an internal interface). Where values are supplied by the IVMO, the initial value of an attribute of transportConnection MO shall be the value of the corresponding attribute in the transportConnectionIVMO (that is, which has the same attribute template label).!

connectionCreationDeletion-B BEHAVIOUR**DEFINED AS**

!Managed object class imports the 10165-2 objectCreation and objectDeletion notifications for transportConnection. The precise synchronisation between these notifications and related protocol and service interactions is not defined by this standard. In addition, where a connection is attempted as a result of an interaction at a single interface (i.e. either the protocol or the service), and fails before any interaction occurs at the other, it is a local matter whether a managed object is created or not, i.e. whether the creation and deletion events occur or not.

ObjectCreation - Generated whenever an instance of the managed object class is created. The sourceIndicator parameter shall be set to the value 'resourceOperation'. None of the other optional parameters are used, with the exception of the additionalInformation field which contains the following parameters:

transportConnectionName
protocolClass-PAR
maxTPDUsize-PAR
callingTselector-PAR
calledTSelector-PAR
callingNSAPAddress-PAR
calledNSAPAddress-PAR
respondingNSAPAddress-PAR
connectionDirection-PAR
networkConnectionIDs-PAR.

ObjectDeletion - Generated whenever an instance of the managed object class is deleted. The sourceIndicator parameter shall be set to the value 'resourceOperation'. None of the other optional parameters are used, with the exception of the additionalInformation field which contains the following parameters:

transportConnectionName
protocolClass-PAR
maxTPDUsize-PAR
callingTselector-PAR
calledTSelector-PAR
callingNSAPAddress-PAR
calledNSAPAddress-PAR
respondingNSAPAddress-PAR
connectionDirection-PAR
networkConnectionIDs-PAR

objectDeletionCause.!!;

-- Name Bindings

transportConnection-comodeTPM NAME BINDING
 SUBORDINATE OBJECT CLASS transportConnection AND SUBCLASSES;
 NAMED BY
 SUPERIOR OBJECT CLASS comodeTPM AND SUBCLASSES;
 WITH ATTRIBUTE "GMI":connectionId;
 REGISTERED AS {TLM.nboi transportConnection-comodeTPM (8)};

transportConnectionIVMO-comodeTPM NAME BINDING
 SUBORDINATE OBJECT CLASS transportConnectionIVMO AND SUBCLASSES;
 NAMED BY
 SUPERIOR OBJECT CLASS comodeTPM AND SUBCLASSES;
 WITH ATTRIBUTE transportConnectionIVMOId;
 CREATE WITH-REFERENCE-OBJECT;
 DELETE;
 REGISTERED AS {TLM.nboi transportConnectionIVMO-comodeTPM (7)};

-- Attributes

acknowledgeTime ATTRIBUTE
 DERIVED FROM "GMI":timer;
 BEHAVIOUR acknowledgeTime-B BEHAVIOUR
 DEFINED AS
 Value of local Acknowledge Timer (as defined in ISO 8073)
 in use for the connection. Unit is in seconds;;
 REGISTERED AS {TLM.aoi acknowledgeTime (47)};

calledNSAPAddress ATTRIBUTE
 WITH ATTRIBUTE SYNTAX TLM.OctetString;
 MATCHES FOR EQUALITY;
 BEHAVIOUR calledNSAPAddress-B BEHAVIOUR
 DEFINED AS
 The Called NSAP Address received
 at the network service interface at N-connection establishment when operating
 over the CONS, or with the N-Unitdata indication that conveyed the CR TPDU
 when operating over the CLNS;;
 REGISTERED AS {TLM.aoi calledNSAPAddress (58)};

calledTSelector ATTRIBUTE
 WITH ATTRIBUTE SYNTAX TLM.OctetString;
 MATCHES FOR EQUALITY;
 BEHAVIOUR calledTSelector-B BEHAVIOUR
 DEFINED AS
 The "Called TSAP Identifier" specified
 at connection establishment;;
 REGISTERED AS {TLM.aoi calledTSelector (56)};

callingNSAPAddress ATTRIBUTE
 WITH ATTRIBUTE SYNTAX TLM.OctetString;
 MATCHES FOR EQUALITY;
 BEHAVIOUR callingNSAPAddress-B BEHAVIOUR
 DEFINED AS
 The Calling NSAP Address specified

at the network service interface at N-connection establishment when operating over the CONS, or for each N-Unitdata.request interaction when operating over the CLNS;;

REGISTERED AS {TLM.aoi callingNSAPAddress (57)};

callingTSelector ATTRIBUTE
 WITH ATTRIBUTE SYNTAX TLM.OctetString;
 MATCHES FOR EQUALITY;
 BEHAVIOUR callingTSelector-B BEHAVIOUR
 DEFINED AS
 The "Calling TSAP Identifier" specified
 at connection establishment;;

REGISTERED AS {TLM.aoi callingTSelector (55)};

checksumNonuse ATTRIBUTE
 WITH ATTRIBUTE SYNTAX TLM.Boolean;
 MATCHES FOR EQUALITY;
 BEHAVIOUR checksumNonuse-B BEHAVIOUR
 DEFINED AS
 enables negotiation / indicates non-use of checksum.
 In transportConnectionIVMO, enables negotiation of checksum
 non-use (Class 4 only) during connection establishment. TRUE enables non-use,
 FALSE disables it.
 In transportConnection, indicates whether checksum non-use has been selected
 for the connection (TRUE) or not (FALSE). During connection establishment,
 this attribute represents the desired value and not necessarily the value
 which will ultimately be used.;;

REGISTERED AS {TLM.aoi checksumNonuse (43)};

connectionDirection ATTRIBUTE
 WITH ATTRIBUTE SYNTAX TLM.ConnectionDirectionSyntax;
 MATCHES FOR EQUALITY;
 BEHAVIOUR connectionDirection-B BEHAVIOUR
 DEFINED AS
 Indicates the direction of the connection.
 The value Incoming means that it was initiated by the remote Transport
 Entity, the value Outgoing means that it was initiated by the local Transport
 Entity.;;

REGISTERED AS {TLM.aoi connectionDirection (60)};

explicitFlowControl ATTRIBUTE
 WITH ATTRIBUTE SYNTAX TLM.Boolean;
 MATCHES FOR EQUALITY;
 BEHAVIOUR explicitFlowControl-B BEHAVIOUR
 DEFINED AS
 enables negotiation / indicates use of explicit Flow Control.
 In transportConnectionIVMO, enables negotiation of non-use of explicit flow
 control (Class 2 only) during connection Establishment. TRUE enables non-
 use, FALSE disables it. In transportConnection, indicates whether non-use of
 explicit flow control has been
 selected for the connection (TRUE) or not (FALSE). For connections not using
 Class 2 of the protocol, this attribute has the value False. During
 connection establishment, this attribute represents the desired value and not
 necessarily the value which will ultimately be used;;

REGISTERED AS {TLM.aoi explicitFlowControl (45)};

extendedFormat ATTRIBUTE
 WITH ATTRIBUTE SYNTAX TLM.Boolean;
 MATCHES FOR EQUALITY;
 BEHAVIOUR extendedFormat-B BEHAVIOUR
 DEFINED AS
 enables negotiation / indicates use of extended TPDU format.
 In transportConnectionIVMO, enables negotiation of extended TPDU format (for
 the classes where this is appropriate) during transport connection

establishment. TRUE enables use of extended format, FALSE disables it. In transportConnection, indicates whether extended TPDU format is in use (TRUE) or not (FALSE). For connections not using Class 4 of the protocol, this attribute will be False. During connection establishment, this attribute represents the desired value and not necessarily the value which will ultimately be used;;

REGISTERED AS {TLM.aoi extendedFormat (41)};

inactivityTime ATTRIBUTE

DERIVED FROM "GMI":timer;

BEHAVIOUR inactivityTime-B BEHAVIOUR

DEFINED AS

Value of inactivity time (as defined in ISO 8073)
in use for the connection. Unit is in seconds;;

REGISTERED AS {TLM.aoi inactivityTime (46)};

localReference ATTRIBUTE

WITH ATTRIBUTE SYNTAX TLM.Integer;

MATCHES FOR EQUALITY;

BEHAVIOUR localReference-B BEHAVIOUR

DEFINED AS

The local reference number (as defined in ISO 8073)
in use for the connection;;

REGISTERED AS {TLM.aoi localReference (53)};

maximumWindow ATTRIBUTE

WITH ATTRIBUTE SYNTAX TLM.Integer;

MATCHES FOR EQUALITY, ORDERING;

BEHAVIOUR maximumWindow-B BEHAVIOUR

DEFINED AS

The maximum window permitted to be given on the connection
at any time. Buffering or other implementation constraints or policies may
cause a smaller value to be used.;;

REGISTERED AS {TLM.aoi maximumWindow (36)};

maxTPDUSize ATTRIBUTE

WITH ATTRIBUTE SYNTAX TLM.Integer;

MATCHES FOR EQUALITY, ORDERING;

BEHAVIOUR maxTPDUSize-B BEHAVIOUR

DEFINED AS

The maximum TPDU size negotiated for the connection. Implementation
constraints or policies, or relating to the remote NSPA or Transport Entity,
may cause a smaller value to be used as an initial value for negotiation.
During connection establishment, this attribute represents the desired value
and not necessarily the value which will ultimately be used;;

REGISTERED AS {TLM.aoi maxTPDUSize (51)};

maxTransmissions ATTRIBUTE

WITH ATTRIBUTE SYNTAX TLM.Integer;

MATCHES FOR EQUALITY, ORDERING;

BEHAVIOUR maxTransmissions-B BEHAVIOUR

DEFINED AS

The maximum number of transmissions
as defined (for Class 4 only) as the parameter 'N' in ISO 8073;;

REGISTERED AS {TLM.aoi maxTransmissions (52)};

networkConnectionIDs ATTRIBUTE

WITH ATTRIBUTE SYNTAX TLM.LocalDistinguishedNames;

MATCHES FOR SET-COMPARISON, SET-INTERSECTION;

BEHAVIOUR networkConnectionIDs-B BEHAVIOUR

DEFINED AS

The Network Connection(s) which support the Transport Connection. If the TC
is running over the CLNS, this attribute has the value of the empty set.;;

REGISTERED AS {TLM.aoi networkConnectionIDs (61)};

networkExpeditedData ATTRIBUTE
 WITH ATTRIBUTE SYNTAX TLM.Boolean;
 MATCHES FOR EQUALITY;
 BEHAVIOUR networkExpeditedData-B BEHAVIOUR
 DEFINED AS
 enables negotiation / indicates use of Network Expedited
 in transportConnectionIVMO, enables the negotiation of use or non-use of
 Network Expedited Data (for class 1 only) during transport connection
 establishment. TRUE enables use of Network Expedited Data, FALSE disables
 it. In transportConnection, indicates whether Network Expedited Data is in
 use (TRUE) or not (FALSE). For connections not using Class 1, the value will
 always be False. During connection establishment, this attribute represents
 the desired value and not necessarily the value which will ultimately be
 used;;
 REGISTERED AS {TLM.aoi networkExpeditedData (42)};

protocolClass ATTRIBUTE
 WITH ATTRIBUTE SYNTAX TLM.ProtocolClassSyntax;
 MATCHES FOR EQUALITY;
 BEHAVIOUR protocolClass-B BEHAVIOUR
 DEFINED AS
 The protocol class in use on the connection,
 as negotiated during connection establishment.
 During connection establishment (before the connection reaches the OPEN
 state) this indicates what is currently preferred and not necessarily the
 ultimate Class which will be used for the connection;;
 REGISTERED AS {TLM.aoi protocolClass (40)};

protocolClasses ATTRIBUTE
 WITH ATTRIBUTE SYNTAX TLM.ProtocolClassesSyntax;
 MATCHES FOR SET-COMPARISON, SET-INTERSECTION;
 BEHAVIOUR protocolClasses-B BEHAVIOUR
 DEFINED AS
 The preferred/alternate set of protocol classes
 which may be stated at connection establishment. The default value is
 implementation dependent, but must be consistent with the class negotiation
 rules of ISO 8073 and Addendum 2;;
 REGISTERED AS {TLM.aoi protocolClasses (26)};

reassignmentsAfterFailure ATTRIBUTE
 DERIVED FROM "GMI":nonWrapping64BitCounter;
 BEHAVIOUR reassignmentsAfterFailure-B BEHAVIOUR
 DEFINED AS
 The total number of times the TC has been reassigned to NC;;
 REGISTERED AS {TLM.aoi reassignmentsAfterFailure (62)};

reassignmentTime ATTRIBUTE
 DERIVED FROM "GMI":timer;
 BEHAVIOUR reassignmentTime-B BEHAVIOUR
 DEFINED AS
 The value of the Reassignment Time (as defined in ISO 8073)
 to be conveyed or established during connection establishment. Unit is in
 seconds;;
 REGISTERED AS {TLM.aoi reassignmentTime (48)};

receiptConfirmation ATTRIBUTE
 WITH ATTRIBUTE SYNTAX TLM.Boolean;
 MATCHES FOR EQUALITY;
 BEHAVIOUR receiptConfirmation-B BEHAVIOUR
 DEFINED AS
 enables negotiation / indicates use of receipt confirmation. In
 transportConnectionIVMO, enables negotiation of use of network receipt
 confirmation (Class 1 only) during transport connection establishment. TRUE

enables use, FALSE enables non-use. In transportConnection, indicates whether use of network receipt confirmation has been selected for the connection (TRUE) or not (FALSE).

For connections not using Class 1 of the protocol, this attribute has the value False. During connection establishment, this attribute represents the desired value and not necessarily the value which will ultimately be used;;

REGISTERED AS {TLM.aoi receiptConfirmation (44)};

relatingNCCMONames ATTRIBUTE

WITH ATTRIBUTE SYNTAX TLM.LocalDistinguishedNames;

MATCHES FOR SET-COMPARISON, SET-INTERSECTION;

BEHAVIOUR relatingNCCMONames-B BEHAVIOUR

DEFINED AS

This attribute indicates the NCC MO(s);;

REGISTERED AS {TLM.aoi relatingNCCMONames (66)};

remoteReference ATTRIBUTE

WITH ATTRIBUTE SYNTAX TLM.Integer;

MATCHES FOR EQUALITY;

BEHAVIOUR remoteReference-B BEHAVIOUR

DEFINED AS

The remote reference number (as defined in ISO 8073)
in use for the connection;;

REGISTERED AS {TLM.aoi remoteReference (54)};

respondingNSAPAddress ATTRIBUTE

WITH ATTRIBUTE SYNTAX TLM.OctetString;

MATCHES FOR EQUALITY;

BEHAVIOUR respondingNSAPAddress-B BEHAVIOUR

DEFINED AS

The Responding NSAP Address received
at network service interface at N-connection establishment.

The value of this attribute is only meaningful when operating over the CONS,
and when the N-connection was initiated by Transport Entity. Otherwise, the
value is not meaningful and no constraints are applied to the value;;

REGISTERED AS {TLM.aoi respondingNSAPAddress (59)};

retransmissionTime ATTRIBUTE

DERIVED FROM "GMI":timer;

BEHAVIOUR resettingTimer-B, retransmissionTime-B BEHAVIOUR

DEFINED AS

Initial or Current value for the Local Retransmission Time
as defined in ISO 8073. Another value may be adopted initially based on
knowledge concerning the remote system. The current value may change during
the lifetime of the connection, based on observations of traffic on the
connection or other information concerning the remote transport entity. The
value of this attribute is used in the absence of other information. Unit is
in seconds;;

REGISTERED AS {TLM.aoi retransmissionTime (49)};

transportConnectionIVMOId ATTRIBUTE

WITH ATTRIBUTE SYNTAX TLM.NamingString;

MATCHES FOR EQUALITY, SUBSTRINGS;

BEHAVIOUR transportConnectionIVMOId-B BEHAVIOUR

DEFINED AS The name of this instance of transportConnectionIVMO;;

REGISTERED AS {TLM.aoi transportConnectionIVMOId (25)};

transportExpeditedService ATTRIBUTE

WITH ATTRIBUTE SYNTAX TLM.Boolean;

BEHAVIOUR transportExpeditedService-B BEHAVIOUR

DEFINED AS

Indicated whether the Transport Expedited Service is provided (true) or not
(False).;;

REGISTERED AS {TLM.aoi transportExpeditedService(65)};

windowTimer ATTRIBUTE
DERIVED FROM "GMI":timer;
BEHAVIOUR windowTimer-B BEHAVIOUR
DEFINED AS
Value of Window Timer as defined in ISO 8073.
The value of this attribute is meaningful only for connections using Class 4
of the protocol. For other connections no constraint is placed on the value
to be returned. Unit is in seconds;;
REGISTERED AS {TLM.aoi windowTimer (50)};

-- Parameters

calledNSAPAddress-PAR PARAMETER
CONTEXT EVENT-INFO;
ATTRIBUTE calledNSAPAddress;;

calledTSelector-PAR PARAMETER
CONTEXT EVENT-INFO;
ATTRIBUTE calledTSelector;;

callingNSAPAddress-PAR PARAMETER
CONTEXT EVENT-INFO;
ATTRIBUTE callingNSAPAddress;;

callingTSelector-PAR PARAMETER
CONTEXT EVENT-INFO;
ATTRIBUTE callingTSelector;;

connectionDirection-PAR PARAMETER
CONTEXT EVENT-INFO;
ATTRIBUTE connectionDirection;;

maxTPDUSize-PAR PARAMETER
CONTEXT EVENT-INFO;
ATTRIBUTE maxTPDUSize;;

networkConnectionIDs-PAR PARAMETER
CONTEXT EVENT-INFO;
ATTRIBUTE networkConnectionIDs;;

objectDeletionCause PARAMETER
CONTEXT EVENT-INFO;
WITH SYNTAX TLM.DeletionCauseSyntax;
BEHAVIOUR objectDeletionCauseB BEHAVIOUR
DEFINED AS

Reason why the Transport Connection Object is being deleted;;
REGISTERED AS {TLM.proi objectDeletionCause (6)};

protocolClass-PAR PARAMETER
CONTEXT EVENT-INFO;
ATTRIBUTE protocolClass;;

respondingNSAPAddress-PAR PARAMETER
CONTEXT EVENT-INFO;
ATTRIBUTE respondingNSAPAddress;;

transportConnectionName PARAMETER
CONTEXT EVENT-INFO;
ATTRIBUTE "GMI":connectionId;;

6 ASN.1 Modules

```
TLM {joint-iso-ccitt transport-layer(14) management(0) tlAsn1Module(2) 0}
DEFINITIONS IMPLICIT TAGS ::= BEGIN
EXPORTS ; -- everything
IMPORTS communicationsProtocolError
FROM Attribute-ASN1Module {joint-iso-ccitt ms(9) smi(3) part2(2) asn1Module(2) 1}
```

6.1 Object identifier definitions

6.1.1 Abbreviations

```
tloi OBJECT IDENTIFIER ::= {joint-iso-ccitt transport-layer(14) management(0)}
ssei OBJECT IDENTIFIER ::= {tloi standardSpecificExtension(0)}
moi OBJECT IDENTIFIER ::= {tloi objectclass(3)}
poi OBJECT IDENTIFIER ::= {tloi package(4)}
proi OBJECT IDENTIFIER ::= {tloi parameter(5)}
nboi OBJECT IDENTIFIER ::= {tloi namebinding(6)}
aoi OBJECT IDENTIFIER ::= {tloi attribute(7)}
agoi OBJECT IDENTIFIER ::= {tloi attributeGroup(8)}
acoi OBJECT IDENTIFIER ::= {tloi action(9)}
noi OBJECT IDENTIFIER ::= {tloi notification(10)}
```

6.1.2 Other Object Identifier Definitions

```
successfulConnectionEstablishment OBJECT IDENTIFIER ::= {ssei informationtype(4)
successfulConnectionEstablishment (1)}
incomingConnectionRejectedType OBJECT IDENTIFIER ::= {ssei informationtype(4)
incomingConnectionRejected (2)}
```

6.2 Other Definitions

Boolean ::= BOOLEAN

ConnectionDirectionSyntax ::= ENUMERATED {outgoing(0), incoming(1)}

clmodeTPMId-Value GraphicString ::= "CLTPM"

comodeTPMId-Value GraphicString ::= "COTPM"

DeletionCauseSyntax ::= ENUMERATED
{protocolError(0), networkServiceProvider(1), remoteCongestion(3),
localCongestion(4)}

NamingString ::= GraphicString

Integer ::= INTEGER

LocalDistinguishedName ::= CMIP-1.BaseManagedObjectId

LocalDistinguishedNames ::= SET OF localDistinguishedName

OctetString ::= OCTET STRING

```
ProtocolClassSyntax ::= ENUMERATED {  
  class0(0), class1(1), class2(2), class3(3), class4(4) }  
  
ProtocolClassesSyntax ::= SET OF ProtocolClassSyntax  
  
PDUHeaderSyntax ::= OCTET STRING (SIZE(1..255))  
  
ReasonCodeSyntax ::= INTEGER  
  
SourceAddressSyntax ::= OCTET STRING  
  
TransportSubsystemId-Value GraphicString ::= "TransportSubsystem"  
END
```

7 Conformance

7.1 Conformance requirements to this International Standard

An implementation for which conformance to this International Standard as a managed implementation is claimed shall

- a) support the transportSubsystem MO;
- b) for each MO supported, support at least one name binding defined in this International Standard, for which the MO is the subordinate;
- c) for each MO supported, support all elements of management information as defined in GDMO description for the MO.

7.2 Protocol specific conformance requirements

7.2.1 Conformance to the management operation of ISO 8073

An implementation claiming conformance to the management operation of ISO 8073 as a managed implementation shall:

- a) conform to ISO/IEC 10737 as defined in 7.1;
- b) support the transportEntity MO, the comodeTPM MO, the TSAP MO and the transportEntity MO.

7.2.2 Conformance to the management operation of ISO 8602

An implementation claiming conformance to the management operation of ISO 8602 as a managed implementation shall

- a) conform to ISO/IEC 10737 as defined in 7.1;
- b) support the transportEntity MO, the clmodeTPM MO and the TSAP MO.

NOTE - Behaviour clauses defined in this International Standard may not always be testable. Care should be exercised when defining behaviour tests suites in order not to impose additional constraints to those defined in this standard for implementations.

Annex A (normative)

Allocation of Object Identifiers

The following Object Identifiers have been allocated by the body of this International Standard. Object Identifiers which had been allocated when this International Standard was at the Draft International Standard stage have not been re-allocated. If any modification, other than a change to the behaviour clause, has been made to any template which had been allocated an Object Identifier, the new template has been allocated a new Object Identifier and the old Object Identifier (identified thus: *obsolete* (1)) shall not be re-used.

joint-iso-ccitt (2)
 ms (9)
 smi (3)
 part2 (2)
 asn1Module (2)
 (1)
 transport-layer (14)
 management (0)
 standardSpecificExtension (0)
 informationtype (4)
 successfulConnectionEstablishment (1)
 incomingConnectionRejected (2)
 tlAsn1Module (2)
 (0)
 objectclass (3)
 transportSubsystem (1)
 transportEntity (2)
 clmodeTPM (3)
 comodeTPM (4)
 tSAP (5)
 transportConnectionIVMO (6)
 transportConnection (7)
 package (4)
 transportConnectionIVMOCClass1-P (1)
 transportConnectionIVMOCClass2-P (2)
 transportConnectionIVMOCClass3-P (3)
 transportConnectionIVMOCClass4-P (4)
 transportConnectionClass1-P (5)
 transportConnectionClass2-P (6)
 transportConnectionClass3-P (7)
 transportConnectionClass4-P (8)
 transportConnectionNCMS-P (9)
 parameter (5)
 tEProtocolErrorPDUHeader (1)
 tEProtocolErrorSourceAddress (2)
 tEProtocolErrorReasonCode (3)
 clPMPDUHeader (4)
 clPMSourceAddress (5)
 objectDeletionCause (6)
 rejectionCause (7)
 namebinding (6)

transportSubsystem-system (1)
obsolete (2)
 clmodeTPM-transportEntity-Management (3)
 comodeTPM-transportEntity-Management (4)
 tSAP-transportEntity-Automatic (5)
 tSAP-transportEntity-Management (6)
 transportConnectionIVMO-comodeTPM (7)
 transportConnection-comodeTPM (8)
 clmodeTPM-transportEntity-Automatic (9)
 comodeTPM-transportEntity-Automatic (10)
 transportEntity-transportSubsystem-Automatic (11)
 transportEntity-transportSubsystem-Management (12)
 attribute (7)
obsolete (1)
obsolete (2)
 targetNSAP (3)
 actualNSAP (4)
 undecodedNSDUs (5)
 checksumErrorsDetected (6)
 protocolErrors (7)
obsolete (8)
 clChecksumOption (9)
 undeliverablePDUsCounter (10)
obsolete (11)
 openConnections (12)
 maxConnections (13)
 localSuccessfulConnections (14)
 remoteSuccessfulConnections (15)
 localUnsuccessfulConnections (16)
 remoteUnsuccessfulConnections (17)
 localErrorDisconnects (18)
 remoteErrorDisconnects (19)
 unassociatedTPDUs (20)
 maxOpenConnections (21)
obsolete (22)
obsolete (23)
obsolete (24)
 transportConnectionIVMOId (25)
 protocolClasses (26)
obsolete (27)
obsolete (28)
obsolete (29)
obsolete (30)
obsolete (31)
obsolete (32)
obsolete (33)
obsolete (34)
obsolete (35)
 maximumWindow (36)
obsolete (37)
obsolete (38)
obsolete (39)
 protocolClass (40)
 extendedFormat (41)
 networkExpeditedData (42)
 checksumNonuse (43)
 receiptConfirmation (44)

explicitFlowControl (45)
inactivityTime (46)
acknowledgeTime (47)
reassignmentTime (48)
retransmissionTime (49)
windowTimer (50)
maxTPDUSize (51)
maxTransmissions (52)
localReference (53)
remoteReference (54)
callingTSelector (55)
calledTSelector (56)
callingNSAPAddress (57)
calledNSAPAddress (58)
respondingNSAPAddress (59)
connectionDirection (60)
networkConnectionIDs (61)
reassignmentsAfterFailure (62)
obsolete (63)
obsolete (64)
transportExpeditedService (65)
relatingNCCMONames (66)
attributeGroup (8)
action (9)
notification (10)

END

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Annex B
(informative)

Shorthand Description of Managed Objects

The information in this annex is intended only to give a broad outline of the Transport Layer Management Specification. While the information contained herein has been derived from the normative GDMO text in the body of this International Standard, it should be treated with caution, as there may be errors.

The following abbreviations are used to describe the property lists of attributes:

G	Get
R	Replace
RWD	Replace With Default
A	Add
RM	Remove

The following abbreviations are used for external label references:

DMI:	"CCITT Rec.X721 (1992) ISO/IEC 10165-2:1992"
GMI:	"CCITT Rec.X723 ISO/IEC 10165-5"

Template types with a '*' suffix (for example ATTRIBUTE*) refer to template types defined in conditional packages. All inherited templates, except those inherited from 'top', are included in each Managed Object Class.

The inheritance hierarchy is illustrated in figure B.1.

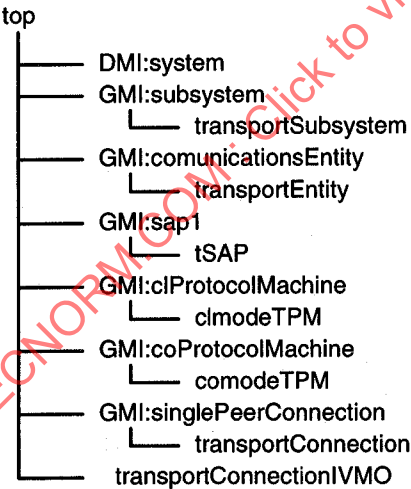


Figure B.1

MANAGED OBJECT CLASS transportConnectionIVMO DERIVED FROM (DMI:top) CONTAINED IN (comodeTPM)

checksumNonuse ATTRIBUTE* (G, R, RWD)
enables negotiation / indicates non-use of checksum.

explicitFlowControl ATTRIBUTE* (G, R, RWD)

enables negotiation / indicates use of explicit Flow Control
 extendedFormat ATTRIBUTE* (G, R, RWD)
 enables negotiation / indicates use of extended TPDU Format
 inactivityTime ATTRIBUTE* (G, R, RWD)
 Value of inactivity time (as defined in ISO 8073)
 maxTPDUSize ATTRIBUTE (G, R, RWD)
 The maximum TPDU size negotiated for the connection.
 maxTransmissions ATTRIBUTE* (G, R, RWD)
 The maximum number of transmissions
 maximumWindow ATTRIBUTE* (G, R, RWD)
 The maximum window permitted to be given on the connection
 networkExpeditedData ATTRIBUTE* (G, R, RWD)
 enables negotiation / indicates use of Network Expedited
 protocolClasses ATTRIBUTE (G, R, RWD)
 The preferred/alternate set of protocol classes
 reassignmentTime ATTRIBUTE* (G, R, RWD)
 The value of the Reassignment Time
 receiptConfirmation ATTRIBUTE* (G, R, RWD)
 enables negotiation / indicates use of Receipt Confirmation
 retransmissionTime ATTRIBUTE* (G, R, RWD)
 Initial or Current value for the Local Retransmission Time
 transportConnectionIVMOld ATTRIBUTE (G)
 The name of this instance of the Transport Connection IVMO
 transportExpeditedService ATTRIBUTE* (G, R, RWD)
 Indicates whether the Transport Expedited Service is provided
 windowTimer ATTRIBUTE* (G, R, RWD)
 Value of Window Timer as defined in ISO 8073.
 END MANAGED OBJECT CLASS transportConnectionIVMO

MANAGED OBJECT CLASS transportConnection DERIVED FROM (GMI:singlePeerConnection) CONTAINED IN (comodeTPM)

DMI:objectCreation NOTIFICATION
 DMI:objectDeletion NOTIFICATION
 DMI:octetsReceivedCounter ATTRIBUTE (G)
 DMI:octetsSentCounter ATTRIBUTE (G)
 DMI:pdusReceivedCounter ATTRIBUTE (G)
 DMI:pdusRetransmittedErrorCounter ATTRIBUTE (G)
 DMI:pdusSentCounter ATTRIBUTE (G)
 GMI:communicationsInformation NOTIFICATION
 GMI:connectionId ATTRIBUTE (G)
 GMI:supportedConnectionNames ATTRIBUTE* (G)
 This attribute contains the distinguished names of managed objects that represent connections
 GMI:underlyingConnectionNames ATTRIBUTE (G)
 acknowledgeTime ATTRIBUTE* (G)
 Value of local Acknowledge Timer
 calledNSAPAddress ATTRIBUTE (G)
 The Called NSAP Address received
 calledTSelector ATTRIBUTE (G)
 The "Called TSAP Identifier" specified
 callingNSAPAddress ATTRIBUTE (G)
 The Calling NSAP Address specified
 callingTSelector ATTRIBUTE (G)
 The "Calling TSAP Identifier" specified
 checksumNonuse ATTRIBUTE* (G)
 enables negotiation / indicates non-use of checksum.
 connectionDirection ATTRIBUTE (G)