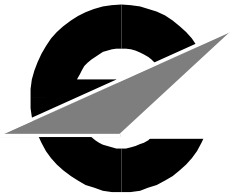

EUROCONTROL

ATN PROJECT

Proposed MO Template for ICAO SARPs

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Author : Tony Kerr

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TABLE OF CONTENTS

1. Introduction

The objective of this paper is to define a standard template for specifying Managed Objects (MOs) in the ATN SARPs.

Where managed objects (MOs) are defined in ISO/IEC standards | ITU Recommendations, they are specified using the templates defined in ISO/IEC 10165-4 Guidelines for the Definition of Managed Objects (GDMO) - see Annex E. This results in compact specifications, but they are difficult to use for expressing conformance requirements, and can be difficult to use for reference purposes as they can use multiple inheritance and they import features from other standards. ATNP/WG1/SG3 determined the need for a tabular description to enable MO conformance requirements to be specified clearly.

The MO template specified in this paper is based on ProATN specifications and incorporates ISO/IEC standard MOs as well as ATN-specific extensions. The requirement is to describe the various aspects of MOs (the existence of the MOs themselves, their attributes, permitted operations, actions and notifications) in terms of which are mandatory, recommended and optional for implementation in the ATN.

A number of candidate templates already exist (e.g. see Annexes A to D), and the attempt has been made to extract the best features from each, while retaining only the minimum essential information.

2. MO Template

The proposed MO template for use in ATN SARPs comprises four separate tables for each MO (though it is possible that one or more table could be "empty" for a given MO; for example, if there are no Notifications or Actions associated with that MO).

The tables are:

1. **MO Class support** - this defines the ATN conformance requirements for the MO Class (mandatory, recommended or optional) and the operations which may apply to the whole MO (create, delete). A further level of refinement is that some MOs apply only to certain types of ATN system (e.g. ES, BIS, BBIS, airborne system), and this is can also be specified in this "top level" table.

2. **Attributes** - this defines the attributes supported by the MO class, and for each attribute type specifies the conformance requirements for each type of operation that may be performed on that attribute.

3. **Notifications** - this defines the notifications that may be emitted by instances of this MO class, and defines the level of support required for ATN implementations.

4. **Actions** - this specifies any Actions that may be performed on instances of this MO class.

The contents of these MO tables are illustrated below.

MO Class Support

Index	Property	Description	ISO Status	ATN Status
mo1	Managed Object Class	<name> <Description>		
mo2	CREATE Operation			

mo3	DELETE Operation			
mo4	Naming attribute			
mo5	Superior in Naming Tree			

Attributes

Index	**Attribute Name** **(Description)** **Syntax**	**Operations**	**ISO Status**	**ATN Status**
at1	<attribute 1> <Description of attribute> <Syntax of attribute, default underlined>	GET REPLACE etc.	< > < >	< > < >
at2	<attribute 2> <Description of attribute> <Syntax of attribute, default underlined>	GET REPLACE etc.	< > < >	< > < >
...	...	...		
atn	<attribute n> <Description of attribute> <Syntax of attribute, default underlined>	GET REPLACE etc.	< > < >	< > < >

Actions

Index	**Action Name** **(Description)**	**ISO Status**	**ATN Status**
ac1	<action 1> <Description of action>	< >	< >
ac2	<action 2> <Description of action>	< >	< >
...	...		
acn	<action n> <Description of action>	< >	< >

Notifications

Index	**Notification Name** **(Description)**	**ISO Status**	**ATN Status**
n1	<notification 1> <Description of notification >	< >	< >
n2	< notification 2> <Description of notification >	< >	< >
...	...		

nn	< notification n> <Description of notification >	< >	< >

In each table, the "ISO Status" column indicates the conformance requirement as specified in the ISO/IEC base standard that defines the MO. A hierarchy exists, so that the conformance requirements of a dependent feature only apply if the "parent" feature is supported (e.g. if an MO class is not supported, then none of the attributes will be supported, even if classified as "M"). Possible values for ISO Status are:

M - Mandatory to implement

O - Optional to implement

C - Dependent upon some Condition explained in a footnote to the table

A - Feature is ATN-specific, i.e. not present in base standard.

The "ATN Status" column indicates the conformance requirement as specified in the ATN SARPs. Notes may be used to expand on the support requirement, e.g. to differentiate between different types of ATN system. Possible values for ATN Status are:

M - Mandatory to implement (equivalent to a "shall" statement)

R - Recommended to implement (equivalent to a "should" statement)

O - Optional to implement (i.e. an implementation is free to implement the feature or not)

X - Prohibited to implement.

3. Example - CO TPM MO

As an example of the use of the proposed templates, the connection mode transport protocol machine MO, which is defined in ISO/IEC10737, is specified here. Note that this is only an example in the use of the notation - it does not specify an agreed position for ATN support of this MO. For illustration of ATN-specific parameters, the additional attributes defined in the ProATN MO specification are included.

3.1 Connection-Oriented Transport Protocol Machine MO

3.1.1 MO Class Support

Index	Property	Description	ISO Status	ATN Status
mo1	Managed Object Class	comodeTPM 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.	O	M

mo2	CREATE Operation	The MO can be created explicitly by management operation.	O	M
mo3	DELETE Operation	The MO can be deleted explicitly by management operation, only if there are no contained objects.	O	M
mo4	Naming attribute	coProcotolMachineId Only the name binding corresponding to the creation and deletion of the MO class by management operation is used.	M	M
mo5	Superior in Naming Tree	transportEntity	M	M

3.1.2 Attributes

Index	**Attribute Name** **(Description)** **Syntax**	**Operations**	**ISO Status**	**ATN Status**
at1	administrativeState ENUMERATED (LOCKED, UNLOCKED, SHUTDOWN)	GET REPLACE	M M	M M
at2	allomorphs SET OF ObjectClass	GET	C	X
at3	coProtocolMachineId Naming attribute GraphicString	GET	M	M
at4	localErrorDisconnects Counter of transport disconnects initiated by the local Transport Entity upon issuing a DR TPDU with an error code other than 'Normal disconnect initiated by Service User', or upon issuing an ER TPDU INTEGER	GET	M	M
at5	localSuccessfulConnections Counter of transport connections initiated by the local entity which have reached the open state INTEGER	GET	M	M
at6	localUnsuccessfulConnections Counter of transport connections initiated by the local entity which have failed to reach the open state INTEGER	GET	M	M
at7	maxConnections The maximun number of simultaneously open connections allowed by the transport entity INTEGER	GET REPLACE SET DEFAULT	M M M	M M M
at8	maxOpenConnections The highest number of simultaneously open transport connections which has occured since the last REPLACE-WITH-DEFAULT operation INTEGER	GET SET DEFAULT	M M	M M

at9	nameBinding OBJECT IDENTIFIER	GET	M	M
at10	objectClass ObjectClass	GET	M	M
at11	octetsReceivedCounter Total number of user data octets received by the COTP4 protocol machine INTEGER	GET	M	M
at12	octetsSentCounter Total number of user data octets sent by the COTP4 protocol machine INTEGER	GET	M	M
at13	openConnections Indicates the number of transport connections which are in the Open state INTEGER	GET	M	M
at14	operationalState Operational state of the COTP protocol machine ENUMERATED (ENABLED, DISABLED)	GET	M	M
at15	packages SET OF OBJECT IDENTIFIER		C	X
at16	remoteErrorDisconnects Counter of transport disconnects initiated by a peer (remote) Transport Entity upon issuing a DR TPDU with an error code other than 'Normal disconnect initiated by Service User', or upon issuing an ER TPDU INTEGER	GET	M	M
at17	remoteSuccessfulConnections Counter of transport connections initiated by the remote entity which have reached the open state INTEGER	GET	M	M
at18	remoteUnsuccessfulConnections Counter of transport connections initiated by the remote entity which have failed to reach the open state INTEGER	GET	M	M
at19	unassociatedTPDUs Counter of TPDUs received which could not be associated with a Transport Connection. This counter is incremented only for such TPDUs received over the CONS INTEGER	GET	M	M
at20	inactime Default maximum time before a transmitted TPDU is received by the peer transport entity.	GET	A	O
at21	init_retrans Initial or current default value for the Local Retransmission Timer as defined in ISO 8073.	GET	A	O
at22	max_retrans Maximum number of times transport will retransmit a TPDU without receiving an acknowledgement.	GET	A	O
at23	window_time Default value of the window timer (W), in milliseconds, as defined in ISO 8073	GET	A	O

at24	localAckTime Default value of the Local Acknoledgment Time (A_L) as defined in ISO 8073	GET	A	O
at25	initialCredit Default value of the credit (CRT) as defined in ISO 8073	GET	A	O
at26	roaProposed Default value of the proposed use of request of acknoledgment procedure as defined in ISO 8073	GET	A	O
at27	roaAccepted Default action if the use of the request of acknowledgment procedure is proposed	GET	A	O
at28	tCRcongestionCounter Number of times a connection request has been refused because of congestion. This counter has a threshold.	REPLACE	A	O
at29	tCRconfigCounter Number of connection local rejections because of a configuration error. This counter has a threshold.	REPLACE	A	O
at30	tDRconfigCounter Number of connection distant rejections because of a configuration error. This counter has a threshold.	REPLACE	A	O
at31	tCRprotocolCounter Number of connection local rejections because of a protocol error. This counter has a threshold.	REPLACE	A	O
at32	tCRfailCounter Number of connection local rejections because of an unsuccessful connect request. This counter has a threshold.	REPLACE	A	O
at33	tPDUrefusedCounter Number of TPDUs (but connection requests) distant rejections. This counter has a threshold.	REPLACE	A	O
at34	timeoutCounter Number of times transport has timed out when trying to transmit a TPDU. This counter has a threshold.	REPLACE	A	O
at35	tpduretxmitCounter Number of times transport retransmits a TPDU.	GET	A	O
at36	tcreditCounter Number of times transport sets the credit field of a data acknowledge TPDU to zero.	REPLACE	A	O

3.1.3 Actions

Index	**Action Name** **(Description)**	**ISO Status**	**ATN Status**
ac1	activate Cause entity to enter operation mode, if successful the Operational State of the TE will eventually become Enabled.	M	M
ac2	deactivate Cause entity to enter operation mode, if successful the Operational State of the TE will eventually become Disabled.	M	M

3.1.4 Notifications

Index	Notification Name (Description)	ISO Status	ATN Status
n1	communicationsInformation Used to report special events related to the normal operation of communication resources. Here it is used to report the following event: • **incomingConnectionRejected**: Generated when an incoming connection is rejected. The rejection cause, calling and called NSAP addresses and T-Selectors are reported as parameters in the informationData field.	M	M
n2	objectCreation Used to report the instance creation. Contains initial attribute values.	M	M
n3	objectDeletion Used to report the instance deletion. Contains the last known attribute values.	M	M
n4	stateChange Used to report the operationalState value changes	M	M
n5	processingErrorAlarm Used to report the reaching of a threshold.	A	O

4. Annex A - ProATN MO Property Tables

To illustrate the MO specification technique used in the ProATN project, the template definition and proATNComodeTPM MO specification are extracted from the document ProATN Function Specification - Manager / Agents Interface Control Document (ICD) - Annex A: MIB Definition (Version 2.1).

4.1 Template

Property	Type	Description	S	O	V	E	b	B	A
	ATT	Naming attribute	✓						
objectCreation	NOT	Used to report the instance creation. Contains initial attribute values.	✓						
objectDeletion	NOT	Used to report the instance deletion. Contains the last known attribute values.							

4.1.1 Notation for the Type column

ATT means Attribute,

NOT means Notification,

ACT means Action,

4.1.2 Notation for the "S" (State) column

Status	Meaning
✓	Standard feature, to be implemented
✖	Standard feature, not to be implemented
●	ATN-specific feature, to be implemented

Notes:

1. *It is proposed that allomorphism be not supported. The allomorphs attribute has not been included in the property tables.*

2. *Properties that are specific to the proATN have been put in **italics**.*

3. *When according to standards an attribute can take one of several values, an UNDERLINED value indicates that this is the default value for proATN.*

4. *When a generic notification is used to convey information about several events, a striked through ~~event~~ represent an event that is not supported in ProATN's implementation.*

4.1.3 Notation for the **O**peration **column**

g means : **get** operation allowed

s means : **set** and **replace** operations allowed

d means : **reset to default** operation allowed

r means : **remove** operation allowed

a means : **add** operation allowed

4.1.4 Notation for the VEbBA columns

X in the V column means : Exists in the Vertel Layer LME

X in the E column means : Applies for the End Systems.

X in the b column means : Applies for the BIS.

X in the B column means : Applies for the BBIS.

X in the A column means : Applies for the airborne systems.

4.2 Example: proATNComodeTPM

Property	Type	Description	S	O	V	E	b	B	A
coProtocolMachineId	ATT	Naming attribute		**g**		**x**	**x**	**x**	**x**
inactime	*ATT*	*Default maximum time before a transmitted TPDU is received by the peer transport entity.*		**g**	**x**	**x**	**x**	**x**	**x**
init_retrans	*ATT*	*Initial or current default value for the Local Retransmission Timer as defined in ISO 8073.*		**g**	**x**	**x**	**x**	**x**	**x**
max_retrans	*ATT*	*Maximum number of times transport will retransmit a TPDU without receiving an acknowledgement.*		**g**	**x**	**x**	**x**	**x**	**x**
window_time	*ATT*	*Default value of the window timer (W), in milliseconds, as defined in ISO 8073*		**g**	**x**	**x**	**x**	**x**	**x**
localAckTime	*ATT*	*Default value of the Local Acknoledgment Time (A_L) as defined in ISO 8073*		**g**	**x**	**x**	**x**	**x**	**x**
initialCredit	*ATT*	*Default value of the credit (CRT) as defined in ISO 8073*		**g**	**x**	**x**	**x**	**x**	**x**
roaProposed	*ATT*	*Default value of the proposed use of request of acknoledgment procedure as defined in ISO 8073*		**g**	**x**	**x**	**x**	**x**	**x**
roaAccepted	*ATT*	*Default action if the use of the request of acknowledgment procedure is proposed*		**g**	**x**	**x**	**x**	**x**	**x**

Property	Type	Description	S	O	V	E	b	B	A
localErrorDisconnects	ATT	Counter of transport disconnects initiated by the local Transport Entity upon issuing a DR TPDU with an error code other than 'Normal disconnect initiated by Service User', or upon issuing an ER TPDU		g		x	x	x	x
localSuccessfulConnections	ATT	Counter of transport connections initiated by the local entity which have reached the open state		g		x	x	x	x
localUnSuccessfulConnections	ATT	Counter of transport connections initiated by the local entity which have failed to reach the open state		g		x	x	x	x
maxConnections	ATT	The maximun number of simultaneously open connections allowed by the transport entity		g		x	x	x	x
maxOpenConnections	ATT	The highest number of simultaneously open transport connections which has occured since the last REPLACE-WITH-DEFAULT operation.		g		x	x	x	x
octetsReceivedCounter	ATT	Total number of user data octets received by the COTP4 protocol machine		g		x	x	x	x
octetsSentCounter	ATT	Total number of user data octets sent by the COTP4 protocol machine		g		x	x	x	x
openConnections	ATT	Indicates the number of transport connections which are in the Open state		g	x	x	x	x	x
operationalState	ATT	Operational state of the COTP protocol machine (ENABLED, DISABLED)		g		x	x	x	x
remoteErrorDisconnects	ATT	Counter of transport disconnects initiated by a peer (remote) Transport Entity upon issuing a DR TPDU with an error code other than 'Normal disconnect initiated by Service User', or upon issuing an ER TPDU		g		x	x	x	x

Property	**Type**	**Description**	**S**	**O**	**V**	**E**	**b**	**B**	**A**
remoteSuccessfulConnections	ATT	Counter of transport connections initiated by the remote entity which have reached the open state		**g**		**x**	**x**	**x**	**x**
remoteUnSuccessfulConnections	ATT	Counter of transport connections initiated by the remote entity which have failed to reach the open state		**g**		**x**	**x**	**x**	**x**
unassociatedTPDUs	ATT	Counter of TPDUs received which could not be associated with a Transport Connection. This counter is incremented only for such TPDUs received over the CONS.		**g**		**x**	**x**	**x**	**x**
tCRcongestionCounter	*ATT*	*Number of times a connection request has been refused because of congestion. This counter has a threshold.*		**s**	**x**	**x**	**x**	**x**	**x**
tCRconfigCounter	*ATT*	*Number of connection local rejections because of a configuration error. This counter has a threshold.*		**s**	**x**	**x**	**x**	**x**	**x**
tDRconfigCounter	*ATT*	*Number of connection distant rejections because of a configuration error. This counter has a threshold.*		**s**	**x**	**x**	**x**	**x**	**x**
tCRprotocolCounter	*ATT*	*Number of connection local rejections because of a protocol error. This counter has a threshold.*		**s**	**x**	**x**	**x**	**x**	**x**
tCRfailCounter	*ATT*	*Number of connection local rejections because of an unsuccessful connect request. This counter has a threshold.*		**s**	**x**	**x**	**x**	**x**	**x**
tPDUrefusedCounter	*ATT*	*Number of TPDUs (but connection requests) distant rejections. This counter has a threshold.*		**s**	**x**	**x**	**x**	**x**	**x**
timeoutCounter	*ATT*	*Number of times transport has timed out when trying to transmit a TPDU. This counter has a threshold.*		**s**	**x**	**x**	**x**	**x**	**x**
tpduretxmitCounter	*ATT*	*Number of times transport retransmits a TPDU.*		**g**	**x**	**x**	**x**	**x**	**x**

Property	**Type**	**Description**	**S**	**O**	**V**	**E**	**b**	**B**	**A**
tcreditCounter	*ATT*	*Number of times transport sets the credit field of a data acknowledge TPDU to zero.*		**g**	**x**	**x**	**x**	**x**	**x**
processingErrorAlarm	NOT	Used to report the reaching of a threshold.				**x**	**x**	**x**	**x**
communicationsInformation	NOT	Used to report special events related to the normal operation of communication resources. Here it is used to report the following event: • **incomingConnectionRejected**: Generated when an incoming connection is rejected. The rejection cause, calling and called NSAP addresses and T-Selectors shall be reported as parameters in the informationData field.				**x**	**x**	**x**	**x**
objectCreation	NOT	Used to report the instance creation. Contains initial attribute values.				**x**	**x**	**x**	**x**
objectDeletion	NOT	Used to report the instance deletion. Contains the last known attribute values.				**x**	**x**	**x**	**x**
stateChange	NOT	Used to report the operationalState value changes				**x**	**x**	**x**	**x**

5. Annex B - ATN Manual MORTs Templates

5.1 Description

MORTs templates were used to specify Network and Transport MOs in the ATN Manual (Second Edition). For each MO class, four tables were defined:

- Operations on Object Class
- Object Class Attributes
- Object Class Notifications
- Object Class Name Type

5.2 Example: CO TPM MO

To illustrate the MORTs definitions, the CO-TPM-MO Object Class, as defined in the ATN Manual Second Edition, is shown. In the MORTs tables:

"Type" can take one of the values:

S - String

R/W - Read / Write

R - Read only

C - Counter

G - Gauge

T - Threshold

"Status" can take one of the values:

M - Mandatory

O - Optional

M-Cx - Mandatory subject to specified condition

R - Recommended.

Index	Operations on Object Class	Ref.	Status
TE.9.1	CREATE	iso/iec 10165-2	M
TE.9.2	DELETE	iso/iec 10165-2	M

TE.9.3	ACTION - Activate. Cause entity to enter operation mode, if successful the Operational State of the TE will eventually become Enabled.	iso/iec 10165-5, 10164-2	M
TE.9.4	ACTION - De-activate. Cause entity to enter operation mode, if successful the Operational State of the TE will eventually become Disabled.	iso/iec 10165-5, 10164-2	M

Template TE-9 Operations on CO-TPM-MO Object Class

Index	**Object Class Attributes**	**Ref.**	**Type**	**Operation**	**Status**
TE.10.1	CO TPM Identity	iso/iec 10165-5	S	GET	M
TE.10.2	Operational state (enable, disabled)	iso/iec 10165-5	R	GET	M
TE.10.3	Administrative state (locked, unlocked, shutting down)		R	GET	M
TE.10.4	The number of octets sent		C	GET	R
TE.10.5	The number of user data octets received		C	GET	R
TE.10.6	The number of TCs currently in an open state		G	GET	R
TE.10.7	The max. number of simultaneously open TCs allowed (more con. requests will be refused)		R/W	DEFAULT, REPLACE, GET	M
TE.10.8	No. of locally initiated TCs that reached open state		C	GET	R
TE.10.9	No. of remotely initiated TCs that reached open state		C	GET	R
TE.10.10	No. of locally initiated TCs that did not reach open state		C	GET	R
TE.10.11	No. of remotely initiated TCs that did not reach open state		C	GET	R
TE.10.12	No. of locally initiated T_Disconnects due to error		C	GET	R
TE.10.13	No. of remotely initiated T_Disconnects due to error		C	GET	R
TE.10.14	No. of TPDUs that could not be associated with a TC		C	GET	R
TE.10.15	Highest no. of TCs to simultaneously be in an open state		T	DEFAULT, REPLACE, GET	R

Template TE-10 CO-TPM-MO Object Class Attributes

Index	Object Class Notifications	Ref.	Status
TE.11.1	Object creation	iso/iec 10165-2, 10164-1 Object Creation	M
TE.11.2	Object deletion	iso/iec 10165-2, 10164-1 Object Deletion	M
TE.11.3	Change administrative or operational state.	iso/iec 10165-2, 10164-2 State Change	M
TE.11.4	Report rejected connection	iso/iec 10165-5, Communications Information	M

Template TE-11 CO-TPM-MO Object Class Notifications

Index	Object Class Name Type	Superior	Ref.	Status
TE.12.1	coProtocolMachineId_Management OR coProtocolMachineId_Automatic	Transport Entity	iso/iec 10165-5	M

Template TE-12 CO-TPM-MO Object Class Name Bindings

6. Annex C - ATNSI MO Tables

6.1 Description

The document "ATN Managed Objects" was presented in Langen as WG2/WP389 and WG3/WP10-5. This paper presents an analysis of the MOs to be specified by ATNSI for their development of production reference router and end system (through upper layers) software.

A top level table shows all the MO classes, their source (ISO 10733, ISO 10737, or ATNSI-specific), and, by means of indentation, their containment hierarchy.

The containment hierarchy (naming tree) is also illustrated graphically for each part of the tree.

For each sub-tree, a table gives the subordinate MO classes and, for those specific to ATNSI, a list of the attributes.

6.2 Example: Transport MO

MO/*Attribute*	**Description**
Transport Entity MO	Defined in ISO 10733 (Container Object)
Transport Subsystem MO	Defined in ISO 10733 (Container Object)
Connection Oriented TP MO	Defined in ISO 10733
Connection-less TP MO	Defined in ISO 10733

7. Annex D - ISO MO Profile Requirements Lists

7.1 Description

The ISO lower layer MOs have been profiled in the following ISPs:

ISO/IEC PDISP 15123-1: 1996 Information technology - International Standardized Profile - OSI Management - Common Management Information for Lower Layer Profiles - Part 1: Transport Layer Management Information

ISO/IEC PDISP 15123-2: 1996 Information technology - International Standardized Profile - OSI Management - Common Management Information for Lower Layer Profiles - Part 2: Network Layer Management Information

ISO/IEC PDISP 15123-3: 1996 Information technology - International Standardized Profile - OSI Management - Common Management Information for Lower Layer Profiles - Part 3: IS-IS Intra-domain Routeing Protocol Management Information

ISO/IEC PDISP 15123-4: 1996 Information technology - International Standardized Profile - OSI Management - Common Management Information for Lower Layer Profiles - Part 4: Inter-domain routeing protocol Management Information

ISO/IEC PDISP 15123-5: 1996 Information technology - International Standardized Profile - OSI Management - Common Management Information for Lower Layer Profiles - Part 5: Data Link Layer Management Information

For each MO class, these ISPs specify a number of ICS requirements list tables:

- Packages
- Attributes
- Attribute Groups
- Notifications
- Actions
- Parameters

7.2 Example: CO TPM MO

Note: The following example is taken from ISO/IEC DISP 15123-1, Table A.1.4.2. That table also has a final column headed "additional information", which is empty, and is omitted here for clarity.

				Set by Create		Get		Replace		Add		Remove		Set to Default	
Index	Attribute template label	Value of object identifier for attribute	Constraints and values	Base Std.	Common profile	Base Std.	Common profile	Base Std.	Common profile	Base Std.	Common profile	Base Std.	Common profile	Base Std.	Common profile
1	"Rec X.721 | ISO/IEC 10165-2 1992" administrativeState	{2 9 3 2 7 31}	ENUMERATED	c33	c33	m	m	m	m	-	-	-	-	c34	i
2	"Rec X.721 | ISO/IEC 10165-2 1992" allomorphs	{2 9 3 2 7 50}	SET OF ObjectClass	c35	i	c36	i	-	i	-	i	-	i	-	i
3	"Rec X.723 | ISO/IEC 10165-5 1994" coProtocolMachineId	{2 9 3 5 7 3}	GraphicString	c37	c33	m	m	x	x	-	-	-	-	x	x
4	localErrorDisconnects	{2 14 0 7 18}	INTEGER	c38	c38	m	m	c34	i	-	-	-	-	c34	i
5	localSuccessfulConnections	{2 14 0 7 14}	INTEGER	c38	c38	m	m	c34	i	-	-	-	-	c34	i
6	localUnsuccessfulConnections	{2 14 0 7 16}	INTEGER	c38	c38	m	m	c34	i	-	-	-	-	c34	i
7	maxConnections	{2 14 0 7 13}	INTEGER	c33	c33	m	m	m	m	-	-	-	-	m	m
8	maxOpenConnections	{2 14 0 7 21}	INTEGER	c33	c33	m	m	c34	i	-	-	-	-	m	m
9	"Rec X.721 | ISO/IEC 10165-2 1992" nameBinding	{2 9 3 2 7 63}	OBJECT IDENTIFIER	c37	c33	m	m	x	x	-	-	-	-	x	x

10	"Rec X.721 | ISO/IEC 10165-2 1992" objectClass	{2 9 3 2 7 65}	ObjectClass	c33	c33	m	m	x	x	-	-	-	-	x	x
11	"Rec X.721 | ISO/IEC 10165-2 1992" octetsReceivedCounter	{2 9 3 2 7 78}	INTEGER	c38	c38	m	m	c34	i	-	-	-	-	c34	i
12	"Rec X.721 | ISO/IEC 10165-2 1992" octetsSentCounter	{2 9 3 2 7 80}	INTEGER	c38	c38	m	m	c34	i	-	-	-	-	c34	i
13	openConnections	{2 14 0 7 12}	INTEGER	c38	c38	m	m	c34	i	-	-	-	-	c34	i
14	"Rec X.721 | ISO/IEC 10165-2 1992" operationalState	{2 9 3 2 7 35}	ENUMERATED	x	x	m	m	x	x	-	-	-	-	x	x
15	"Rec X.721 | ISO/IEC 10165-2 1992" packages	{2 9 3 2 7 66}	SET OF OBJECT IDENTIFIER	c39	i	c40	i	c41	i	c41	i	c41	i	c41	i
16	remoteErrorDisconnects	{2 14 0 7 19}	INTEGER	c38	c38	m	m	c34	i	-	-	-	-	c34	i
17	remoteSuccessfulConnections	{2 14 0 7 15}	INTEGER	c38	c38	m	m	c34	i	-	-	-	-	c34	i
18	remoteUnsuccessfulConnections	{2 14 0 7 17}	INTEGER	c38	c38	m	m	c34	i	-	-	-	-	c34	i
19	unassociatedTPDUs	{2 14 0 7 20}	INTEGER	c38	c38	m	m	c34	i	-	-	-	-	c34	i

c33: if G.1/10a [ISO/IEC 10737] then m else x
c34: if F.20/1b [ISO/IEC 10737] then x else -
c35: if F.22/1a [ISO/IEC 10737] then (if G.1/10a [ISO/IEC 10737] then o else x) else -
c36: if F.22/1a [ISO/IEC 10737] then m else -
c37: if G.1/10a [ISO/IEC 10737] then o else x
c38: if F.20/1b or G.1/9a or G.1/11a [ISO/IEC 10737] then x else -
c39: if F.22/3a [ISO/IEC 10737] then (if G.1/10a [ISO/IEC 10737] then o else x) else -
c40: if F.22/3a [ISO/IEC 10737] then m else -
c41: if F.22/3a [ISO/IEC 10737] then x else -

8. Annex E - GDMO Templates

8.1 Description

This annex summarises the template format defined in ISO/IEC 10165-4 Guidelines for the Definition of Managed Objects (GDMO).

```
<class-label>  MANAGED OBJECT CLASS
    DERIVED FROM       <class-label> ;
    CHARACTERISED BY    <package-label> ;
    CONDITIONAL PACKAGES
        <package-label>  PRESENT IF !xxxx! ;
REGISTERED AS <object-identifier> ;


<package-label>     PACKAGE
    BEHAVIOUR      <behaviour-definition-label> ;
    ATTRIBUTES
        <attribute-label>
        REPLACE-WITH-DEFAULT
        DEFAULT VALUE       <value-reference>
            DERIVATION RULE     <behaviour-defn-label>
        INITIAL VALUE       <value-reference>
            DERIVATION RULE     <behaviour-defn-label>
        PERMITTED VALUES    <type-reference>
        REQUIRED VALUES     <type-reference>
            GET | REPLACE | GET-REPLACE
            ADD | REMOVE  | ADD-REMOVE
                <parameter-label> ;
    ATTRIBUTE GROUPS
        <group-label>
        <attribute-label> ;
    ACTIONS
        <action-label>
        <parameter-label> ;
    NOTIFICATIONS
        <notification-label>
        <parameter-label> ;
REGISTERED AS <object-identifier> ;


!!! SIMPLIFIED !!!!!
<package-label>     PACKAGE
```

```
    BEHAVIOUR
     <behaviour-definition-label>     BEHAVIOUR
       DEFINED AS     !xxx!
     ;
    ;
    ATTRIBUTES
       <attribute-label>   GET | REPLACE | GET-REPLACE ;
REGISTERED AS <object-identifier> ;

<parameter-label>   PARAMETER
    CONTEXT       <context-keyword> | ACTION-INFO | ACTION-
                  REPLY |              EVENT-INFO | EVENT-
                                       REPLY | SPECIFIC-
                                       ERROR ;
    WITH SYNTAX    <type-reference> | ATTRIBUTE  <attribute-label> ;
    BEHAVIOUR <behaviour-definition-label> ;
REGISTERED AS <object-identifier> ;

<name-binding-label>     NAME BINDING
    SUBORDINATE OBJECT CLASS  <class-label> AND SUBCLASSES ;
    NAMED BY SUPERIOR OBJECT CLASS <class-label> AND
SUBCLASSES ;
    WITH ATTRIBUTE <attribute-label> ;
    BEHAVIOUR      <behaviour-definition-label> ;
    CREATE        WITH-REFERENCE-OBJECT | WITH-AUTOMATIC-INSTANCE-
                  NAMING
             <parameter-label> ;
    DELETE    ONLY-IF-NO-CONTAINED-OBJECTS | DELETES-CONTAINED-
             OBJECTS
             <parameter-label> ;
REGISTERED AS <object-identifier> ;

<attribute-label>   ATTRIBUTE
    DERIVED FROM  <attribute-label> |
             WITH ATTRIBUTE SYNTAX  <type-reference> ;
    MATCHES FOR    EQUALITY | ORDERING | SUBSTRINGS |
                  SET-COMPARISON | SET-INTERSECTION
    BEHAVIOUR <behaviour-definition-label> ;
    PARAMETERS     <parameter-label> ;
REGISTERED AS <object-identifier> ;
```

```
<group-label>  ATTRIBUTE GROUP
    GROUP ELEMENTS <attribute-label> ;
    FIXED ;
    DESCRIPTION    !xxx! ;
REGISTERED AS <object-identifier> ;

<behaviour-definition-label>  BEHAVIOUR
    DEFINED AS     !xxx! ;

<action-label> ACTION
    BEHAVIOUR <behaviour-definition-label> ;
    MODE CONFIRMED ;
    PARAMETERS                  <parameter-label> ;
    WITH INFORMATION SYNTAX  <type-reference> ;
    WITH REPLY SYNTAX           <type-reference> ;
REGISTERED AS <object-identifier> ;

<notification-label>     NOTIFICATION
    BEHAVIOUR <behaviour-definition-label> ;
    PARAMETERS     <parameter-label> ;
    WITH INFORMATION SYNTAX  <type-reference>
        AND ATTRIBUTE IDS   <field-name>   <attribute-label> ;
    WITH REPLY SYNTAX   <type-reference> ;
REGISTERED AS <object-identifier> ;
```

RFC 1155 Object Types

```
<label>   OBJECT-TYPE
    SYNTAX    INTEGER | OCTET STRING | OBJECT IDENTIFIER | NULL |
              NetworkAddress | Counter | Gauge | TimeTicks | Opaque
    ACCESS    read-only | read-write | write-only | not-accessible
    STATUS    mandatory | optional | obsolete
    DESCRIPTION
              "xxxxxxx"
    ::= { <object-identifier> }
```