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INTERNATIONAL TELECOMMUNICATION UNION

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TELECOMMUNICATION STANDARDIZATION SECTOR

STUDY PERIOD 2001-2004

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Title:	Consent of Q.2630.3, Q.2631.1, and Q.2632.1

LIAISON STATEMENT

To:	3GPP TSG SA, RAN, and CN via ETSI
Approval:	**Study Group 11 (12th September 2003)**
For:	**Information**
Deadline:	**none**

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ITU-T Study Group 11 would like to inform 3GPP TSG RAN and CN about the consent of the following ITU-T Recommendations:

- Q.2630.3 (AAL type 2 Signalling Protocol Capability Set 3) TD-PLEN-0026
- Q.2631.1 (IP Connection Control Signalling Protocol Capability Set 1) TD-PLEN-0019
- Q.2632.1 (Interworking between AAL type 2 Signalling Protocol Capability Set 2 and IP Connection Control Protocol Capability Set 1) TD-PLEN-0018

INTERNATIONAL TELECOMMUNICATION UNION

TELECOMMUNICATION STANDARDIZATION SECTOR

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TEMPORARY DOCUMENT

Source: Editor (B. Pfeil, Siemens AG)

Title: Draft New ITU-T Recommendation Q.2632.1

This temporary document contains Draft New ITU-T Recommendation Q.2632.1 "Interworking between AAL type 2 Signalling Protocol Capability Set 2 and IP Connection Control Protocol Capability Set 1" for Consent.

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INTERNATIONAL TELECOMMUNICATION UNION

ITU-T Q.2632.1

(09/03)

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

SERIES Q: SWITCHING AND SIGNALLING

Broadband ISDN – Common aspects of B-ISDN application protocols for access signalling and network signalling and interworking

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Interworking between AAL type 2 Signalling Protocol Capability Set 2 and IP Connection Control Signalling Protocol Capability Set 1

ITU-T Recommendation Q.2632.1

(Previously CCITT Recommendation)

ITU-T RECOMMENDATION Q.2632.1

INTERWORKING BETWEEN AAL TYPE 2 SIGNALLING PROTOCOL CAPABILITY SET 2 AND IP CONNECTION CONTROL SIGNALLING PROTOCOL CAPABILITY SET 1

Summary

This Recommendation describes the interworking between the AAL type 2 Signalling Protocol and the IP Connection Control Signalling Protocol. This Recommendation describes the mapping tables and diagrams which support interworking between the two protocols for call set-up, modification and clear down.

Source

ITU-T Recommendation Q.2632.1 was revised by ITU-T Study Group 11 (2001-2004) and was approved under the WTSC Resolution No. 1 procedure on xxxxxxxxxxxxxx.

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Recommendation Q.2632.1

INTERWORKING BETWEEN AAL TYPE 2 SIGNALLING PROTOCOL CAPABILITY SET 2 AND IP CONNECTION CONTROL SIGNALLING PROTOCOL CAPABILITY SET 1

1 Scope

This ITU-T Recommendation defines the interworking relationship between the AAL type 2 Signalling Protocol Capability Set 2 and the IP Connection Control Signalling Protocol. For the purpose of this interworking, AAL type 2 Signalling is defined in ITU-T Recommendation Q.2630.2[1] and subject to restrictions stated in TRQ.2800[3]. For the purpose of this interworking, IP Connection Control signalling is defined in ITU-T Recommendation Q.2631.1[2].

The interworking between the above two signalling protocols typically may occur in 3GPP UTRANs with AAL type 2 and IP network portions connected via an Interworking Unit.

The objective of this ITU-T Recommendation is to specify the interworking between the AAL type 2 protocol and the IP Connection Control Signalling protocol.

Interworking is shown as message arrow diagrams. The diagrams included represent a sample of typical situations. Mapping tables are provided to define the relationship between AAL type 2 protocol messages and parameters, on the one hand, and IP Connection Control Signalling protocol messages and parameters on the other hand.

Tables are provided for each AAL type 2 message that maps onto an IP Connection Control message. These tables also specify the mapping of parameters, which are carried by the concerned messages.

Parameters that are of local significance only, i.e. are not mapped onto parameters in the other signalling system, are not shown.

The arrow diagrams used in this Recommendation show the message movement for interworking the bearer control protocols of AAL type 2 signalling and IP Connection Control signalling. The working inside of the exchanges will not be shown, but rather the external stimulus to the exchange only (see Figures 1 and 2).

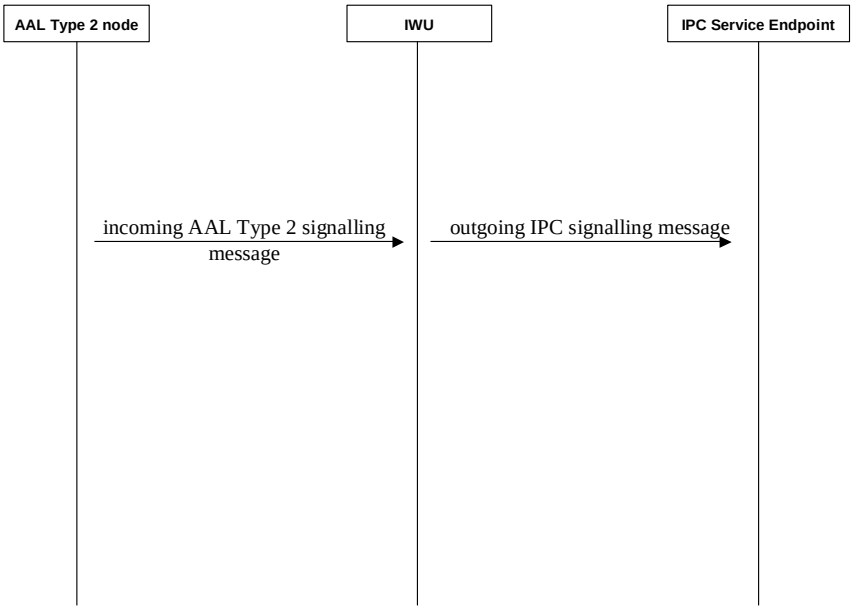

Figure 1/Q.2632.1 – AAL type 2 to IPC signalling interworking

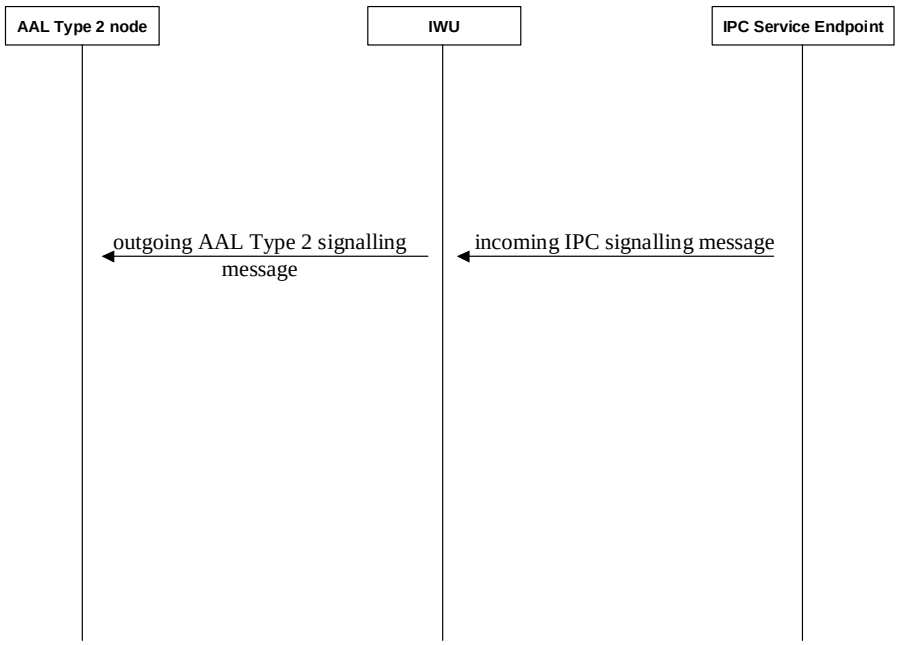

Figure 2/Q.2632.1 – IPC to AAL type 2 signalling interworking

2 References

2.1 Normative References

The following ITU-T Recommendations and other references contain provisions, which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; all users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[1] ITU-T Recommendation Q.2630.2 (2001) - AAL type 2 Signalling Protocol Capability Set 2

[2] ITU-T Recommendation Q.2631.1 (2003) - IP Connection Control Signalling Protocol Capability Set 1

2.2 Bibliography

[3] ITU-T Technical Report TRQ.2800 - Transport Control Signalling Requirements – Signalling Requirements for AAL type 2 to IP Interworking Capability Set 1

3 Abbreviations

This Recommendation uses the following abbreviations:

3GPP	3rd Generation Partnership Project
A2EA	AAL type 2 Service Endpoint Address
A2IP	AAL type 2 - IP
AAL	ATM Adaptation Layer
AAL2	AAL type 2
ATM	Asynchronous Transfer Mode
BLC	Block Confirm Message
BLO	Block Request Message
CAU	Cause Parameter
CEID	AAL type 2 Connection Element Identifier
CFN	ConFusioN Message
CPS	(AAL type 2) Common Part Sublayer
DEAE	Destination Endpoint E.164 Address
DEAX	Destination Endpoint X.213 Address
ECF	Establish Confirm Message
ERQ	Establish Request Message
ESEA	Destination E.164 Service Endpoint Address Parameter
HBx	Header bit rate associated with x
IP	Internet Protocol
IPC	IP Connection Control
IPHL	Total length of the header of an IP packet
IPQOS	IP Quality of Service parameter
IPTT	IP Transport Type parameter
IWU	Interworking Unit
LC	(AAL type 2) Link Characteristics Parameter
MAX	Maximum function
MIN	Minimum function
MOA	Modification Acknowledge message
MOD	Modification Request message
MOR	Modification Reject message
MSLC	Modify Support for Link Characteristics Parameter
MSSSI	Modify Support for SSCS Information Parameter
MSTC	Modify Support for IP Transfer Capability Parameter
NSEA	Destination NSAP Service Endpoint Address Parameter
PLC	Preferred Link Characteristics Parameter
PSSCS	Preferred SSCS Information Parameter
PSSIAE	Preferred Service Specific Information (Audio Extended) Parameter
PSSIME	Preferred Service Specific Information (Multirate Extended) Parameter
PT	Path type Parameter
PTC	Preferred IP Transfer Capability
PTC-DBW	Dedicated Bandwidth Preferred IP Transfer Capability
PTC-SBW	Statistical Bandwidth Preferred IP Transfer Capability
REL	Release Request Message

RES	Reset Request Message
RLC	Release Confirm Message
RSC	Reset Confirm Message
SAR	Segmentation and Reassembly (Sublayer)
SDU	Service Data Unit
SSCS	Service Specific Convergence Sublayer
SSIA	Service Specific Information (Audio) Parameter
SSIAE	Service Specific Information (Audio Extended) Parameter
SSIM	Service Specific Information (Multirate) Parameter
SSIME	Service Specific Information (Multirate Extended) Parameter
SSISA	Service Specific Information (SAR-assured) Parameter
SSISU	Service Specific Information (SAR-unassured) Parameter
SSSAR	Segmentation and Reassembly Service Specific Convergence Sublayer
SUCI	Served User Correlation ID Parameter
SUGR	Served User Generated Reference Parameter
SUT	Served User Transport Parameter
TC	IP Transfer Capability
TC-DBW	Dedicated Bandwidth IP Transfer Capability
TC-SBW	Statistical Bandwidth IP Transfer Capability
TCI	Test Connection Indication Parameter
UBC	Unblock Confirm Message
UBL	Unblock Request Message
UTRAN	UMTS Terrestrial Radio Access Network

4 General statements on interworking

- No ATM or AAL type 2 specific parameters defined for AAL type 2 signalling will be carried in the IP Connection Control signalling.
- No IP specific parameters defined for IP Connection Control signalling will be carried in the AAL type 2 signalling.
- All AAL type 2 and all IP Connection Control messages carry message compatibility information.
- All AAL type 2 and all IP Connection Control parameters carry parameter compatibility information.
- Through-connection in the IWU will occur immediately after either the AAL type 2 or the IP Connection Control signalling sends the Establish Request Message (ERQ).
- According to TRQ.2800[3] interworking is specified for AAL type 2 signalling with SSCS support restricted to SSSAR unassured. Therefore reception of any of the parameters listed in Table 1 at the IWU shall lead to the behaviour as specified there.
  Furthermore none of these parameters shall be generated at the IWU in AAL type 2 signalling messages.

Table 1/Q.2632.1 – List of not supported AAL type 2 parameters

AAL type 2 parameter	Action on Reception	
	AAL type 2 side	IP side
MSSSI in ERQ and ECF messages	Discard parameter, do not send notification	As specified in clauses 5.1.1 and 5.2
PSSIAE in ERQ message	Discard parameter, do not send notification	As specified in clause 5.1.1
PSSIME in ERQ message	Discard parameter, do not send notification	As specified in clause 5.1.1

SSIAE in ERQ message	Release connection, do not send notification	-
SSIA in ERQ message	Release connection, do not send notification	-
SSIME in ERQ message	Release connection, do not send notification	-
SSIM in ERQ message	Release connection, do not send notification	-
SSISA in ERQ message	Release connection, do not send notification	-
SUCI in MOD and MOA messages	Discard parameter, do not send notification	As specified in clauses 8.1.1 and 8.2

NOTE – These parameters are not shown in the mapping tables.

5 Successful connection set-up

5.1 Mapping of the Establish Request Message

5.1.1 Connection Establishment initiated from the AAL type 2 Network

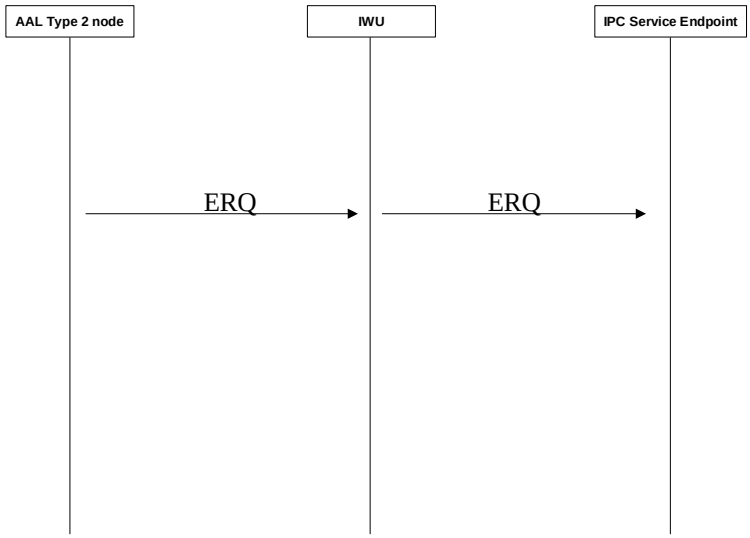

Figure 3/Q.2632.1 – ERQ from AAL type 2 network

Table 2/Q.2632.1 – Mapping of ERQ parameters (ERQ initiated from AAL2)

Incoming AAL type 2 ERQ	Outgoing IPC ERQ
ESEA (Note 1)	DEAE (Note 2)
NSEA (Note 1)	DEAX (Note 2)
LC	TC (Note 3)
PLC	PTC (Note 3)
MSLC	MSTC
SSISU	(Note 3)
SUGR	SUGR
SUT	SUT
TCI	Not carried
PT	Not carried (Note 4)
	IPQOS (Note 4)
	IPTT (Note 5)

NOTE 1 – Only one of these parameters is present.

NOTE 2 – Only one of these parameters is present. Values may be taken unchanged or with format conversion (E.164 to NSAP, NSAP to E.164) or derived by address translation with and without format change from the received ESEA or NSEA parameter.

NOTE 3 – TC and PTC are of the form of a Dedicated Bandwidth or Statistical Bandwidth IP Transfer Capability. Appendix I gives guideline for the derivation of these parameters.

NOTE 4 – The PT value may be taken into account to derive the value of this parameter.

NOTE 5 – The value of this parameter may de determined from administrative settings and/or routing decisions.

5.1.2 Connection Establishment initiated from the IP Network

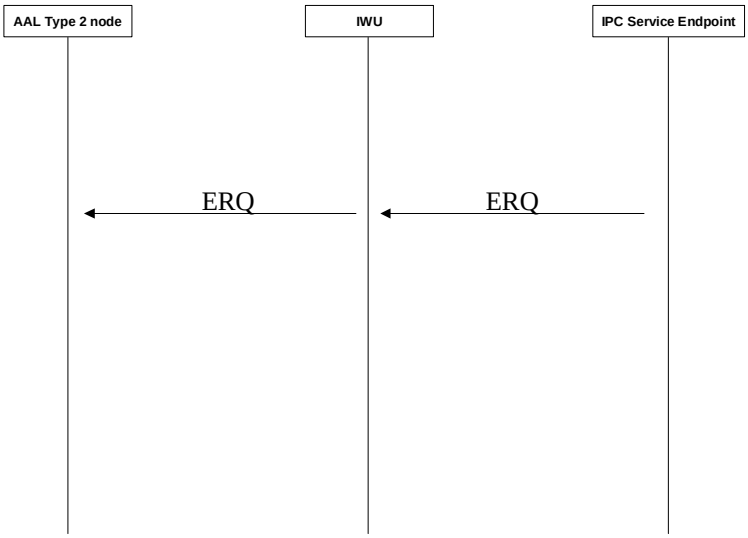

Figure 4/Q.2632.1 – ERQ from IP network

Table 3/Q.2632.1 – Mapping of ERQ parameters (ERQ initiated from IP)

Outgoing AAL type 2 ERQ	Incoming IPC ERQ
ESEA (Note 2)	DEAE (Note 1)
NSEA (Note 2)	DEAX (Note 1)
LC (Note 3)	TC (Note 4)
PLC (Note 3)	PTC (Note 4)
MSLC	MSTC
SSISU (Note 3)	Not carried
SUGR	SUGR
SUT	SUT
TCI (Note 6)	
PT (Note 5)	
Not carried	IPQOS
Not carried	IPTT

NOTE 1 – Only one of these parameters is present.

NOTE 2 – Only one of these parameters is present. Values may be taken unchanged or with format conversion (E.164 to NSAP, NSAP to E.164) or derived by address translation with and without format change from the received DEAE or DEAX parameter.

NOTE 3 – Appendix I gives guideline for the derivation of these parameters.

NOTE 4 – TC and PTC are of the form of a Dedicated Bandwidth or Statistical Bandwidth IP Transfer Capability.

NOTE 5 – The IPQOS value may be taken into account to derive the value of this parameter.

NOTE 6 – TCI shall not be generated by the IWU. Only listed for completeness.

5.2 Mapping of the Establish Confirm Message

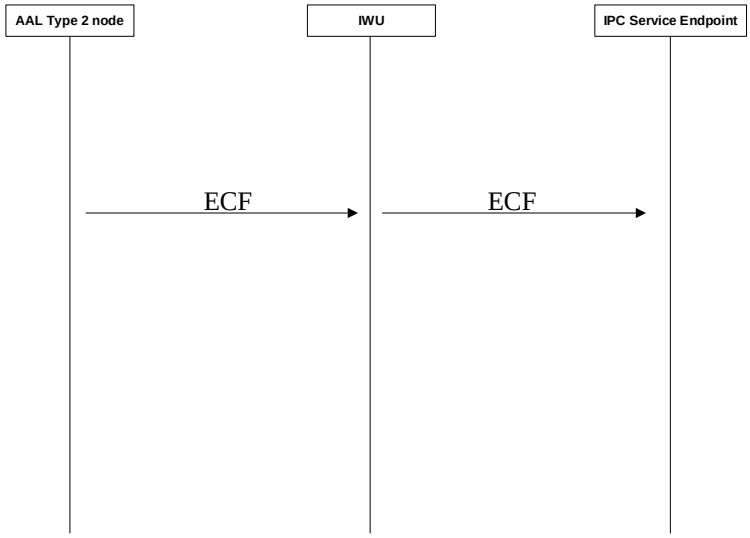

Figure 5/Q.2632.1 – ECF from AAL type 2 network

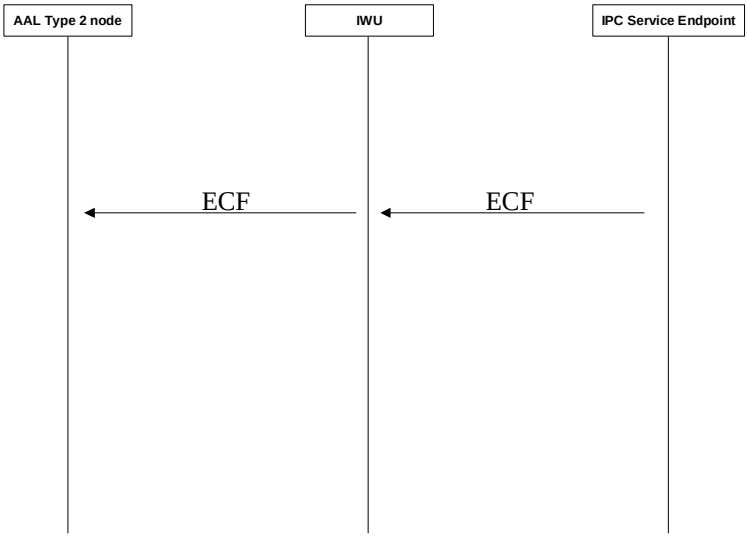

Figure 6/Q.2632.1 – ECF from IP network

Table 4/Q.2632.1 – Mapping of ECF parameters

Incoming/Outgoing AAL type 2 ECF	Outgoing/Incoming IPC ECF
MSLC	MSTC

6 Unsuccessful Connection set-up

6.1 Mapping of the RLC message

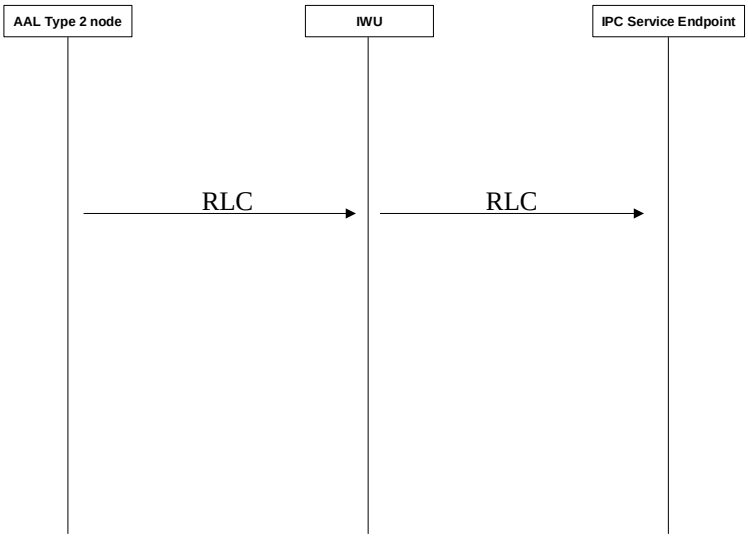

Figure 7/Q.2632.1 – RLC from AAL type 2 network

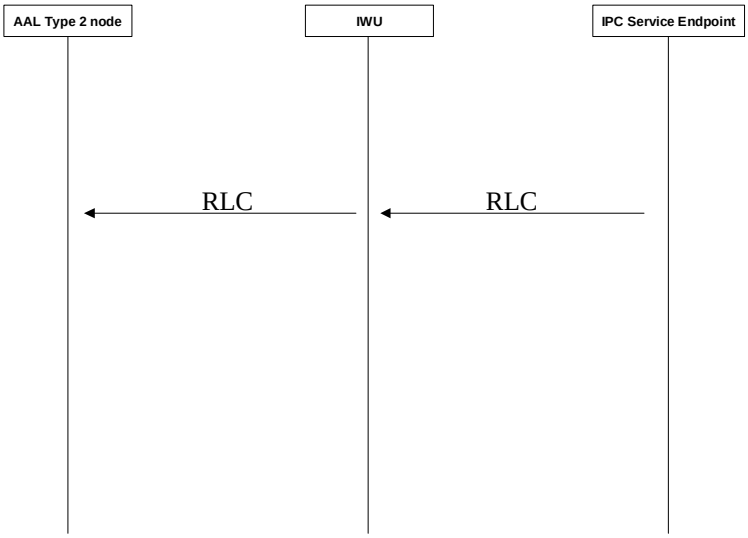

Figure 8/Q.2632.1 – RLC from IP network

Table 5/Q.2632.1 – Mapping of RLC parameters

Incoming/Outgoing AAL type 2 RLC	Outgoing/Incoming IPC RLC
CAU (Note 1, Note 2)	CAU (Note 1, Note 2)
NOTE 1 – Cause values received at the IWU that are unique to the network portion where they are generated, i.e. unknown in the other network portion, shall be mapped to "Normal, unspecified". NOTE 2 – If Cause parameters are received containing compatibility information the cause value shall be mapped to "Normal unspecified" and the diagnostics shall be discarded.	

7 Connection release

In AAL type 2 signalling the Connection Establishment procedures show an end-to-end behaviour, whereas the Connection Release procedures are of a link-by-link characteristic. The A2IP Interworking Unit simulates these principles; i.e. the A2IP IWU behaves from the point of view of the AAL type 2 network portion like an AAL type 2 switch.

Guided by this principle a Connection Release procedure will be handled by the A2IP IWU in the following manner:

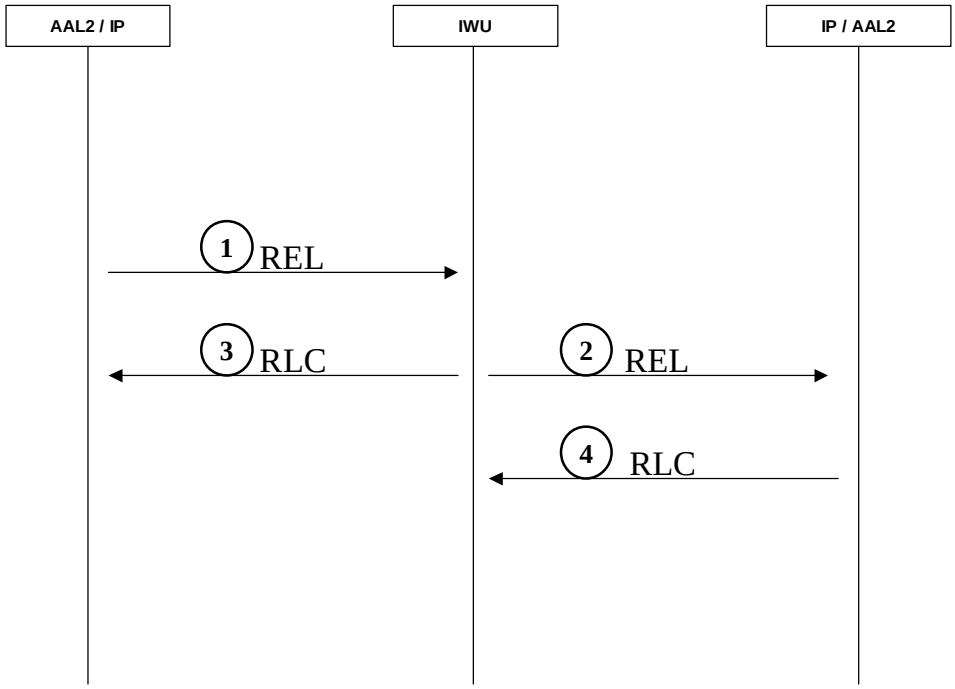

Figure 9/Q.2632.1 – General Release handling

The REL message (1) causes the REL message (2) and the RLC message (3) to be sent. There is no time or logical correlation between (2) and (3) or between (3) and (4).

7.1 Mapping of the REL message

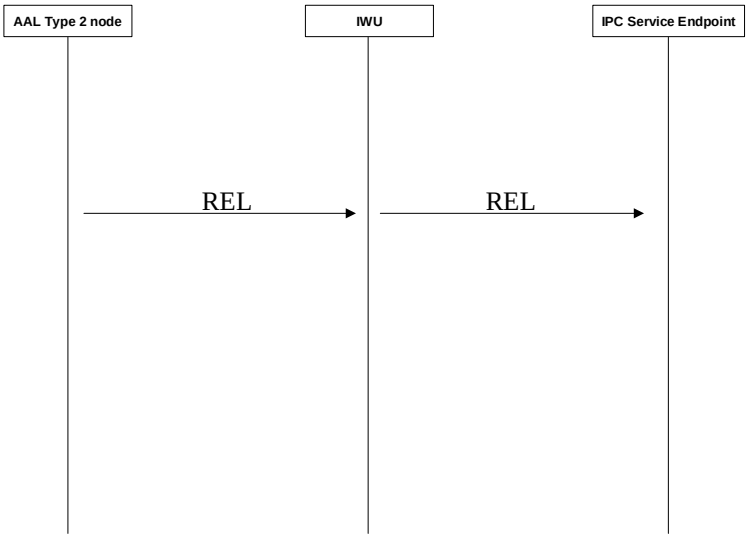

Figure 10/Q.2632.1 – REL from AAL type 2 network

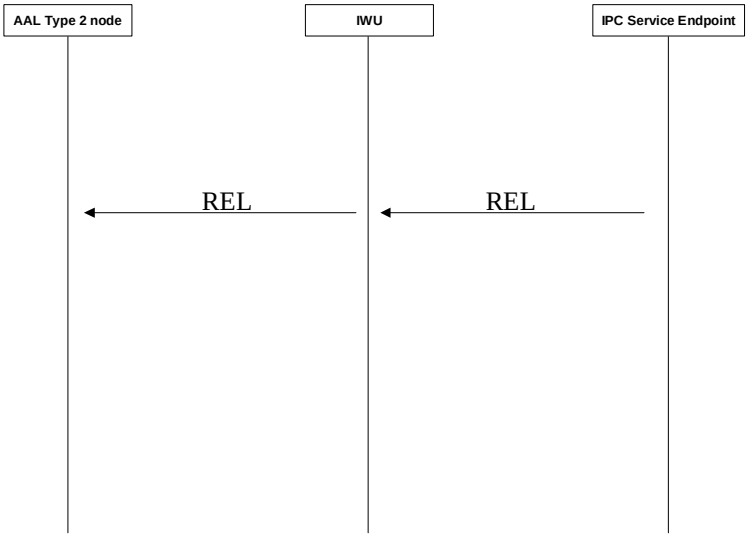

Figure 11/Q.2632.1 – REL from IP network

Table 6/Q.2632.1 – Mapping of REL parameters

Incoming/Outgoing AAL type 2 REL	Outgoing/Incoming IPC REL

CAU (Note 1, Note 2)	CAU (Note 1, Note 2)
NOTE 1 – Cause values received at the IWU that are unique to the network portion where they are generated, i.e. unknown in the other network portion, shall be mapped to "Normal, unspecified". NOTE 2 – If Cause parameters are received containing compatibility information the cause value shall be mapped to "Normal unspecified" and the diagnostics shall be discarded.	

7.2 Mapping of the RLC message

There is no interworking of RLC messages at connection release.

A RLC message that is received in response to a REL message which has been initiated in the IWU due to a reset procedure in the other network portion (see Section 10) shall not be interworked.

NOTE – Interworking of RLC messages takes place if and only if the RLC message is received as negative acknowledgement to an ERQ message in case of unsuccessful connection set-up (see Section 6.1)

8 Successful Modification

8.1 Mapping of the MOD message

8.1.1 Modification initiated from the AAL type 2 network

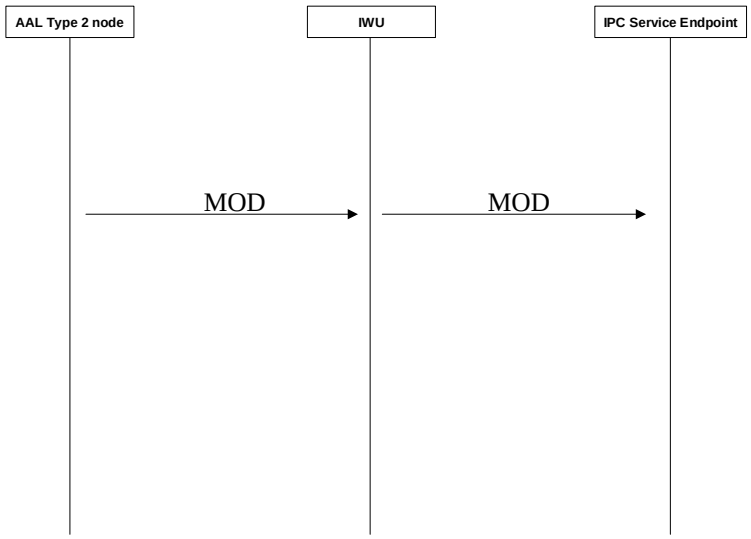

Figure 12/Q.2632.1 – MOD from AAL type 2 network

Table 7/Q.2632.1 – Mapping of MOD parameters (MOD initiated from AAL2)

Incoming AAL type 2 MOD	Outgoing IPC MOD
LC	TC (Note 1)

Incoming AAL type 2 MOD	Outgoing IPC MOD
NOTE 1 – TC is of the form of a Dedicated Bandwidth or Statistical Bandwidth IP Transfer Capability. Appendix I gives guideline for the derivation of this parameters.	

8.1.2 Modification initiated from the IP network

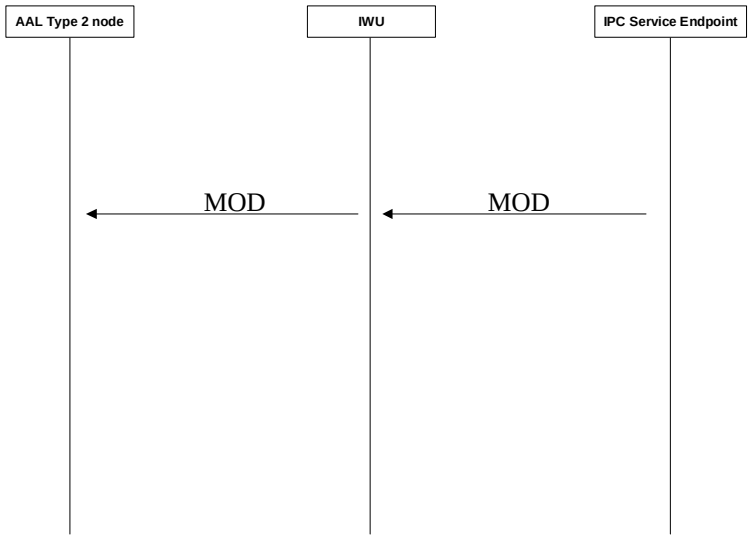

Figure 13/Q.2632.1 – MOD from IP network

Table 8/Q.2632.1 – Mapping of MOD parameters (MOD initiated from IP)

Outgoing AAL type 2 MOD	Incoming IPC MOD
LC (Note 1)	TC (Note 2)
NOTE 1 – Appendix I gives guideline for the derivation of this parameter. NOTE 2 – TC is of the form of a Dedicated Bandwidth or Statistical Bandwidth IP Transfer Capability.	

8.2 Mapping of the MOA message

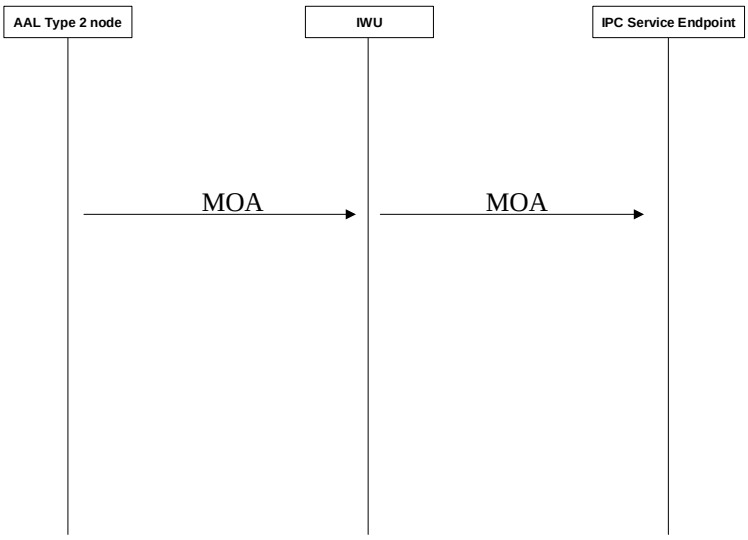

Figure 14/Q.2632.1 – MOA from AAL type 2 network

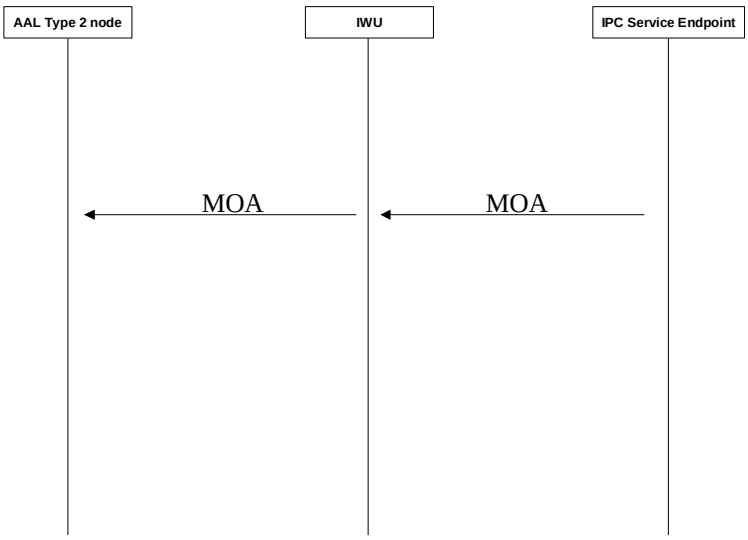

Figure 15/Q.2632.1 – MOA from IP network

Table 9/Q.2632.1 – Mapping of MOA parameters

Incoming/Outgoing AAL type 2 MOA	Outgoing/Incoming IPC MOA

- (Note 1)	- (Note 1)
NOTE 1 – MOA messages carry no parameters requiring interworking.	

9 Unsuccessful Modification

9.1 Mapping of the MOR message

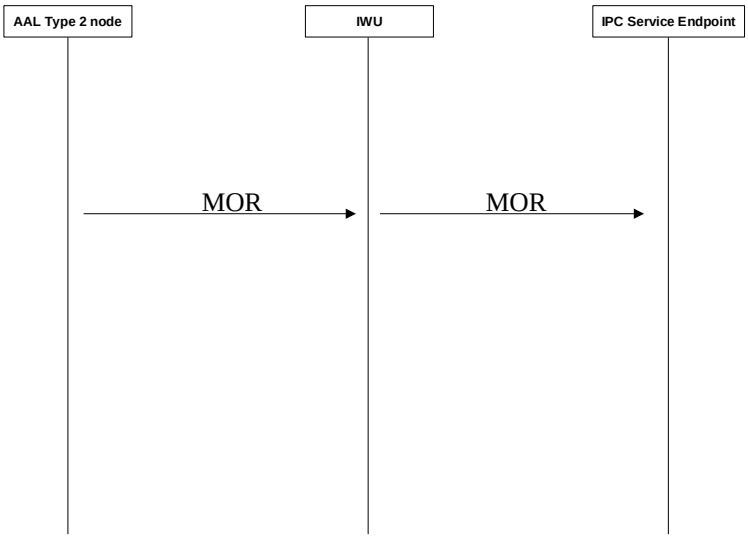

Figure 16/Q.2632.1 – MOR from AAL type 2 network

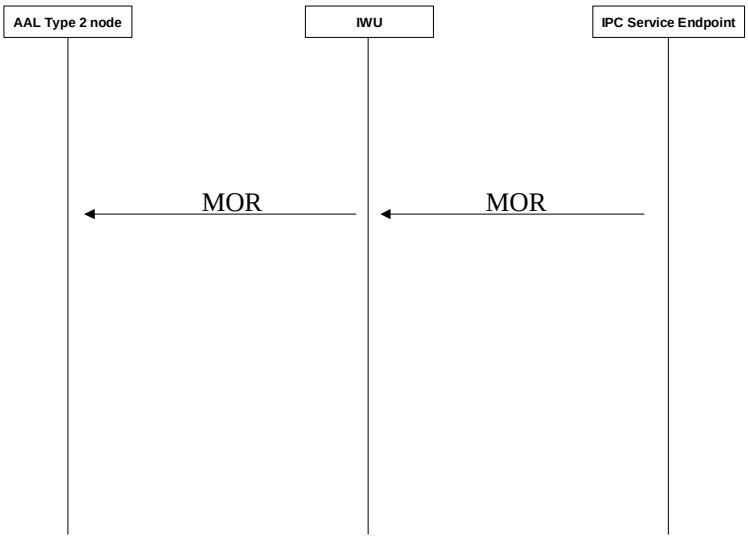

Figure 17/Q.2632.1 – MOR from IP network

Table 10/Q.2632.1 – Mapping of MOR parameters

Incoming/Outgoing AAL type 2 MOR	Outgoing/Incoming IPC MOR
CAU (Note 1, Note 2)	CAU (Note 1, Note 2)
NOTE 1 – Cause values received at the IWU that are unique to the network portion where they are generated, i.e. unknown in the other network portion, shall be mapped to "Normal, unspecified". NOTE 2 – If Cause parameters are received containing compatibility information the cause value shall be mapped to "Normal unspecified" and the diagnostics shall be discarded.	

10 Reset

10.1 Reset initiated in AAL type 2 / IP network

In AAL type 2 signalling the Reset procedures are confined to two adjacent nodes.

Guided by this principle a Reset procedure will be handled by the A2IP IWU in the following manner:

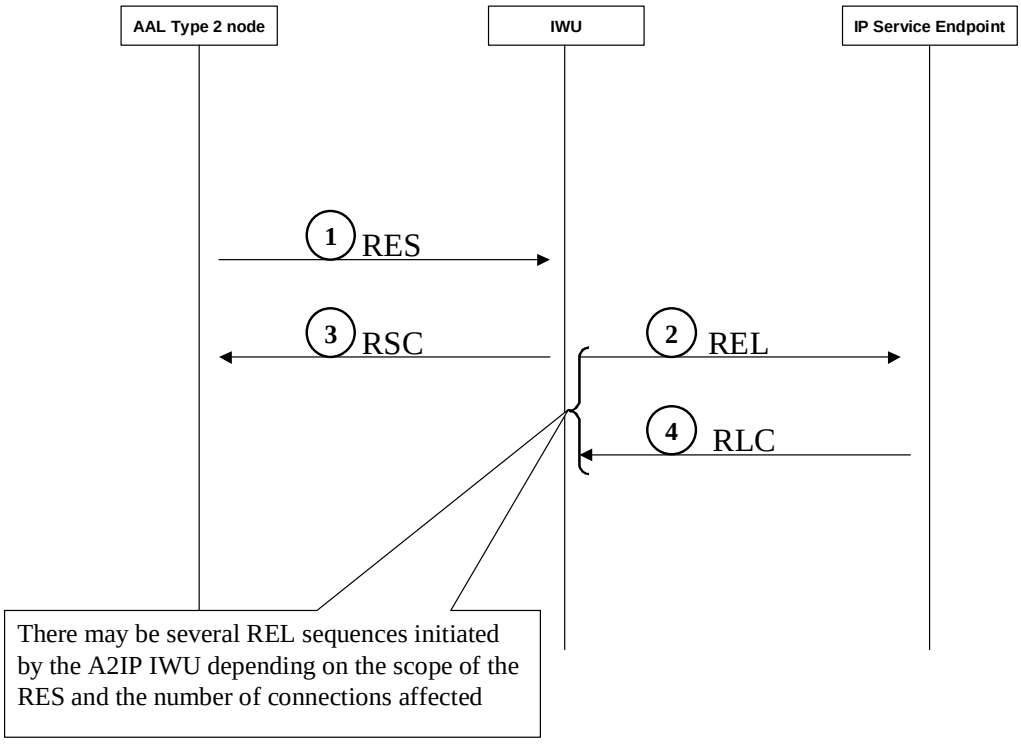

Figure 18/Q.2632.1 – General Reset handling

Reception of the RES message (1) causes the REL message (2) and the RSC message (3) to be sent. There is no time or logical correlation between (2) and (3) or between (3) and (4).

The handling is analogous in cases where the RES is received from the IP network portion or generated by the IWU.

10.1.1 Reset initiated in AAL type 2 network

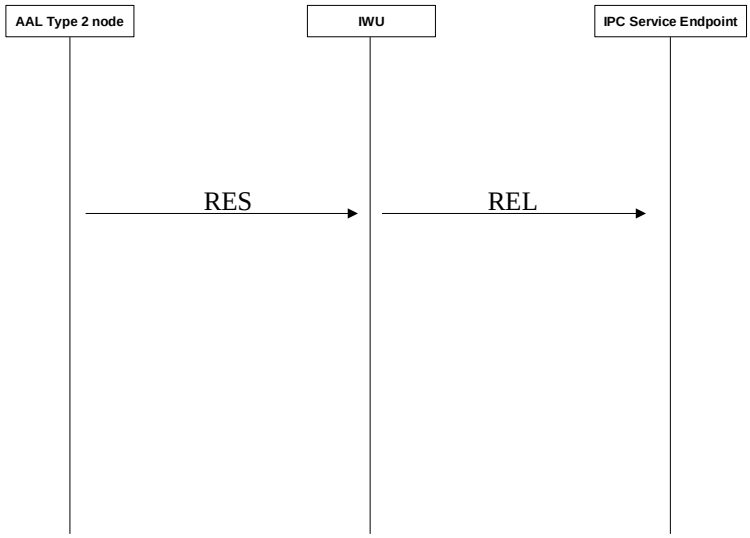

Figure 19/Q.2632.1 – RES from AAL type 2 network

Table 11/Q.2632.1 – Mapping of RES parameters

Incoming AAL type 2 RES	Outgoing IPC REL (Note 3)
(Note 1)	CAU (Note 2)
NOTE 1 – RES messages carry no parameters requiring interworking NOTE 2 – Cause value set to "Temporary failure" NOTE 3 – If the RES applies to one or more AAL type 2 paths affecting several active connections, a REL message for each of these connections shall be generated at the IP side.	

10.1.2 Reset initiated in IP network

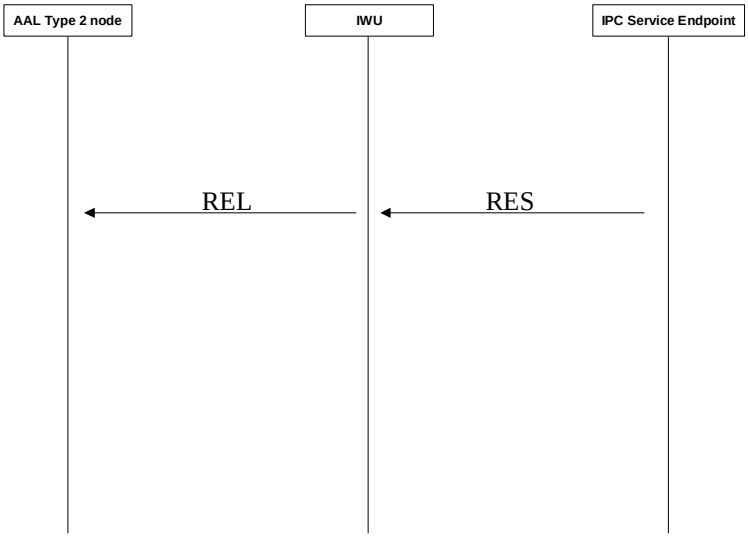

Figure 20/Q.2632.1 – RES from IP network

Table 12/Q.2632.1 – Mapping of RES parameters

Outgoing AAL type 2 REL	Incoming IPC RES (Note 3)
CAU (Note 2)	(Note 1)
NOTE 1 – RES messages carry no parameters requiring interworking NOTE 2 – Cause value set to "Temporary failure" NOTE 3 – If the RES affects several active connections, a REL message for each of these connections shall be generated at the AAL type 2 side.	

10.2 Reset initiated by the IWU

In analogy to the Reset handling in AAL type 2 signalling a Reset procedure initiated by the IWU shall be handled according to Figure 21/Q.2632.1:

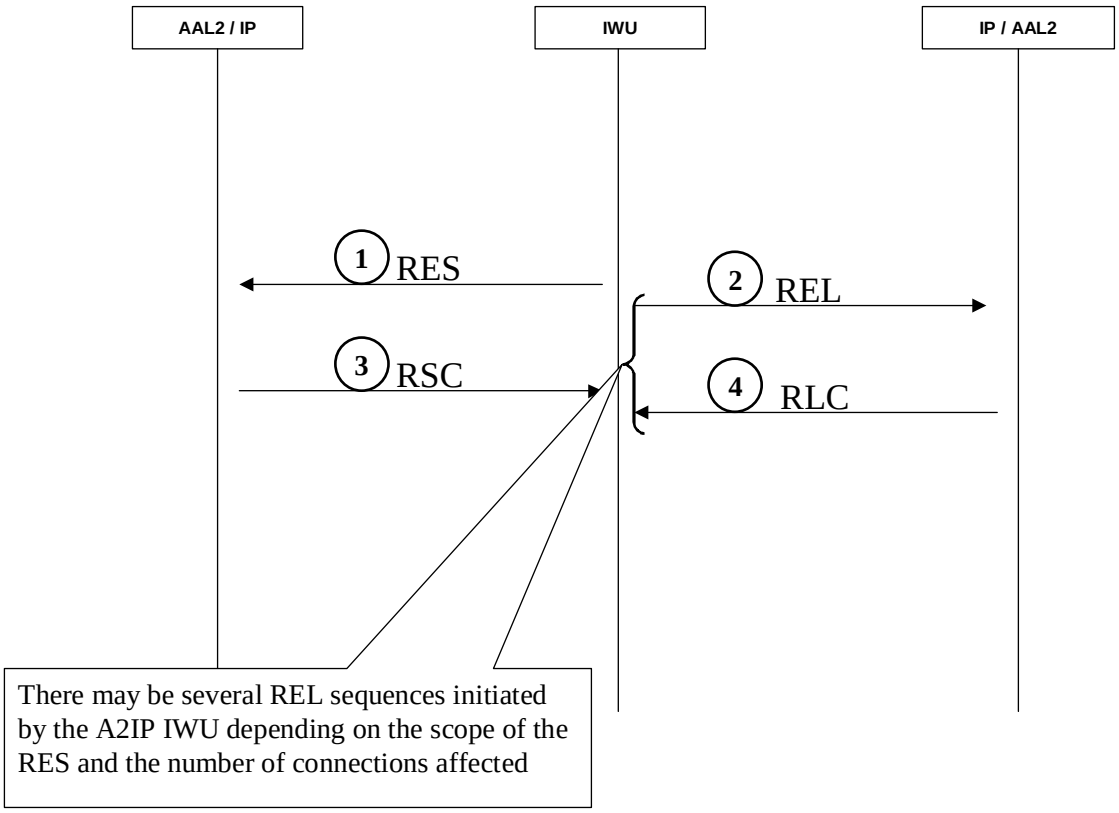

Figure 21/Q.2632.1 – General IWU initiated Reset handling

Sending of the RES message (1) causes the REL message (2) to be sent.

10.2.1 Reset towards the AAL type 2 network

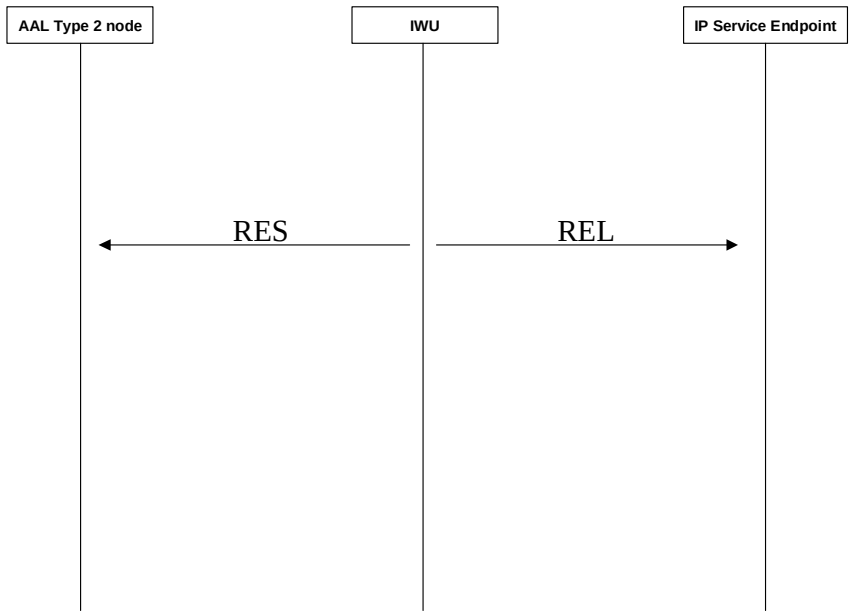

Figure 22/Q.2632.1 – RES towards AAL2 network

Table 13/Q.2632.1 – Mapping of RES parameters

Outgoing AAL type 2 RES	Outgoing IPC REL (Note 3)
CAU (Note 2)	(Note 1)
NOTE 1 – RES messages carry no parameters requiring interworking NOTE 2 – Cause value set to "Temporary failure" NOTE 3 – If the RES affects several active connections, a REL message for each of these connections shall be generated at the IP side.	

10.2.2 Reset towards the IP network

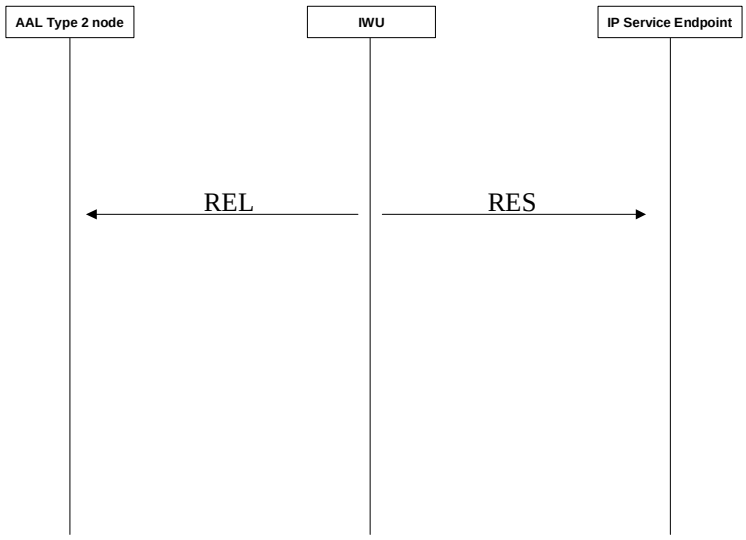

Figure 23/Q.2632.1 – RES towards IP network

Table 14/Q.2632.1 – Mapping of RES parameters

Outgoing AAL type 2 REL	Outgoing IPC RES (Note 3)
CAU (Note 2)	(Note 1)
NOTE 1 – RES messages carry no parameters requiring interworking NOTE 2 – Cause value set to "Temporary failure" NOTE 3 – If the RES affects several active connections, a REL message for each of these connections shall be generated at the AAL2 side.	

11 Messages requiring no Interworking

11.1 AAL type 2 messages

The following AAL type 2 messages are not interworked when received at the IWU: CFN, RSC, BLO, BLC, UBL, and UBC.

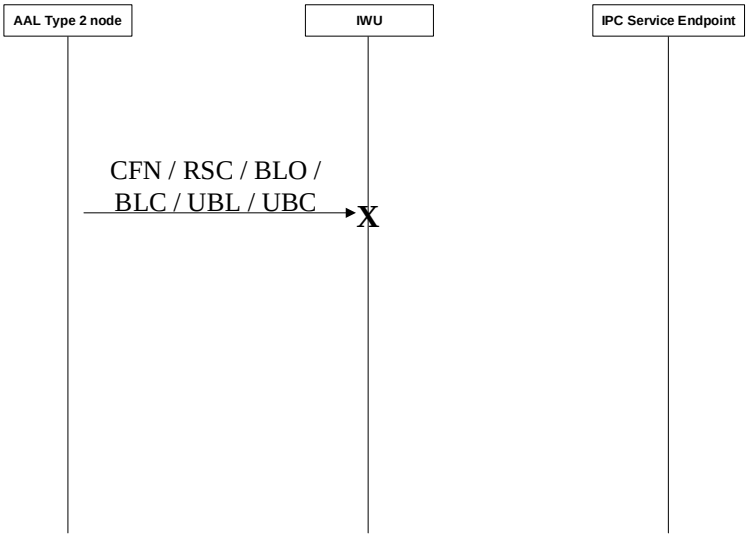

Figure 24/Q.2632.1 –AAL type 2 messages without interworking

11.2 IPC messages

The following IPC messages are not interworked when received at the IWU: CFN, RSC.

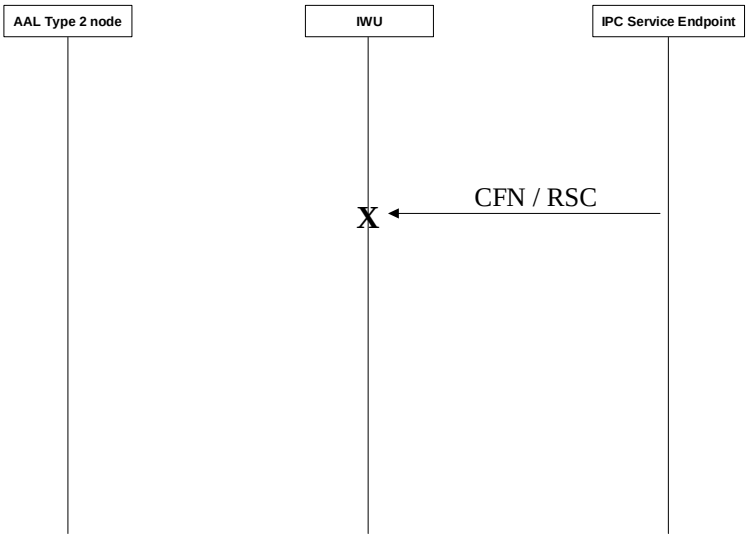

Figure 25/Q.2632.1 –IPC messages without interworking

APPENDIX I

Interworking of AAL type 2 Link Characteristics and SSISU parameters with IPC IP Transfer Capabilities

I.0 Guidelines and Definitions

This Appendix provides rules for conversions between LC-type and TC-type parameters. In some cases explicit expressions are defined that allow computing outgoing parameter values based on incoming parameter values. These expressions should be understood as formal in the sense that

- they do not request by themselves the existence of certain parameters neither incoming nor outgoing,
- they do not overrule constraints of any type that are defined within any of the interworked protocols.

Due to the modification capability of both interworked protocols situations may arise where parameters are received in a Modification Request message that contain in part identical values compared to those that are already in operation for the part of the network where from the modification is received. Here application of the conversion rules might lead to an "artificial" alteration of connection parameters in the other network part. In order to avoid these artificial alterations the corresponding values already in operation in the succeeding network portion shall be used.

This shall be illustrated with an example:

For an established connection the IP side wants to modify only the token bucket sizes. Therefore a MOD message is sent that contains identical bit rates and maximum packet sizes compared to those that are in use for the IP part of the connection and new token bucket size values. In this case the MOD message generated by the A2IP IWU for the AAL type 2 network shall contain an Link Characteristics parameter with values identical to those already in use in the AAL type 2 network portion for this connection.

For the purpose of this Appendix the following shorthand notation shall be used (tables I-1/Q.2632.1 to I-5/Q.2632.1)

Table I-1/Q.2632.1

LC parameter fields

A = *maximum CPS-SDU bit rate in the forward direction*
B = *average CPS-SDU bit rate in the forward direction*
C = *maximum CPS-SDU bit rate in the backward direction*
D = *average CPS-SDU bit rate in the backward direction*
E = *maximum CPS-SDU size in the forward direction*
F = *average CPS-SDU size in the forward direction*
G = *maximum CPS-SDU size in the backward direction*
H = *average CPS-SDU size in the backward direction*

Table I-2/Q.2632.1

SSISU parameter fields

I = *maximum length of SSSAR-SDU in the forward direction*
J = *maximum length of SSSAR-SDU in the backward direction*

Table I-3/Q.2632.1

TC parameter fields

U = *peak bit rate in the forward direction*
V = *sustainable bit rate in the forward direction*
W = *peak bit rate in the backward direction*
X = *sustainable bit rate in the backward direction*
Y = *maximum allowed packet size in the forward direction*
Z = *maximum allowed packet size in the backward direction*

Table I-4/Q.2632.1

PLC parameter fields

a = *maximum CPS-SDU bit rate in the forward direction*
b = *average CPS-SDU bit rate in the forward direction*
c = *maximum CPS-SDU bit rate in the backward direction*
d = *average CPS-SDU bit rate in the backward direction*
e = *maximum CPS-SDU size in the forward direction*
f = *average CPS-SDU size in the forward direction*
g = *maximum CPS-SDU size in the backward direction*
h = *average CPS-SDU size in the backward direction*

Table I-5/Q.2632.1

PTC parameter fields

u = *peak bit rate in the forward direction*
v = *sustainable bit rate in the forward direction*
w = *peak bit rate in the backward direction*
x = *sustainable bit rate in the backward direction*
y = *maximum allowed packet size in the forward direction*
z = *maximum allowed packet size in the backward direction*

IPHL shall denote the total length of the header of the IP packet measured in octet and including the IP packet header, the UDP header, and, if RTP is used, the RTP header.

For any real number x, [x] is defined as the smallest integer greater or equal to x.

MAX (x1, ..., xn) determines the maximum, MIN (x1, ..., xn) the minimum of the values x1, ..., xn.

Bit rates are measured in bit per second (“bit/s”), sizes, e.g. of data structures, in octet.

I.1 Interworking for AAL type 2 to IP

I.1.1 Bit Rates

The conversion from LC-type bit rates to TC-type bit rates requires to estimate the rate that will be caused by the IP overhead of length IPHL. This estimate is given in Table I-6/Q.2632.1. The values are "normalized" to multiples of 64 bit/s.

Table I-6/Q.2632.1

IP overhead rates

Definition	Meaning
HBA := [(IPHL*A) / (64*F)] * 64	Estimate of the IPHL bit rate for the Peak Bit Rate in the forward direction for given LC
HBa := [(IPHL*a) / (64*f)] * 64	Estimate of the IPHL bit rate for the Peak Bit Rate in the forward direction for given PLC
HBB := [(IPHL*B) / (64*F)] * 64	Estimate of the IPHL bit rate for the Sustainable Bit Rate in the forward direction for given LC
HBb := [(IPHL*b) / (64*f)] * 64	Estimate of the IPHL bit rate for the Sustainable Bit Rate in the forward direction for given PLC
HBC := [(IPHL*C) / (64*H)] * 64	Estimate of the IPHL bit rate for the Peak Bit Rate in the backward direction for given LC
HBc := [(IPHL*c) / (64*h)] * 64	Estimate of the IPHL bit rate for the Peak Bit Rate in the backward direction for given PLC
HBD := [(IPHL*D) / (64*H)] * 64	Estimate of the IPHL bit rate for the Sustainable Bit Rate in the backward direction for given LC
HBd := [(IPHL*d) / (64*h)] * 64	Estimate of the IPHL bit rate for the Sustainable Bit Rate in the backward direction for given PLC
NOTE 1– If a denominator turns out to be zero in any of the expressions above, the result of the expression shall be set equal to zero. NOTE 2 – If a factor does not exist in any of the expressions above the result of the expression shall be set equal to zero. NOTE 3 – The definitions in this table are formal. Whether or not a certain expression is required, is determined by the interworking.	

Table I-7/Q.2632.1 defines the interworking of LC bit rates (AAL type 2) to TC bit rates (IP)

Table I-7/Q.2632.1

TC bit rates determined from LC

TC parameter field	Value
U	A + HBA
V	B + HBB
W	C + HBC
X	D + HBD

NOTE 1 – The interworking and the involved protocols determine whether or not a certain field is required. NOTE 2 –The involved protocol determines whether or not a certain value is meaningful and valid.

Table I-8/Q.2632.1 defines the interworking of PLC bit rates (AAL type 2) to PTC bit rates (IP)

Table I-8/Q.2632.1

PTC bit rates determined from PLC

PTC parameter field	Value
u	a + HBa
v	b + HBb
w	c + HBc
x	d + HBd
NOTE 1 – The interworking and the involved protocols determine whether or not a certain field is required. NOTE 2 – The involved protocol determines whether or not a certain field is required.	

I.1.2 Maximum allowed packet sizes

Table I-9/Q.2632.1 defines the derivation of TC and PTC maximum allowed packet sizes from LC and PLC CPS-SDU sizes and/or SSISU.

Table I-9/Q.2632.1

Determination of maximum allowed packet sizes

TC/PTC SDU size subfields	Value
Y	IPHL + MAX (E, I)
Z	IPHL + MAX (G, J)
y	IPHL + MAX (e, I)
z	IPHL + MAX (g, J)
NOTE 1 - “0” is assumed as value to guarantee a correct working of the MAXimum function if a certain parameter does not exist. NOTE 2 – The interworking and the involved protocols determine whether or not a certain field is required. NOTE 3 – The involved protocol determines whether or not a certain field is required.	

I.1.3 Token bucket sizes

The A2IP Interworking Unit shall set the token bucket sizes to the allowed maximum values. The allowed maximum value is the minimum out of the maximum defined by the protocol and the maximum defined within the network.

NOTE – An appropriate adjustment of the token bucket sizes controlled by the Served User may be initiated from the IP network portion with a subsequent MOD message.

I.1.4 Determination of the TC class

Q.2631.1[2] supports two IP transfer capability classes: Dedicated Bandwidth and Statistical Bandwidth Transfer Capability.

For an incoming connection set-up from the AAL type 2 network portion, the AAL2IP Interworking Unit has to determine the IP Transfer Capability class to be used in the IP portion.

If all subsequent conditions

C1) A = B

C2) C = D

C3) E = F

C4) G = H

C5) MSLC not set

are satisfied the Dedicated Bandwidth Transfer Capability shall be selected. If at least one of the conditions C1), ..., C5) is not fulfilled the Statistical Bandwidth Transfer Capability shall be applied.

Note – If no LC parameter is received and no specific provisions are applied for this case, the A2IP IWU may reject the connection request.

I.2 Interworking for IP to AAL type 2

I.2.1 Bit Rates

The conversion from TC-type bit rates to LC-type bit rates requires to estimate the portion that is induced by the IP overhead of length IPHL. This estimate is given in Table I-10/Q.2632.1. The values are “normalized” to multiples of 64 bit/s.

Table I-10/Q.2632.1

Received IP overhead rates

Definition	Meaning
HBU := [(IPHL*U) / (64*Y)] * 64	Estimate of the IPHL bit rate portion in the Peak Bit Rate in the forward direction for given TC
HBu := [(IPHL*u) / (64*y)] * 64	Estimate of the IPHL bit rate portion in the Peak Bit Rate in the forward direction for given PTC
HBU := [(IPHL*V) / (64*Y)] * 64	Estimate of the IPHL bit rate portion in the Sustainable Bit Rate in the forward direction for given TC
HBu := [(IPHL*v) / (64*y)] * 64	Estimate of the IPHL bit rate portion in the Sustainable Bit Rate in the forward direction for given PTC
HBW := [(IPHL*W) / (64*Z)] * 64	Estimate of the IPHL bit rate portion in the Peak Bit Rate in the backward direction for given TC
HBw := [(IPHL*w) / (64*z)] * 64	Estimate of the IPHL bit rate portion in the Peak Bit Rate in the backward direction for given PTC
HBX := [(IPHL*X) / (64*Z)] * 64	Estimate of the IPHL bit rate portion in the Sustainable Bit Rate in the backward direction for given TC

HBx := [(IPHL*x) / (64*z)] * 64	Estimate of the IPHL bit rate portion in the Sustainable Bit Rate in the backward direction for given PTC
NOTE 1– If a denominator turns out to be zero in any of the expressions above, the result of the expression shall be set equal to zero. NOTE 2 – If a factor does not exist in any of the expressions above the result of the expression shall be set equal to zero. NOTE 3 – The definitions in this table are formal. Whether or not a certain expression is required, is determined by the interworking.	

Tables I-11/Q.2632.1 and I-12/Q.2632.1 define the interworking of TC/PTC bit rates (IP) to LC/PLC bit rates (AAL type 2) if a Statistical Bandwidth Transfer Capability was received.

Table I-11/Q.2632.1

Interworking of TC to LC bit rates

LC parameter field	Value
A	U - HBU
B	V - HBV
C	W - HBW
D	X - HBX
NOTE 1 – The interworking and the involved protocols determine whether or not a certain field is required. NOTE 2 – The involved protocol determines whether or not a certain field is required.	

Table I-12/Q.2632.1

PLC bit rates determined from PTC

PLC parameter field	Value
a	u - HBu
b	v - HBv
c	w - HBw
d	x - HBx
NOTE 1 – The interworking and the involved protocols determine whether or not a certain field is required. NOTE 2 – The involved protocol determines whether or not a certain field is required.	

For received Dedicated Bandwidth Transfer Capability Tables I-13/Q.2632.1 and I-14/Q.2632.1 define the interworking of TC/PTC bit rates (IP) to LC/PLC bit rates (AAL type 2).

Table I-13/Q.2632.1

Interworking of TC to LC bit rates

LC parameter field	Value
A	U - HBU
B	U - HBU
C	W - HBW
D	W - HBW
NOTE 1 – The interworking and the involved protocols determine whether or not a certain field is required. NOTE 2 – The involved protocol determines whether or not a certain field is required.	

Table I-14/Q.2632.1

PLC bit rates determined from PTC

PLC parameter field	Value
a	u - HBu
b	u - HBu
c	w - HBw
d	w- HBx
NOTE 1 – The interworking and the involved protocols determine whether or not a certain field is required. NOTE 2 – The involved protocol determines whether or not a certain field is required.	

I.2.2 CPS-SDU sizes

Tables I-15/Q.2632.1 and I-16/Q.2632.1 define the derivation of LC/PLC CPS-SDU sizes from TC/PTC maximum allowed packet sizes.

Table I-15/Q.2632.1

TC to LC CPS-SDU size interworking

LC CPS-SDU size subfields	Value
E, F	MIN (Y - IPHL, 45)
G, H	MIN (Z - IPHL, 45)

Table I-16/Q.2632.1

PTC to PLC CPS-SDU size interworking

PLC CPS-SDU size subfields	Value
e, f	MIN (y - IPHL, 45)
g, h	MIN (z - IPHL, 45)

I.2.3 SSISU SDU sizes

Table I-17/Q.2632.1 defines the derivation of SSISU SDU sizes from TC and PTC maximum allowed packet sizes.

Table I-17/Q.2632.1

TC and PTC to SSISU interworking

SSISU subfields	Value
I	MAX (Y – IPHL, y - IPHL)
J	MAX (Z – IPHL, z - IPHL)
NOTE 1 - "0" is assumed as value to guarantee a correct working of the MAXimum function if a certain parameter does not exist. NOTE 2 – if the value of all SSISU subfields determined according to these rules does not exceed 45, no SSISU parameter will be generated at all.	

INTERNATIONAL TELECOMMUNICATION UNION

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ABSTRACT

The attachment to this document contains draft Q.2631.1 "IP Connection Control Signalling Protocol – Capability Set 1", proposed for consent at this SG11 meeting

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Draft New ITU-T Recommendation Q.2631.1

IP Connection Control Signalling Protocol – Capability Set 1

Summary

This Recommendation specifies the inter-node protocol and nodal functions that support the dynamic establishment, modification and release of individual IP connections.

The IP Connection Control signalling protocol specified in this Recommendation can operate in public or private networks over a range of signalling transport protocol stacks.

It also provides maintenance capabilities, carriage of user-plane protocol stack information and carriage of an identifier to link the connection control protocol with other higher layer control protocols.

Draft New ITU-T Recommendation Q.2631.1

IP Connection Control Signalling Protocol (Capability Set 1)

(Geneva 2003)

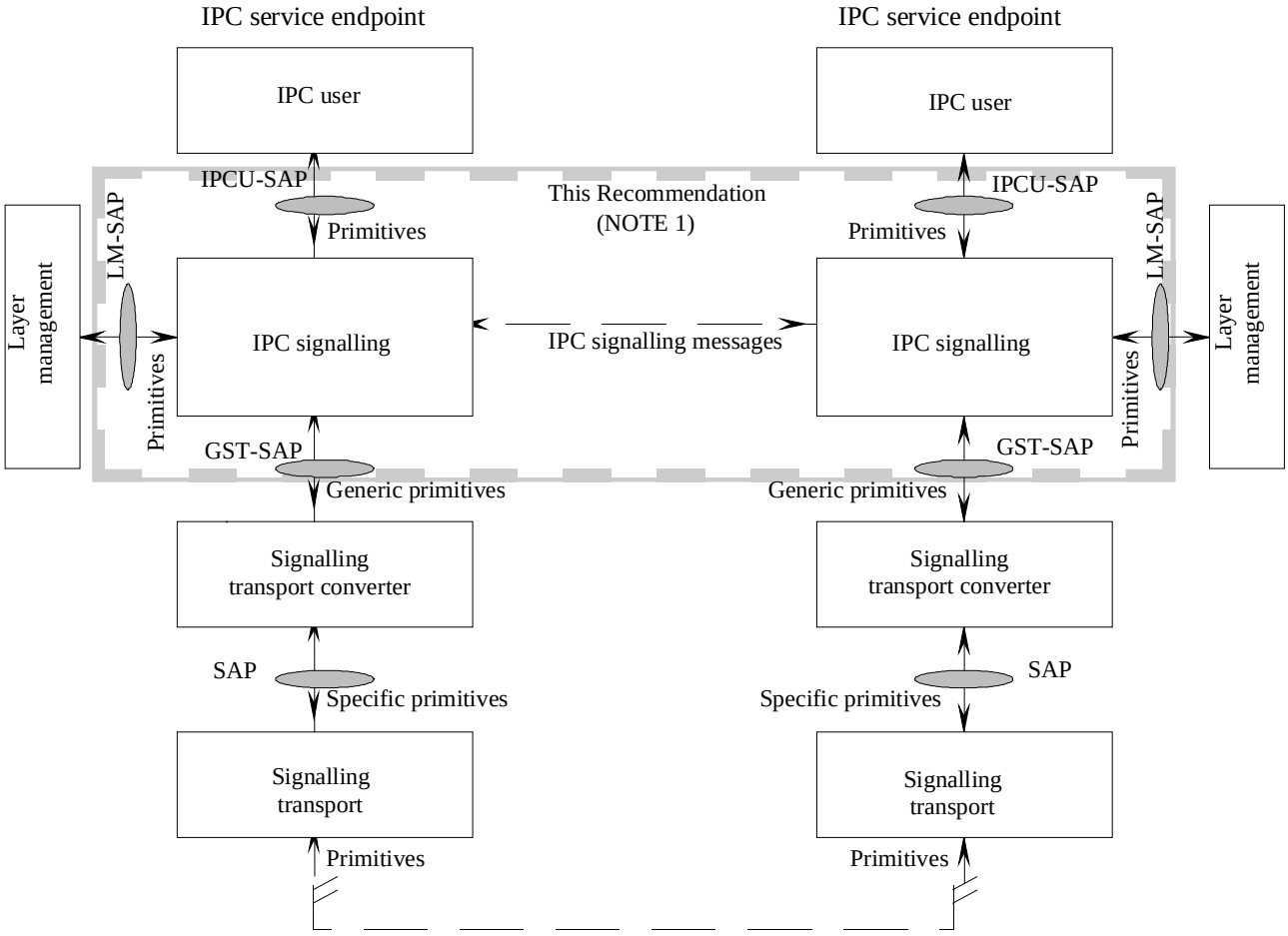
1 Scope

This Recommendation describes the IP Connection Control signalling protocol that supports the dynamic establishment, modification and release of individual IP connections. It also describes the maintenance procedures, the framework of the protocol, and the interactions between an IPC signalling entity and:

- the signalling protocol user;
- a signalling transport converter; and
- layer management.

The scope of this Recommendation is illustrated in Figure 1-1/Q.2631.1. The IPC signalling protocol can be deployed over a range of signalling transport protocol stacks.

This Recommendation is based on the requirements defined in ITU-T Technical Report TRQ.2415 [25] "Signalling Requirements for IP Connection Control in Radio Access Networks Capability Set 1".



NOTE 1 - The entities and Service Access Points (SAP) bounded by the grey broken line indicate the extent of the definitions specified in this Recommendation.

FIGURE 1-1/Q.2631.1
Functional architecture of IPC signalling

2 References

2.1 Normative references

The following ITU-T Recommendations and other references contain provisions, which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[1] ITU-T Recommendation X.200 (1994) - Information Technology - Open Systems Interconnection - Basic reference model: The basic model
[2] ITU-T Recommendation X.210 (1993) - Information Technology - Open Systems Interconnection - Basic reference model: Conventions for the definition of OSI services
[3] ITU-T Recommendation Q.2150.0 - Generic Signalling Transport Service
[4] RFC 791, "Internet Protocol", J. Postel, September 1981
[5] RFC 2460, "Internet Protocol, Version 6 (IPv6) Specification", S. Deering and R. Hinden, December 1998
[6] RFC 768, “User Datagram Protocol”, J. Postel, August 1980
[7] RFC 3550, “RTP: A Transport Protocol for Real-Time Applications”, H. Schulzrinne, S. Casner, R. Frederick, V. Jacobson, July 2003
[8] RFC 2474, “Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 headers”, K. Nichols et al., December 1998
[9] RFC 2597, “Assured Forwarding PHB Group”, J. Heinanen et al., June 1999
[10] RFC 3246, “An Expedited Forwarding PHB”, B. Davie et al., March 2002
[11] RFC 3513, "IP Version 6 (IPv6) Addressing Architecture", R. Hinden and S. Deering, April 2003.
[12] ITU-T Recommendation Q.850 (1998) - Usage of cause and location in DSS 1 and SS No. 7 ISUP.
[13] ITU-T Recommendation Q.2610 (1999) - B-ISDN - Usage of Cause and Location in B-ISDN User Part and DSS 2.
[14] ITU-T Recommendation E.164 (1997) - The international public telecommunication numbering plan.
[15] ITU-T Recommendation X.213 (2001) - Information Technology - Open Systems Interconnection - Network Service Definitions.
[16] ITU-T Recommendation Q.542 (1993) – Digital Exchanges — Digital Exchange Design Objectives — Operations and Maintenance
[17] ITU-T Recommendation Y.1221 (2002) – Traffic Control and Congestion Control in IP-based Networks

2.2 Bibliography

[20] ITU-T Recommendation Q.2630.1 (1999) – AAL type 2 Signalling Protocol Capability Set 1.
[21] ITU-T Recommendation Q.2630.2 (2000) – AAL type 2 Signalling Protocol Capability Set 2.
[22] ITU-T Recommendation Q.2150.1 - Signalling Transport Converter on MTP3 and MTP3b.
[23] ITU-T Recommendation Q.2150.2 - Signalling Transport Converter on SSCOP and SSCOPMCE.
[24] ITU-T Recommendation Q.2150.3 - Signalling Transport Converter on SCTP.
[25] Draft Technical Report TRQ.2415 Transport Control Signalling Requirements – Signalling Requirements for IP Connection Control in Radio Access Networks, Capability Set 1
[26] Draft Technical Report TRQ.2800 Transport Control Signalling Requirements – Signalling Requirements for AAL type 2 to IP Interworking, Capability Set 1
[27] RFC 3260, “New Terminology and Clarifications for Diffserv”, D.Grossman, April 2002

[28] 3GPP TS 25.414, "3rd Generation Partnership Project, Technical Specification Group Radio Access Network, UTRAN Iu interface data transport and transport signalling (Release 5)"
[29] 3GPP TS 25.426, "3rd Generation Partnership Project, Technical Specification Group Radio Access Network, UTRAN Iur and Iub interface data transport & transport signalling for DCH data streams (Release 5)"

3 Definitions

This Recommendation is based upon the concepts developed in ITU-T Recommendations X.200 [1] and X.210 [2].

In addition, for the purpose of this Recommendation, the following definitions apply:

IP connection: The logical user plane communication facility between two IPC nodes, which is controlled by the IPC signalling protocol. An IP connection is designated by a pair of IP address/port number combinations.

IPC node: A physical entity that contains an IPC signalling entity.

IPC user: The user of the IPC signalling protocol. An IPC user resides at an IPC service endpoint.

IPC signalling protocol: Control plane functions for establishing, modifying and releasing IP connections and the maintenance functions associated with the IPC signalling.

IPC signalling transport: A facility for carrying IPC signalling messages.

IPC signalling endpoint: The termination point of IPC signalling transport.

IPC service endpoint: A functional entity which includes the IPC signalling endpoint and the IPC user.

IP transfer capability: Information that describes the attributes of the IP connection.

IP transport type: Information that describes the IP transport protocol stack used for the IP connection.

Field: Information carried in a parameter in a message. A field can have fixed or variable length data.

Generic signalling transport: The function that enables an IPC signalling entity to communicate with a peer IPC signalling entity independently of the underlying signalling transport.

Local IP address: IP address to be used by the peer IPC node to direct the user traffic.

Local UDP port number: UDP port number to be used by the peer IPC node to direct the user traffic.

Parameter: Information carried in a message. A parameter has a fixed, defined set of fields.

Signalling Association: A signalling capability that exists between two adjacent IPC nodes to control the IP connections. There may be one or more signalling associations between two adjacent IPC nodes.

Signalling transport: A signalling link or network that connects two IPC nodes.

Signalling transport converter: A function that converts the services provided by a particular signalling transport to the services required by the generic signalling transport.

Sub-field: The smallest unit of information in a field that has its own functional meaning.

4 Abbreviations

ACC	Automatic Congestion Control
ANI	Adjacent IPC Node Identifier
CAU	Cause Parameter
CFN	Confusion Message
DEA	Destination Endpoint Address
DEAE	Destination Endpoint E.164 Address
DEAX	Destination Endpoint X.213 Address
DS	Differentiated Services
DSAID	Destination Signalling Association Identifier
DSCP	Differentiated Services Code Point
ECF	Establish Confirm Message
ERQ	Establish Request Message
GST	Generic Signalling Transport
ID	Identifier
IP	Internet Protocol
IPC	IP Connection Control
IPCU	IPC user
IPQOS	IP Quality of Service
IPTA	IP Transport Sink Address
IPTT	IP Transport Type
LM	Layer Management
LSB	Least Significant Bit
M	Mandatory
MOA	Modification Acknowledge message
MOD	Modification Request message
MOR	Modification Reject message
MSB	Most Significant Bit
MSTC	Modify Support for Transfer Capability
O	Optional
OSAID	Originating Signalling Association Identifier
PHB	Per-hop forwarding behaviour
PTC	Preferred Transfer Capability
PTC-DBW	Dedicated Bandwidth Preferred Transfer Capability
PTC-SBW	Statistical Bandwidth Preferred Transfer Capability
QoS	Quality of Service
REL	Release Request Message
RES	Reset Request Message
RLC	Release Confirm Message
RSC	Reset Confirm Message
RTP	Real-time Protocol
SAID	Signalling Association Identifier
SAP	Service Access Point
SDU	Service Data Unit
STC	Signalling Transport Converter
SUGR	Served User Generated Reference
SUT	Served User Transport

TC	Transfer Capability
TC-DBW	Dedicated Bandwidth Transfer Capability
TCI	Test Connection Indication
TC-SBW	Statistical Bandwidth Transfer Capability
UDP	User Datagram Protocol

5 General framework of the IPC signalling protocol

The IP connection control signalling protocol provides the signalling capability to establish, modify and release virtual connections in an IP environment. These services are accessible via the IPC user service access point (IPCU-SAP).

The IPC signalling protocol also provides maintenance functions associated with the IPC signalling. These functions are accessible via the Layer Management service access point (LM-SAP).

Two peer IPC signalling entities rely on the generic signalling transport service to provide assured data transfer between them and service availability indications. These services are accessible via the Generic Signalling Transport Service Access Point (GST-SAP).

NOTE — Primitives over the IPCU-SAP, GST-SAP and LM-SAP are used for descriptive purpose only. They do not imply a specific implementation.

Both peer IPC signalling entities provide the same set of services.

IPC signalling messages are analyzed only in IPC service endpoints (see Figure 1-1/Q.2631.1).

IPC signalling messages are exchanged between peer protocol entities using the generic signalling transport service. The IPC signalling is independent of the signalling transport, although an assured data transport is required and a message size limit applies. The Generic Signalling Transport Service used is defined in ITU-T Recommendation Q.2150.0 [3]. To adapt the Generic Signalling Transport Services to a specific signalling transport service, a signalling transport converter may be needed. The specification of signalling transport converters is beyond the scope of this Recommendation (see ITU-T Recommendation Q.2150.1 [22], ITU-T Recommendation Q.2150.2 [23], and ITU-T Recommendation Q.2150.3 [24]).

5.1 Interface between the IPC signalling entity and the IPC user

5.1.1 Service provided by the IPC signalling entity

The IPC signalling entity provides the following services to the IPC user across the IPCU-SAP:

- Establishment of IP connections,
- Release of IP connections, and
- Modification of IP connection resources.

The IPC signalling entity is independent of the IPC user.

5.1.2 Primitives between IPC signalling entity and the IPC user

The IPCU-SAP primitives are used:

1) by the originating IPC user to initiate IP connection establishment and by either of the IPC users to initiate the release of a connection.

2) by the terminating IPC signalling entity to indicate an incoming IP connection establishment request to the terminating IPC user and by either of the IPC signalling entities to notify its corresponding IPC user of the release of a connection.

3) by either IPC user to initiate an IP connection resource modification and by the modification terminating IPC user to respond to a modification request.

4) by either IPC signalling entity to indicate a modification of the IP connection resource to its corresponding IPC user and notify the modification initiating IPC user of the successful or unsuccessful modification.

NOTE — When sending a primitive between the signalling protocol and its user, the primitive needs to be associated with a particular IP connection instance. The mechanism used for this binding is considered to be an implementation detail and therefore is outside the scope of this Recommendation.

The services are provided through the transfer of primitives, which are summarised in Table 5-1/Q.2631.1, and are defined after the table.

The IPC user passes information in parameters in the primitives. Some of those parameters are mandatory and some are optional; the appropriate usage of the parameters is described in § 8.

TABLE 5-1/Q.2631.1

Primitives and parameters exchanged between the IPC signalling entity and the IPC user

Primitive	Type			
Generic Name	Request	Indication	Response	Confirm
ESTABLISH	DEA, SUGR, SUT, MSTC, TC, PTC, IPQOS, IPTT, CP	SUGR, SUT, MSTC, TC, PTC, IPQOS, IPTT, CP	MSTC	MSTC
RELEASE	Cause	Cause	Not defined	Cause
MODIFY	TC	TC	-	-
MODIFY-REJECT	Not defined	Not defined	Cause	Cause
–: This primitive has no parameters.				

a) **ESTABLISH.Request**:
This primitive is used by the originating IPC user to initiate the establishment of a new IP connection and optionally request the capability for subsequent modification to be performed on this IP connection.

b) **ESTABLISH.Indication**:
This primitive is used by the terminating IPC signalling entity to indicate an incoming IP connection establishment request to the terminating IPC user and optionally indicate that subsequent modification may be performed on this IP connection.

c) **ESTABLISH.Response**:
This primitive is used by the terminating IPC user to indicate to the terminating IPC signalling entity that the establishment request has been successful.

d) **ESTABLISH.Confirm**:
This primitive is used by the originating IPC signalling entity to indicate to the originating IPC user that the IP connection (which was previously requested by the originating IPC user) has successfully been established and optionally indicate that the established connection is capable of subsequent modification.

e) **RELEASE.Request**:
This primitive is used by the IPC user to initiate clearing of an IP connection.

f) **RELEASE.Indication**:
This primitive is used by the IPC signalling entity to indicate that an IP connection has been released.

g) **RELEASE.Confirm**:
This primitive is used by the originating IPC signalling entity to indicate to the originating IPC user that an establishment request has been unsuccessful.

h) **MODIFY.Request**:
This primitive is used by either IPC user to initiate the modification of the IP connection resource.

i) **MODIFY.Indication**:
This primitive is used by the modify receiving IPC signalling entity to indicate that modification of the IP connection resource has been requested.

j) **MODIFY.Response**:
This primitive is used by the modify receiving IPC user to indicate to the IPC signalling entity that the modification request has been successful.

k) **MODIFY.Confirm**:
This primitive is used by either IPC signalling entity to indicate that the IP connection resource modification (which was previously requested by the IPC user) has successfully been performed

l) **MODIFY-REJECT.Response**:
This primitive is used by the modify receiving IPC user to indicate to the IPC signalling entity that the IP connection resource modification has been rejected.

m) **MODIFY-REJECT.Confirm**:
This primitive is used by the modify sending IPC signalling entity to indicate that the IP connection resource modification (which was previously requested by the IPC user) has been rejected.

5.1.3 Parameters between IPC signalling entity and the IPC user

a) **Destination Endpoint Address (DEA)**
This parameter carries the endpoint address of the destination. It can have the form of an E.164 [14] address or an X.213 [15] address, and is transported unmodified to the destination IPC user.

b) **Served User Generated Reference (SUGR)**
This parameter carries a reference provided by the originating IPC user and this reference is transported unmodified to the destination IPC user.

c) **Served User Transport (SUT)**
This parameter carries the user data that is transported unmodified to the destination IPC user.

d) **Transfer Capability (TC)**
This parameter gives an indication of the resources required for the IP connection. This parameter can have the form of either:

- Dedicated Bandwidth Transfer Capability (see ITU-T Recommendation Y.1221 [17]); or
- Statistical Bandwidth Transfer Capability (see ITU-T Recommendation Y.1221 [17]).

e) **Cause**
This parameter describes the reason for the release of the IP connection. It also may indicate the reason why an IP connection could not be established or why a modification of an IP connection was rejected.

f) **Modify Support for Transfer Capability (MSTC)**
This parameter gives an indication that the Transfer Capability of the IP connection may need to be modified during the lifetime of the IP connection (ESTABLISH.Request) or are permitted to be modified (ESTABLISH.Indication and ESTABLISH.Confirm).

g) **Preferred Transfer Capability (PTC)**
This parameter gives an indication that the Transfer Capability shall be set as indicated in this parameter if the modification of the Transfer Capability is permitted. This parameter can have the form of either:

-
- Dedicated Bandwidth Transfer Capability (see ITU-T Recommendation Y.1221 [17]); or
- Statistical Bandwidth Transfer Capability (see ITU-T Recommendation Y.1221 [17])

h) **Quality of Service (IPQOS)**
This parameter indicates a request for an IP connection with a specified Quality of Service.

i) **IP Transport Type (IPTT)**
This parameter indicates a request for an IP connection with a specified IP transport protocol stack.

j) **Connection Priority (CP)**
This parameter carries information to indicate the priority level of the connection request.

5.2 Interface between the IPC signalling entity and the generic signalling transport

5.2.1. Service provided by the generic signalling transport service

The Generic Signalling Transport Service is specified in ITU-T Recommendation Q.2150.0 [3]. For convenience, a summary of the primitives for accessing the service is reproduced in Table 5-2/Q.2631.1. In the event of any difference between this table and the definitions in ITU-T Recommendation Q.2150.0 [3], the definitions in ITU-T Recommendation Q. 2150.0 [3] take precedence.

TABLE 5-2/Q.2631.1
Primitives and parameters of the Generic Signalling Transport Sublayer

Primitive	**Type**			
Generic Name	**Request**	**Indication**	**Response**	**Confirm**
START-INFO	not defined	Max_Length CIC_Control	not defined	not defined
IN-SERVICE	not defined	Level	not defined	not defined
OUT-OF-SERVICE	not defined	(Note 1)	not defined	not defined
CONGESTION	not defined	Level	not defined	not defined
TRANSFER	Sequence Control STC User Data Priority (Note 2)	STC User Data Priority (Note 2)	not defined	not defined

NOTES
1 This primitive has no parameters
2 This parameter is a national option (and the use of this parameter is not supported by all signalling transports)

On the establishment of a signalling transport converter entity and the associated signalling transport converter user entity, for example at power up, the initial conditions is the same as if an OUT-OF-SERVICE.indication primitive had been conveyed across this SAP. Also at this time the START-INFO.indication is sent to the signalling entity.

NOTE — The CIC_Control parameter of the START-INFO.indication is ignored by the IPC signalling entity.

5.2.2 State transition diagram for sequences of primitives of the generic signalling transport service

This subclause defines the constraints on the sequences in which the primitives may occur at the layer boundaries of the generic signalling transport service. The sequences are related to the states at one generic signalling transport endpoint between the generic signalling transport service provider and its user. The possible overall sequences of primitives are shown in the state transition diagram, Figure 5-3/Q.2631.1.

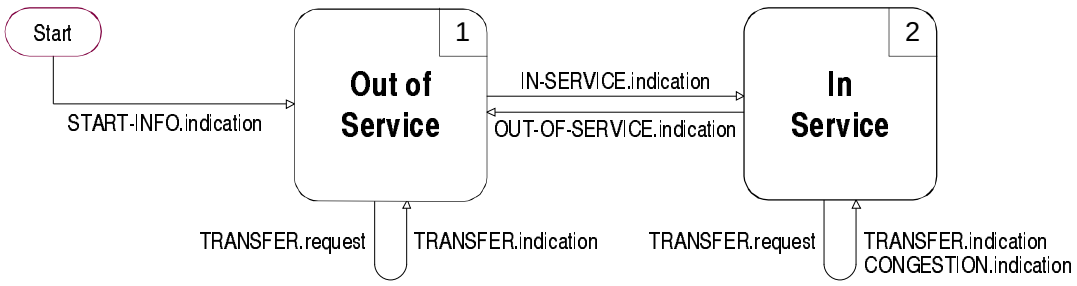


Figure 5-3/Q.2631.1
State transition diagram for sequences of primitives between the GST and its user

This model assumes that a request primitive is never issued at the same time as an indication primitive. The model also assumes that the primitives are serviced immediately and in zero time.

5.3 Interface between the IPC signalling entity and layer management

5.3.1 Service provided by layer management

This interface provides the internal interface to the network management system.

5.3.2 Primitives between IPC signalling entity and layer management

The primitives are summarised in Table 5-3/Q.2631.1 and are defined after the table.

TABLE 5-3/Q.2631.1
Primitives and parameters exchanged between the IPC signalling entities and layer management

Primitive	**Type**			
Generic Name	**Request**	**Indication**	**Response**	**Confirm**
RESET	ANI, IPTA	ANI, IPTA	Not defined	-
STOP-RESET	ANI, IPTA	Not defined	Not defined	Not defined
ERROR	Not defined	ANI, IPTA, Cause	Not defined	Not defined
- : This primitive has no parameters				

NOTE — When sending a primitive between the IPC signalling entity and layer management, the primitive needs to be associated with a particular management action instance. The mechanism used for this binding is considered to be an implementation detail and, therefore, is outside the scope of this Recommendation.

a) **RESET.Request**:
A primitive to request either IPC signalling entity to reset a particular IP connection, or all IP connections associated with a signalling association to the "Idle" state and to indicate this to the peer IPC signalling entity.

b) **RESET.Indication**:
A primitive indicating that the IPC signalling entity has reset a particular IP connection, or all IP connections associated with a signalling association to the "Idle" state on the request of the peer IPC signalling entity.

c) **RESET.Confirm**:
A primitive indicating that the IPC signalling entity has successfully informed the peer IPC signalling entity of the resetting of a particular IP connection, or all IP connections associated with a signalling association.

d) **STOP-RESET.Request**:
A primitive to request the IPC signalling entity to stop a reset procedure.

e) **ERROR.Indication**:
A primitive to indicate any operational errors in the IPC signalling procedures.

5.3.3 Parameters between IPC signalling entity and layer management

a) **IP Transport Address (IPTA)**
This parameter allows for the identification of:
i) all IP connections associated with a signalling association; or
ii) a particular IP connection.

b) **Cause**
This parameter gives the reason of an operational error.

c) **Adjacent IPC Node Identifier (ANI)**
This parameter is used to unambiguously indicate an adjacent IPC node.

6 Forward and backward compatibility

The compatibility mechanism remains unchanged for all capability sets and/or subsets of the IPC protocol defined in this Recommendation. It is based on forward compatibility information associated with all signalling information.

The compatibility method eases the network operation, for example:

- For the typical case of an IPC signalling protocol mismatch during a network upgrading.
- To interconnect two networks on a different functional level.
- For networks using a different subset of the same IPC protocol, etc.

NOTE — An IPC node may be at a different functional level due to having implemented a different capability set or another subset of the protocol specified in this Recommendation.

The forward compatibility mechanism specified in § 6.2 and § 8.1 applies to this and future capability sets of this Recommendation.

6.1 Backward compatibility rules

Compatible interworking between IPC protocol capability sets should be optimised by adhering to the following rules when specifying a new capability set (release):

1) Existing protocol elements, i.e. procedures, messages, parameters and sub-field values, should not be changed unless a protocol error needs to be corrected or it becomes necessary to change the operation of the service that is being supported by the protocol.

2) The semantics of a message, a parameter, or of a field and sub-field within a parameter should not be changed.

3) Established rules for formatting and encoding messages and parameters should not be modified.

6.2 Forward compatibility mechanism

Compatibility between this and future capability sets will be guaranteed, in the sense that any two capability sets can be interconnected directly with each other, if the following requirements are fulfilled:

i) Protocol compatibility
Connections between any two IPC protocols do not fail for the reason of not satisfying protocol requirements.

ii) Service and functional compatibility
This feature may be considered as compatibility typically between originating and destination IPC nodes.

iii) Resource control and management compatibility
For these functions, at least a backward notification is needed, if correct handling is not possible.

7 Format and coding of the IPC signalling protocol

7.1 Coding conventions for the IPC signalling protocol

7.1.1 Principles

The following principles shall apply for the coding of the IPC signalling protocol:

a) The order of coding of messages shall consist of “destination signalling association identifier”, “message identifier”, “message compatibility”, and any parameters.

b) Messages shall carry zero or more parameters.

c) The sequence of parameters is unconstrained.

d) The order of coding of parameters shall consist of “parameter identifier”, “parameter compatibility”, “parameter length”, and any fields.

e) Parameters shall carry zero or more fields.

f) A parameter shall always consist of the same sequence of fields.

g) If new fields need to be added to a parameter or the length of a fixed size field needs to be changed, the modifications shall be carried in a new parameter (different parameter identifier); the existing parameter shall remain unchanged.

h) Any sequence of fixed size fields and variable size fields is permissible.

i) Fixed length fields shall consist of the “field” only; no length is indicated.

j) Variable length fields shall consist of “field length” and “field”.

k) Fields shall be multiples of one octet.

l) Fields are composed of one or more sub-fields.

m) Reserved sub-fields shall be coded all zeroes and need not be interpreted by the receiver.

n) If there is no information to be carried in a variable size field, its length shall be set to zero, i.e. only the field length octet will be present.

o) If there is no information to be carried in a fixed size field, its content shall be set to zero in all octets.

p) The presence or the interpretation of a field shall not depend on the value of a field in another parameter.

Consistent with the above coding principles, it is further specified that:

- The message length shall allow for lengths of up to 4 000 octets.
- The parameter length shall allow for lengths of up to 255 octets.

7.1.2 General format of messages

The general format of a message is shown in Table 7-1/Q.2631.1.

NOTE — No “message length” needs to be carried in the message itself; the length of information passed via a primitive implicitly defines its length and the assured data transfer assures that no octets are lost or gained in transport.

TABLE 7-1/Q.2631.1
IPC message format

	8	7	6	5	4	3	2	1	
Header	Destination Signalling Association Identifier								4 octets
	Message Identifier								1 octet
	Message Compatibility								1 octet
Payload	Parameters								

The message header consists of the Destination Signalling Association Identifier field, the Message Identifier field, and the Message Compatibility field. The Destination Signalling Association Identifier field is coded the same as the Signalling Association Identifier field (see § 7.4.2), the coding of the Message identifier field is specified in § 7.2.1, and the Message Compatibility field is coded the same as the Compatibility field (see § 7.4.1).

The message payload consists of zero, one, or more parameters.

7.1.2.1 Bit coding rules

When a field is contained within a single octet, the lowest bit number of the field represents the lowest order value.

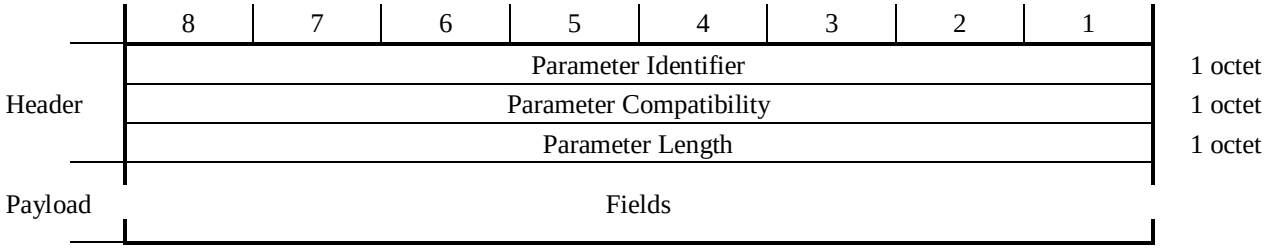
When a field spans more than one octet, the order of bit values within each octet progressively decreases as the octet number increases; the lowest bit number associated with the field represents the lowest order value.

7.1.3 General format of parameters

The general format of a parameter is shown in Table 7-2/Q.2631.1.

TABLE 7-2/Q.2631.1

IPC parameter format



The coding of the Parameter Identifier field is specified in § 7.2.2 Table 7-7/Q.2631.1 and the Parameter Compatibility field is coded as a Compatibility field (see § 7.4.1). The coding of the Parameter Length is a binary value indicating the number of octets in the parameter payload, i.e. the count does not include the octets in the parameter header.

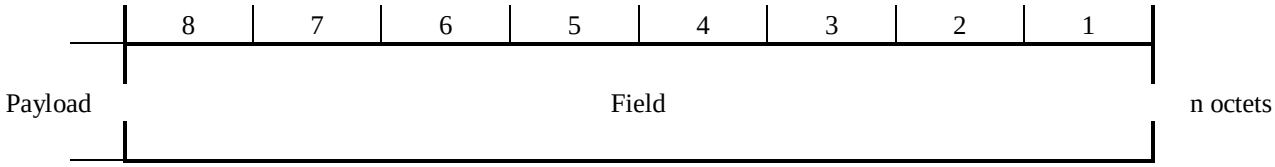
Each parameter has a defined number of fields of defined type and in a particular order.

7.1.4 General format of fixed length fields

The general format of a fixed length field is shown in Table 7-3/Q.2631.1.

TABLE 7-3/Q.2631.1

IPC field – fixed length format



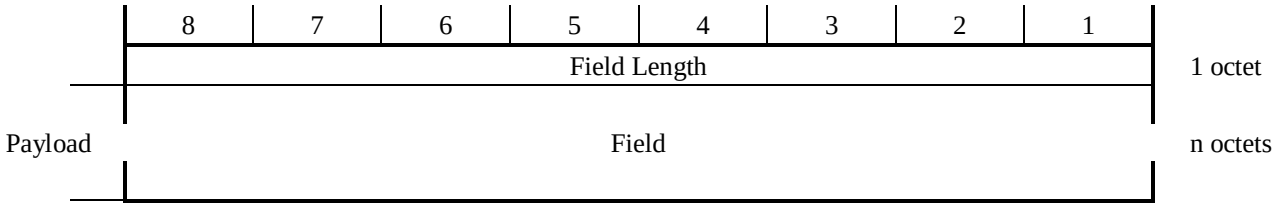
The Field type is determined by the location of the field in the particular parameter.

7.1.5 General format of variable length fields

The general format of a variable length field is shown in Table 7-4/Q.2631.1.

TABLE 7-4/Q.2631.1

IPC field – variable length format



The coding of the Field Length is a binary value indicating the number of octets in the Field payload, i.e. the count does not include the Field Length octet.

The field type is determined by the location of the field in the particular parameter.

7.2 Format and coding of the IPC signalling protocol messages

7.2.1 IPC signalling protocol messages

The IPC signalling protocol messages and their message identifiers are shown in Table 7-5/Q.2631.1.

TABLE 7-5/Q.2631.1
IPC messages and the coding of the message identifiers

Message	Acronym	Message Identifier
Confusion	CFN	0 0 0 0 0 0 1 1
Establish Confirm	ECF	0 0 0 0 0 1 0 0
Establish Request	ERQ	0 0 0 0 0 1 0 1
Modify Acknowledge	MOA	0 0 0 0 1 1 0 0
Modify Reject	MOR	0 0 0 0 1 1 0 1
Modify Request	MOD	0 0 0 0 1 1 1 0
Release Confirm	RLC	0 0 0 0 0 1 1 0
Release Request	REL	0 0 0 0 0 1 1 1
Reset Confirm	RSC	0 0 0 0 1 0 0 0
Reset Request	RES	0 0 0 0 1 0 0 1

7.2.2 Parameters of the IPC signalling protocol messages

The parameters of the IPC signalling protocol messages are shown in Table 7-6/Q.2631.1. The indications of “mandatory” and “optional” are for information only. The authoritative definition is given in § 8. If any difference between the indications in this clause and the definitions in § 8 exists, the definitions in § 8 take precedence.

Multiple presence of the same parameter in a single message is not permitted.

TABLE 7-6/Q.2631.1 (part 1 of 2)
Parameters of the IPC signalling protocol messages

Parameter	**Message**						
	ERQ	**ECF**	**REL**	**RLC**	**MOD**	**MOA**	**MOR**
Automatic Congestion Control	—	—	O	O	—	—	—
Cause	—	—	M	[1]	—	—	M
Connection Priority	O	—	—	—	—	—	—
Dedicated Bandwidth Preferred Transfer Capability	[2]	—	—	—	—	—	—
Dedicated Bandwidth Transfer Capability	[3]	—	—	—	[4]	—	—
Destination Endpoint E.164 Address	[5]	—	—	—	—	—	—
Destination Endpoint X.213 Address	[5]	—	—	—	—	—	—
Destination Signalling Association Identifier [6]	[7]	M	M	M	M	M	M
IP QoS	O	—	—	—	—	—	—
IP Transport Sink Address	M	M	—	—	—	—	—
IP Transport Type	O	—	—	—	—	—	—
Modify Support for Transfer Capability	O	O	—	—	—	—	—
Originating Signalling Association Identifier	M	M	—	—	—	—	—
Served User Generated Reference	O	—	—	—	—	—	—
Served User Transport	O	—	—	—	—	—	—
Statistical Bandwidth Preferred Transfer Capability	[2]	—	—	—	—	—	—
Statistical Bandwidth Transfer Capability	[3]	—	—	—	[4]	—	—

M Mandatory parameter
O Optional parameter
— Parameter not present

NOTES

1 The “Cause” parameter is present in the Release Confirm message if
   a) the RLC is used to reject a connection establishment, or
   b) the cause reports unrecognised information received in the REL message.

2 This parameter may only be included if “Modify Support for Transfer Capability” is included. At most one of these parameters is present in an instance of the message. If present it must refer to the same transfer capability as the Transfer Capability parameter present in the same Establish Request message.

3 Exactly one of these parameters must be present in an instance of the message.

4 Exactly one of these parameters is present in an instance of the message and only the same parameter that was present in the Establish Request message may be present.

5 Exactly one of these parameters is present in an instance of the message

6 This row designates the Destination Signalling Association Identifier field in the message header.

7 The Destination Signalling Association Identifier field contains the value “unknown”.

TABLE 7-6/Q.2631.1 (part 2 of 2)
Parameters of the IPC signalling protocol messages

Parameter	Message		
	RES	**RSC**	**CFN**
Cause	—	1)	M
Destination Signalling Association Identifier 2)	3)	M	M
IP Transport Sink Address	M	—	—
Originating Signalling Association Identifier	M	—	—

M Mandatory parameter
O Optional parameter
— Parameter not present
NOTES
1 The "Cause" parameter is present only if the cause reports unrecognised information received.
2 This row designates the Destination Signalling Association Identifier field in the message header.
3 The Destination Signalling Association Identifier field contains the value "unknown".

The identifiers of the IPC message parameters are defined in Table 7-7/Q.2631.1.

TABLE 7-7/Q.2631.1
Identifiers of the IPC message parameters

IPC Parameter	Ref.	Acronym	Identifier
Automatic Congestion Control	7.3.1	ACC	0 0 0 1 1 0 0 1
Cause	7.3.2	CAU	0 0 0 0 0 0 0 1
Connection Priority	7.3.3	CP	0 0 0 1 1 0 1 0
Dedicated Bandwidth Preferred Transfer Capability	7.3.4	PTC-DBW	0 0 0 1 0 0 0 1
Dedicated Bandwidth Transfer Capability	7.3.5	TC-DBW	0 0 0 0 0 1 0 1
Destination Endpoint E.164 Address	7.3.6	DEAE	0 0 0 0 0 0 1 1
Destination Endpoint X.213 Address	7.3.7	DEAX	0 0 0 0 0 1 0 0
IP QoS	7.3.8	IPQOS	0 0 0 1 0 0 0 0
IP Transport Sink Address	7.3.9	IPTA	0 0 0 0 0 0 1 0
IP Transport Type	7.3.10	IPTT	0 0 1 0 0 0 0 0
Modify Support for Transfer Capability	7.3.11	MSTC	0 0 0 0 1 1 1 0
Originating Signalling Association Identifier	7.3.12	OSAID	0 0 0 0 0 1 1 0
Served User Generated Reference	7.3.13	SUGR	0 0 0 0 0 1 1 1
Served User Transport	7.3.14	SUT	0 0 0 0 1 0 0 0
Statistical Bandwidth Preferred Transfer Capability	7.3.15	PTC-SBW	0 0 1 0 0 0 1 1
Statistical Bandwidth Transfer Capability	7.3.16	TC-SBW	0 0 1 0 0 0 0 1

7.3 Parameter specification of the IPC signalling protocol messages

7.3.1 Automatic Congestion Control

The sequence of fields in the Automatic Congestion Control parameter is shown in Table 7-8/Q.2631.1.

Table 7-8/Q.2631.1
Sequence of fields in the Automatic Congestion Control parameter

Field No.	Field	Ref.
1	IPC Node Automatic Congestion Level	7.4.3

7.3.2 Cause

The sequence of fields in the Cause parameter is shown in Table 7-9/Q.2631.1.

TABLE 7-9/Q.2631.1
Sequence of fields in the Cause parameter

Field No.	Field	Ref.
1	Cause Value	7.4.4
2	Diagnostics	7.4.5

7.3.3 Connection Priority

The sequence of fields in the Connection Priority parameter is shown in Table 7-10/Q.2631.1.

TABLE 7-10/Q.2631.1
Sequence of fields in the Connection Priority parameter

Field No.	Field	Ref.
1	Priority	7.4.6

7.3.4 Dedicated Bandwidth Preferred Transfer Capability

The sequence of fields in the Dedicated Bandwidth Preferred Transfer Capability parameter is shown in Table 7-11/Q.2631.1.

TABLE 7-11/Q.2631.1
Sequence of fields in the Dedicated Bandwidth Preferred Transfer Capability parameter

Field No.	Field	Ref.
1	Peak bit rate	Note 1
2	Peak token bucket size associated with the Peak bit rate	Note 2
3	Maximum allowed packet size	Note 3
NOTE 1 - This field is coded as a Bit Rate field (see 7.4.10). NOTE 2 - This field is coded as a Token Bucket Size field (see 7.4.18). NOTE 3 – This field is coded as a Packet Size field (see 7.4.11)		

7.3.5 Dedicated Bandwidth Transfer Capability

The sequence of fields in the Dedicated Bandwidth Transfer Capability parameter is shown in Table 7-12/Q.2631.1.

TABLE 7-12/Q.2631.1
Sequence of fields in the Dedicated Bandwidth Transfer Capability parameter

Field No.	Field	Ref.
1	Peak bit rate	Note 1
2	Peak token bucket size associated with the Peak bit rate	Note 2
3	Maximum allowed packet size	Note 3
NOTE 1 - This field is coded as a Bit Rate field (see 7.4.10). NOTE 2 - This field is coded as a Token Bucket Size field (see 7.4.18). NOTE 3 – This field is coded as a Packet Size field (see 7.4.11)		

7.3.6 Destination Endpoint E.164 Address

The sequence of fields in the Destination Endpoint E.164 Address parameter is shown in Table 7-13/Q.2631.1.

TABLE 7-13/Q.2631.1
Sequence of fields in the Destination Endpoint E.164 Address parameter

Field No.	Field	Ref.
1	Nature of Address	7.4.7
2	E.164 Address	7.4.8

7.3.7 Destination Endpoint X.213 Address

The sequence of fields in the Destination Endpoint X.213 Address parameter is shown in Table 7-14/Q.2631.1.

TABLE 7-14/Q.2631.1
Sequence of fields in the Destination Endpoint X.213 Address parameter

Field No.	Field	Ref.
1	X.213 Address	7.4.9

7.3.8 IP QoS

The sequence of fields in the IP QoS parameter is shown in Table 7-15/Q.2631.1.

Table 7-15/Q.2631.1
Sequence of fields in the IP QoS parameter

Field No.	Field	Ref.
1	IP QoS Codepoint	7.4.10

7.3.9 IP Transport Sink Address

The sequence of fields in the IP transport address parameter is shown in Table 7-16/Q.2631.1.

TABLE 7-16/Q.2631.1
Sequence of fields in the IP Transport Sink Address parameter

Field No.	Field	Ref.
1	UDP Port Number	7.4.13
2	IP Address	7.4.14

IP address	**UDP port number**	**Meaning**
Null	ignored	All IP connections toward an adjacent IPC node associated with an IPC

		signalling association
Value	Value	The combination of both values uniquely identifies an IP connection between adjacent IPC nodes

A “Null” value of the IP address is never regarded as a valid IP address in an IP network. It is only used to identify all IP connections associated within one IPC signalling association.

7.3.10 IP Transport Type

The sequence of fields in the IP Transport Type parameter is shown in Table 7-17/Q.2631.1.

Table 7-17/Q.2631.1
Sequence of fields in the IP Transport Type parameter

Field No.	Field	Ref.
1	IP Transport Protocol Identifier	7.4.15

7.3.11 Modify Support for Transfer Capability

The Modify Support for Transfer Capability parameter has no fields, i.e. the parameter length is always zero.

7.3.12 Originating Signalling Association Identifier

The sequence of fields in the Originating Signalling Association Identifier parameter is shown in Table 7-18/Q.2631.1.

TABLE 7-18/Q.2631.1
Sequence of fields in the Originating Signalling Association Identifier parameter

Field No.	Field	Ref.
1	Originating Signalling Association	Note
NOTE - This field is coded as a Signalling Association Identifier field (see 7.4.2).		

7.3.13 Served User Generated Reference

The sequence of fields in the Served User Generated Reference parameter is shown in Table 7-19/Q.2631.1.

TABLE 7-19/Q.2631.1
Sequence of fields in the Served User Generated Reference parameter

Field No.	Field	Ref.
1	Served User Generated Reference	7.4.16

7.3.14 Served User Transport

The sequence of fields in the Served User Transport parameter is shown in Table 7-20/Q.2631.1.

TABLE 7-20/Q.2631.1
Sequence of fields in the Served User Transport parameter

Field No.	Field	Ref.
1	Served User Transport	7.4.17

7.3.15 Statistical Bandwidth Preferred Transfer Capability

The sequence of fields in the Statistical Bandwidth Preferred Transfer Capability parameter is shown in Table 7-21/Q.2631.1.

TABLE 7-21/Q.2631.1
Sequence of fields in the Statistical Bandwidth Preferred Transfer Capability parameter

Field No.	Field	Ref.
1	Peak bit rate	Note 1
2	Peak token bucket size associated with the Peak bit rate	Note 2
3	Sustainable bit rate	Note 1
4	Sustainable token bucket size associated with the Sustainable bit rate	Note 2
5	Maximum allowed packet size	Note 3
NOTE 1 - This field is coded as a Bit Rate field (see 7.4.10). NOTE 2 - This field is coded as a Token Bucket Size field (see 7.4.18). NOTE 3 – This field is coded as a Packet Size field (see 7.4.11)		

7.3.16 Statistical Bandwidth Transfer Capability

The sequence of fields in the Statistical Bandwidth Transfer Capability parameter is shown in Table 7-22/Q.2631.1.

TABLE 7-22/Q.2631.1
Sequence of fields in the Statistical Bandwidth Transfer Capability parameter

Field No.	Field	Ref.
1	Peak bit rate	Note 1
2	Peak token bucket size associated with the Peak bit rate	Note 2
3	Sustainable bit rate	Note 1
4	Sustainable token bucket size associated with the Sustainable bit rate	Note 2
5	Maximum allowed packet size	Note 3
NOTE 1 - This field is coded as a Bit Rate field (see 7.4.10). NOTE 2 - This field is coded as a Token Bucket Size field (see 7.4.18). NOTE 3 – This field is coded as a Packet Size field (see 7.4.11)		

7.4 Field specification of the IPC signalling protocol parameters

7.4.1 Compatibility

The structure of the Compatibility field is shown in Table 7-23/Q.2631.1; the field is a fixed size field of 1 octet.

TABLE 7-23/Q.2631.1
Structure of the Compatibility field

8	7	6	5	4	3	2	1	
Reserved					send notification indicator	instruction indicator		Octet 1

The following codes are used in the sub-fields of the compatibility information field.

a) Send notification indicator
- 0 Do not send notification.
- 1 Send notification.

b) Instruction indicator
- 00 Reserved.
- 01 Discard parameter (see Note).
- 10 Discard message.
- 11 Release Connection.

NOTE — When used as message compatibility field, value “01” should not be used. If received, it is interpreted so as to discard the message.

7.4.2 Signalling Association Identifier

The structure of the Signalling Association Identifier field is shown in Table 7-24/Q.2631.1; the field is a fixed size field of 4 octets.

TABLE 7-24/Q.2631.1
Structure of the signalling association identifier field

8	7	6	5	4	3	2	1	
								Octet 1
								Octet 2
								Octet 3
								Octet 4

The coding is implementation dependent.

If the signalling association identifier is used as a destination signalling association identifier that is not known, the field is set to zero indicating the value "unknown".

If the signalling association identifier is used as an originating signalling association identifier, the value zero shall not be used.

7.4.3 IPC Node Automatic Congestion Level

The structure of the IPC Node Automatic Congestion Level field is shown in Table 7-25/Q.2631.1; the field is a fixed size field of 1 octet.

Table 7-25/Q.2631.1
Structure of the IPC Node Automatic Congestion Level field

8	7	6	5	4	3	2	1	
IPC Node Automatic Congestion Level codepoint								Octet 1

CS5: The IPC Node Automatic Congestion Level Codepoint has the following meaning:

0000000 Spare
0000001 Congestion Level 1 exceeded
0000010 Congestion Level 2 exceeded
0000011 to 1111111 } Spare

7.4.4 Cause Value

The structure of the Cause Value field is shown in Table 7-26/Q.2631.1; the field is a fixed size field of 2 octets.

TABLE 7-26/Q.2631.1
Structure of the Cause Value field

8	7	6	5	4	3	2	1	
Reserved						Coding Standard		Octet 1
Reserved	Cause							Octet 2

Coding Standard

00 ITU-T standardised coding as described in Q.850 [12] and Q.2610 [13]
01 ISO/IEC standard (Note)
10 national standard (Note)

11 standard defined for the network (either public of private) present on the network side of the interface (Note)

NOTE — These other coding standards should be used only when the parameter contents cannot be represented with the ITU-T standardised coding.

The procedures defined in § 8 make use of ITU-T standardised codes described in Q.850 [12] and Q.2610 [13]. The codes are listed here for convenience. If there exists any difference in the names and code points of the following causes, the definitions in Q.850 [12] and Q.2610 [13] take precedence.

Code	Cause Description
1	Unallocated (unassigned) number
3	No route to destination
25	Exchange routing error
31	Normal, unspecified
38	Network out of order
41	Temporary failure
42	Switching equipment congestion
47	Resource unavailable, unspecified
95	Invalid message, unspecified
96	Mandatory information element is missing
97	Message type non-existent or not implemented
99	Information element/parameter non-existent or not implemented
100	Invalid information element contents
102	Recovery on timer expiry
110	Message with unrecognised parameter, discarded
111	Protocol error, unspecified

7.4.5 Diagnostics

The structure of the Diagnostics field is shown in Table 7-27/Q.2631.1; the field is a variable size field.

TABLE 7-27/Q.2631.1
Structure of the Diagnostic field

8	7	6	5	4	3	2	1	
Field Length								Octet 1
Diagnostic								Octet 2
								Octet n

The coding is specified in ITU-T Recommendation Q.2610 [13] except when associated with one of the following causes:

- Message type non-existent or not implemented,
- Information element/parameter non-existent or not implemented, or
- Message with unrecognised parameter, discarded.

In these cases, the Diagnostics field is shown in Table 7-28/Q.2631.1; the field is a variable size field.

Table 7-28/Q.2631.1
Structure of the Diagnostic field for compatibility causes

8	7	6	5	4	3	2	1	
Field Length								Octet 1
Message Identifier								Octet 2
first			Parameter Identifier					Octet 3
pair			Field Number					Octet 4
second			Parameter Identifier					Octet 5
pair			Field Number					Octet 6
last			Parameter Identifier					
pair			Field Number					Octet n

The Diagnostic field for compatibility always starts — after the field length — with an octet containing the copy of the Message Identifier (of the message that gave rise to a compatibility diagnostic) followed by 0 to 125 octet pairs each containing a parameter identifier and a field number. If the field number octet is zero, the whole parameter is designated.

7.4.6 Priority

The structure of the Priority field is shown in Table 7-29/Q.2631.1; the field is a fixed size field of 1 octet.

Table 7-29/Q.2631.1
Structure of the Priority field

8	7	6	5	4	3	2	1	
Reserved					Priority			Octet 1

The priority codepoint has the following meaning:

0 0 0	level 1 (highest)
0 0 1	level 2
0 1 0	level 3
0 1 1	level 4
1 0 0	level 5 (lowest)
1 0 1 to 1 1 1	reserved

7.4.7 Nature of Address

The structure of the Nature of Address field is shown in Table 7-30/Q.2631.1; the field is a fixed size field of 1 octet.

TABLE 7-30/Q.2631.1
Structure of the Nature of Address field

8	7	6	5	4	3	2	1	
Reserved	Nature of address code							Octet 1

The nature of address code has the following meaning:

0000000	Spare
0000001	Subscriber number (national use)
0000010	Unknown (national use) (note 1)
0000011	National (significant) number
0000100	International number
0000101	Network-specific number (national use) (note 2)
0000110 to 1101111	Spare
1110000 to 1111110	Reserved for national use
1111111	Spare

NOTE 1 — This code point is used when the type of number is indicated using the digits in the E.164 [14] Address field. The E.164 Address field is organised according to the network dialling plan; e.g. prefix digits might be present; in addition, escape digits may also be present.

NOTE 2 — This code point is used to indicate an administration/service number specific to the serving network.

7.4.8 E.164 Address

The structure of the E.164 [14] address field is shown in Table 7-31/Q.2631.1; the field is a variable size field.

TABLE 7-31/Q.2631.1
Structure of the E.164 Address field

8	7	6	5	4	3	2	1	
Field Length								Octet 1
Reserved				First hexadecimal digit of address - - - - Last hexadecimal digit of address				Octet 2 Octet n

7.4.9 X.213 Address

The structure of the X.213 [15] Address field is shown in Table 7-32/Q.2631.1; the field is a fixed size field of 20 octets.

TABLE 7-32/Q.2631.1
Structure of the X.213 Address field

8	7	6	5	4	3	2	1	
NSAP								Octet 1
								Octet 20

7.4.10 IP QoS Codepoint

The structure of the IP QoS Codepoint field is shown in Table 7-33/Q.2631.1.

Table 7-33/Q.2631.1
Structure of the IP QoS Codepoint field

8	7	6	5	4	3	2	1	
DSCP						Reserved		Octet 1

The IP QoS Codepoint field accommodates the “Differentiated Services Codepoint (DSCP) Values” as specified in RFC2474 [8], RFC2597 [9], and RFC3246 [10] with the following encoding:

000000	Background
000001 to 001001	Spare
001010	AF11
001011 to 010001	Spare
010010	AF21
010011 to 011001	Spare
011010	AF31
011011	Spare
011100	AF32
011101	Spare
011110	AF33
011111 to 101101	Spare
101110	EF
101111 to 111111	Spare

7.4.11 Bit Rate

The structure of the Bit Rate field is shown in Table 7-34/Q.2631.1; the field is a fixed size field of 6 octets.

TABLE 7-34/Q.2631.1
Structure of the Bit Rate field

8	7	6	5	4	3	2	1	
Bit rate in the forward direction								Octet 1
								Octet 2
								Octet 3
Bit rate in the backward direction								Octet 4
								Octet 5
								Octet 6

A Bit rate may be used as a Peak CPS bit rate or a Sustainable CPS bit rate according to ITU-T Recommendation Y.1221[17]. Allowed Bit rates are 0 to 16384 kbit/s. The granularity is 64 bit/s.

The following values for Bit rates in either specified direction are allowed :-

0 – 262144 Corresponding to Bit rates of 0 – 16 Mbit/s

262145 – 16777215 Spare

7.4.12 Packet Size

The structure of the Packet Size field is shown in Table 7-35/Q.2631.1; the field is a fixed size field of 4 octets.

TABLE 7-35/Q.2631.1
Structure of the Packet Size field

8	7	6	5	4	3	2	1	
Packet size in the forward direction								Octet 1
								Octet 2
Packet size in the backward direction								Octet 3
								Octet 4

A Packet size may be used as maximum allowed packet size, in octets, allowed to be sent in the specified direction during the holding time of the connection according to ITU-T Recommendation Y.1221[17]. Allowed packet sizes are 0 to 1500 octets.

When calculating the Packet sizes, all the transport headers are included, e.g. IP header, UDP header and, if relevant, RTP header.

As an example, when the transport is UDP over IP, the valid range of this field is:

0 maximum packet size value (used in case of uni-directional connections)

1 – 28 reserved

29 – 1500 maximum packet size value

1501 – 65535 spare

7.4.13 UDP Port Number

The structure of the UDP Port Number field is shown in Table 7-36/Q.2631.1; the field is a fixed size field of 2 octets.

TABLE 7-36/Q.2631.1
Structure of the UDP Port Number field

8	7	6	5	4	3	2	1	
UDP port number								Octet 1 Octet 2

The UDP Port Number field represents a port number as specified in [6] to be used for the user data flow.

7.4.14 IP Address

The structure of the IP Address field is shown in Table 7-37/Q.2631.1; the field is a variable size field.

TABLE 7-37/Q.2631.1
Structure of the IP Address field

8	7	6	5	4	3	2	1	
Field Length								Octet 1
IP Address								Octet 2 Octet n

Depending on the IP version in use the length of the IP Address field is either 4 (IPv4 [4]) or 16 (IPv6 [5]).

The IP Address field represents an address as specified in IPv4 [4] or IPv6 [5] to be used for the user data flow.

An IPv4 [4] IP address written in decimal representation as $d_1.d_2.d_3.d_4$ is represented by d_1 in octet 2……d_4 in octet 5

An IPv6 address ([5], [11]) represented hexadecimally as $w_1x_1y_1z_1$:……:$w_8x_8y_8z_8$, is represented by w_1 in the lowest order bits of octet 2……z_8 in the highest order bits of octet 17.

7.4.15 IP Transport Protocol Identifier

The structure of the IP Transport Protocol Identifier field is shown in Table 7-38/Q.2631.1.

Table 7-38/Q.2631.1
Structure of the IP Transport Protocol Identifier field

8	7	6	5	4	3	2	1	
Reserved				Transport Protocol				Octet 1
Reserved	Payload Type							Octet 2

The Transport Protocol specifies whether UDP [6], or RTP [7] over UDP [6] is used for the user data flow and has the following encoding:

0000 Spare
0001 UDP
0010 RTP over UDP
0011 to 1111 Spare

The Payload Type specifies the RTP payload type, as defined in RFC 1889 [7] and is only valid when the Transport Protocol indicates RTP as one of the transport protocols. In all other cases, the Payload Type shall be set to zero.

7.4.16 Served User Generated Reference

The structure of the Served User Generated Reference field is shown in Table 7-39/Q.2631.1; the field is a fixed size field of 4 octets.

TABLE 7-39/Q.2631.1
Structure of the Served User Generated Reference field

8	7	6	5	4	3	2	1	
								Octet 1
								Octet 2
								Octet 3
								Octet 4

7.4.17 Served User Transport

The structure of the Served User Transport field is shown in Table 7-40/Q2631.1; the field is a variable size field.

TABLE 7-40/Q.2631.1
Structure of the Served User Transport field

8	7	6	5	4	3	2	1	
Field Length								Octet 1
								Octet 2
Served User Transport								
								Octet n

The served user transport length can be from 1 to 254 octets.

7.4.18 Token Bucket Size

The structure of the Token Bucket size field is shown in Table 7-41/Q.2631.1; the field is a fixed size field of 4 octets.

TABLE 7-41/Q.2631.1
Structure of the Token Bucket Size field

8	7	6	5	4	3	2	1	
Token Bucket size in the forward direction								Octet 1
								Octet 2
Token Bucket size in the backward direction								Octet 3
								Octet 4

A Token Bucket size may be used as token bucket size, in octets, associated with peak or with sustainable bit rates allowed for the specified direction according to ITU-T Recommendation Y.1221[17]. Allowed values are 0 to 1500 octets for token bucket sizes associated with peak bit rates, and 0 to 3200 octets for token bucket sizes associated with sustainable bit rates.

When calculating the token bucket sizes, all transport headers are included, e.g. IP header, UDP header and, if relevant, RTP header.

As an example, when the transport is UDP over IP, the valid range of this field is:

0 Token Bucket size (used in case of uni-directional connections)

1 – 28	reserved
29 – 1500	Token Bucket size associated with peak or sustainable bit rates
1501 – 3200	Token Bucket size associated with sustainable bit rates
3201 - 65535	spare

8 Procedure of the IPC signalling protocol

Each IP connection request shall contain an Endpoint Address which indicates the destination of the intended IP connection instance. This information is used by the originating IPC signalling endpoint to route the IP establish request message to the destination IPC signalling endpoint. In capability set 1, the supported address formats are: E.164 [14] and X.213 [15].

It is up to the application area or the operator of a particular network to decide what addressing plan is used in the IP network.

NOTE — Causes in the procedures defined in § 8 specify which ITU-T standardised code should be used in cause parameters of IPC signalling protocol messages. Implementation dependent non-standardised causes may be used for IPC signalling entity internal processing and for IPCU-SAP, GST-SAP, and LM-SAP cause primitive parameters.

The following procedures may be supported as a network option:

a) Connection Priority

b) Automatic Congestion Control (see Recommendation Q.542 [16])

8.1 Compatibility

8.1.1 General requirements on receipt of unrecognised signalling information

It may occur that an IPC node receives unrecognised signalling information, i.e. messages, parameter types or sub-field values. This can typically be caused by the upgrading of the signalling system used by other IPC nodes in the network. In these cases the following compatibility procedures are invoked to ensure the predictable network behaviour.

All messages and parameters shall include a compatibility field generated by the IPC signalling entity.

The procedures to be used on receipt of unrecognised information make use of:

- compatibility field received in the same message as the unrecognised information;
- the cause parameter containing a cause value and diagnostics;
- the confusion message and the release request message (maintaining the signalling association); and
- the release confirm message and the reset confirm message (terminating the signalling association).

The following causes are used:

- "message type non-existent or not implemented";
- "information element/parameter non-existent or not implemented"; or
- "message with unrecognised parameter, discarded".

For all the above causes a diagnostic field is included containing, dependant on the cause, the message identifier and zero, one, or more pairs of parameter identifier and field number.

The procedures are based on the following assumptions:

i) Since IPC nodes can be both national and international nodes, the compatibility mechanism is applicable to the national and international network.

ii) If an IPC node receives a confusion message, a release request message, a release confirm message or a reset confirm message indicating an unrecognised message or parameter received, it assumes interaction with an IPC node supporting a different functional level.

NOTE — An IPC node may be at a different functional level due to having implemented a different capability set or another subset of the protocol specified in this Recommendation.

When an unrecognised parameter or message is received, the IPC signalling entity will find some corresponding instructions contained in the parameter compatibility information or message compatibility field respectively. The message compatibility field contains the instructions specific for the handling of the complete message.

The following general rules apply to the interpretation of these instruction indicators:

a) "Reserved" sub-fields of the compatibility field are not examined. They may be used by future capability sets of this Recommendation; in this case, the future capability sets will set the currently defined instruction indicators to a reasonable value for IPC nodes implementing the current capability set. This rule ensures that more types of instructions can be defined in the future without creating a backward compatibility problem.

b) At an IPC signalling entity, the IP connection is released, using normal release procedures, if the instruction indicator is set to "release connection".

c) At an IPC signalling entity, if the instruction indicator is set to: "Discard message", or "Discard parameter", the message or parameter is discarded, as instructed. If the send notification indicator is set to "send notification", the appropriate message is issued towards the IPC signalling entity that sent the unrecognised information:
- A confusion message is sent in response to an establish request message, an establish confirm message or in response to an unrecognised message.
- The appropriate confirm message is sent in response to a release request message or reset request message.
- No response is returned in response to a confusion message, release confirm message, or reset confirm message.

d) For the case of an unrecognised parameter, it is possible for the instruction to require that either the unrecognised parameter or the whole message is discarded. This provides for the case where the sending IPC signalling entity determines that it is not acceptable for the message to continue being processed without this parameter.

8.1.2 Procedures for the handling of the unrecognised messages or parameters

If the unrecognised signalling information is received, an ERROR.indication primitive with an appropriate cause (described in the following sections) is sent to layer management.

A confusion message must not be issued in response to the following messages:
- Confusion
- Release request
- Release confirm
- Reset request
- Reset confirm

Any unrecognised parameters received in the following messages are discarded:
- Confusion
- Release confirm
- Reset confirm

8.1.2.1 Unrecognised messages

Depending on the instructions received in the message compatibility field, an IPC signalling entity receiving an unrecognised message will either:

a) discard the message;

b) discard the message and send notification; or

c) release the connection.

The release request in case c) and the confusion message in case b) shall include the cause "Message type non-existent or not implemented", followed by a diagnostic field containing only the message identifier.

8.1.2.2 Unrecognised parameters

Unexpected parameters (a parameter in the "wrong" message) are handled like unrecognised parameters.

Depending on the instructions received in the parameter compatibility information field, an IPC signalling entity receiving an unrecognised parameter will either:

a) discard the parameter;

b) discard the parameter and send notification;

c) discard the message;

d) discard the message and send notification; or

e) release the connection.

In case b), the confusion message shall include the cause "Information element/parameter non-existent or not implemented" followed by a diagnostic field containing the message identifier and containing pairs of parameter identifier and field number for each unrecognised parameter; the field number in each pair is set to "zero".

In case d), the confusion message shall include the cause "Message with unrecognised parameter, discarded", followed by a diagnostic field containing the message identifier and a parameter identifier (of the first detected unrecognised parameter which caused the message to be discarded) and a field number set to "zero". A confusion message may refer to multiple unrecognised parameters.

A IPC signalling entity receiving a message including multiple unrecognised parameters shall process the different instruction indicators, associated with those parameters, according to the following order:

1) release the connection;

2) discard the message and send notification;

3) discard the message.

A release request message shall include the cause "Information element/parameter non-existent or not implemented" followed by a diagnostic field containing the message identifier, the parameter identifier (of the first detected unrecognised parameter which caused the connection to be released), and a field number set to "zero".

If a release request message is received containing an unrecognised parameter, depending on the instructions received in the parameter compatibility field the signalling entity will either:

- discard the parameter; or
- discard the parameter and send a cause "Information element/parameter non-existent or not implemented", in the release confirm message; the diagnostic field contains the message identifier and one or more pairs of parameter identifier and field number indicating all parameters that match the cause value; the field number of all pairs contains the null value.

If a reset request message is received containing an unrecognised parameter, depending on the instructions received in the parameter compatibility field the IPC signalling entity will either:

- discard the parameter; or
- discard the parameter and send a cause "Information element/parameter non-existent or not implemented", in the reset confirm message; the diagnostic field contains the message identifier and one or more pairs of parameter identifier and field number indicating all parameters that match the cause value; the field number of all pairs contains the null value.

8.1.2.3 Unrecognised fields

There exists no specific compatibility information for each field. For all fields contained in a parameter, the compatibility information of the parameter applies.

Any value in a sub-field that is marked as "spare", "reserved" or "national use" is regarded as unrecognised and the procedures as stated for unrecognised parameters apply except that the field number is coded in the diagnostics field.

8.1.3 Procedures for the handling of responses indicating unrecognised information has been sent

Action taken on receipt of responses indicating unrecognised information has been sent at an originating or terminating IPC signalling entity will depend on the connection state and the affected service.

The definition of any procedure that is outside the basic connection set-up protocol, as defined in this Recommendation, should include procedures for handling responses that indicate that another IPC signalling entity has received, but not recognised, information belonging to that procedure. The procedure receiving this response should take the appropriate actions.

The default action taken on receipt of a confusion message is to discard the message without disrupting normal connection processing.

8.2 IP Connection Control Procedures

8.2.1 Connection Control

8.2.1.1 Successful Connection Set-up

8.2.1.1.1 Actions at Originating IPC Signalling Entity

When the IPC signalling entity receives an ESTABLISH.Request primitive from the IPC user, the following restrictions on the optionality of the parameters of the primitive apply:

- The Preferred Transfer Capability parameter shall only be present if the Modify Support for Transfer Capability parameter is also present;
- If a Preferred Transfer Capability parameter is specified, it has to refer to the same transfer capability as the Transfer Capability parameter (for example, if the Transfer Capability parameter indicates a Dedicated Bandwidth Transfer Capability, the Preferred Transfer Capability, if present, may only indicate a Dedicated Bandwidth Transfer Capability).

Upon reception of the ESTABLISH.Request primitive from the IPC user, an originating IPC signalling entity instance is created. The originating IPC signalling entity instance analyses the routing information and selects a route with sufficient IP resources to the destination IPC node.

NOTE 1 — Routing typically is based on:

- Addressing information,
- Transfer Capability,
- Automatic congestion control and the congestion level in the routing tables,
- Connection Priority, and
- IP Transport Type.

A local IP Transport sink address (i.e. an IP address and UDP port number) and other resources (e.g. indicated by Transfer Capability and Connection Priority) are allocated by the originating IPC signalling entity instance.

Under the normal condition, when the network is not congested and the originating IPC signalling entity has the necessary resources to complete it, the connection establishment is processed without special treatments.

NOTE 2 - In times of network congestion, when the originating IPC signalling entity does not have sufficient resources to complete all of the incoming connection establishment requests, as one option, the originating IPC signalling entity may give preferential treatments based on the priority level. The preferential treatment should include access to reserved network resources, e.g.:

1) the highest priority connections are given access to available network resources including the resources reserved for highest priority connections;

2) the second highest priority connections are given access to available network resources including the resources reserved for the second highest priority connections, except for the resources reserved for the highest priority connections, and so on;

NOTE 3 - Allocation of reserved network resources to specific priority levels is implementation specific, and is not a subject for standardisation.

A free Signalling Association Identifier is allocated and an ERQ message (establish request) is sent to the destination IPC node and Timer_ERQ started. The ERQ message contains a destination signalling association identifier field set to the "unknown" value and an originating signalling association identifier parameter. The ERQ message also contains the Transfer Capability and the Destination IP Endpoint Address as received from the IPC user and the local IP Transport sink address.

The Destination Endpoint Address, the Transfer Capability, the IP QoS, the IP Transport Type, the Modify Support for Transfer Capability, the Preferred Transfer Capability, the Served User Generated Reference and the Served User Transport shall not be modified by either originating or terminating IPC signalling entities. The Served User Generated Reference and the Served User Transport are parameters with significance to the IPC user only; therefore they shall not be examined by either originating or terminating signalling entities.

The following parameters are included in the ERQ message only if they were received from the IPC User: the Connection Priority, the Destination Endpoint Address; the Transfer Capability, the IP QoS, the Preferred Transfer Capability, the Modify Support for Transfer Capability, the Served User Generated Reference and the Served User Transport.

NOTE 4 — Through-connection of the transmission path at an IPC node is not specified by this Recommendation. It may be controlled by the IPC user.

If an ECF message (establish confirm) is received, Timer_ERQ is stopped and an ESTABLISH.Confirm primitive is sent to the IPC user including a Modify Support for Transfer Capability parameter, if received. The handling of Transfer Capability and Modify Support for Transfer Capability parameters is specified in Annex A.

8.2.1.1.2Actions at Terminating IPC Signalling Entity

Upon receiving an ERQ message (establish request) with the DSAID set to "unknown", a terminating IPC signalling entity instance is created and a Signalling Association Identifier (SAID) is allocated.

The terminating IPC signalling entity instance checks the availability of a suitable local IP Transport sink address (i.e. an IP address and UDP port number) and other resources (e.g. indicated by Transfer Capability and Connection Priority). The handling of Transfer Capability and Modify Support for Transfer Capability parameters is specified in Annex A.

If a local IP Transport sink address and the other resources are available for the new IP connection, they are allocated to the new connection.
Under the normal condition, when the network is not congested and the terminating IPC signalling entity has the necessary resources to complete it, the connection establishment is processed without special treatments.

NOTE 1 - In times of network congestion, when the terminating IPC signalling entity does not have sufficient resources to complete all of the incoming connection establishment requests, as one option, the terminating IPC signalling entity may give preferential treatments based on the priority level. The preferential treatment should include access to reserved network resources, e.g.:

1) the highest priority connections are given access to available network resources including the resources reserved for highest priority connections;

2) the second highest priority connections are given access to available network resources including the resources reserved for the second highest priority connections, except for the resources reserved for the highest priority connections, and so on;

NOTE 2 - Allocation of reserved network resources to specific priority levels is implementation specific, and is not a subject for standardisation.

The Destination Endpoint Address, the Transfer Capability, the IP QoS, the IP Transport Type, the Modify Support for Transfer Capability, the Preferred Transfer Capability, the Served User Generated Reference and the Served User Transport shall not be modified by either originating or terminating IPC signalling entities. The Served User Generated Reference and the Served User Transport are parameters with significance to the IPC user only; therefore they shall not be examined by either originating or terminating signalling entities.

An ESTABLISH.indication primitive is sent to the terminating IPC user to inform it of the new connection establishment request. The terminating IPC signalling entity instance shall pass the Transfer Capability and, only if they were received in the ERQ message, the following parameters to the terminating IPC user only if they were received in the ERQ message: the Connection Priority, the Destination Endpoint Address; the Transfer Capability, the IP QoS, the Preferred Transfer Capability, the Modify Support for Transfer Capability, the Served User Generated Reference and the Served User Transport.

Upon reception of an ESTABLISH.response primitive from the IPC user, the terminating IPC signalling entity instance acknowledges the successful IP connection establishment by returning an ECF message (establish confirm) to the sender of the ERQ message. The ECF message contains both the Originating and Destination Signalling Association Identifiers and the local IP Transport Sink Address. If modification capability is supported the Modify Support for Transfer Capability parameter will also be included. The handling of Transfer Capability and Modify Support for Transfer Capability parameters is specified in Annex A.

NOTE 3 — Through-connection of the transmission path at an IPC nodes is not specified by this Recommendation. It may be controlled by the IPC user.

8.2.1.2 Unsuccessful/Abnormal Connection Set-up

8.2.1.2.1Actions at Originating IPC Signalling Entity

If the allocation of a local IP Transport sink address, the SAID, or other resources for the outgoing IP connection described in § 8.2.1.1.1 fails, a RELEASE.Confirm primitive is returned to the IPC user with one of the following causes:

- "Unallocated (unassigned) number";
- "No route to destination";
- "Resource unavailable, unspecified";
- “Switching equipment congestion”;
- "Network out of order"; or
- "Temporary failure".

If the originating IPC signalling entity cannot complete a high priority connection establishment request even after application of the preferential treatment, a RELEASE.Confirm primitive is returned to the IPC user with cause “Resource unavailable, unspecified”.

If the ERQ message (establish request) is longer than the signalling transport allows, the IPC user is informed by a RELEASE.Confirm primitive containing the cause “Protocol error, unspecified”.

If an RLC message (release confirm) is received by the originating IPC signalling entity instance, Timer_ERQ is stopped and the IPC user is informed by a RELEASE.Confirm primitive containing the cause received in the release confirm message. If the release confirm message indicates that there has been a change in the level of congestion of the adjacent IPC node, the routing tables in the originating IPC node shall be updated accordingly. The absence of an Automatic Congestion Control parameter indicates that there is no reported congestion in the adjacent IPC node, whilst if the Automatic Congestion Control parameter is present it indicates whether congestion level 1 or 2 has been exceeded. After the routing tables have been updated, the Automatic Congestion Control parameter is discarded.

In all of the above cases, any resources allocated to the originating IPC signalling entity instance are released and made available for new traffic. The originating IPC signalling entity instance is released.

If Timer_ERQ expires, the IPC user is informed by a RELEASE.Confirm primitive containing the cause "Recovery on timer expiry", any resources allocated to the originating IPC signalling entity instance, and the originating IPC signalling entity instance are released, and a reset procedure is initiated (see § 8.2.2.1.1 case 2 a)).

8.2.1.2.2Actions at Terminating IPC Signalling Entity

Upon reception of an ERQ message (establish request), if resources for the incoming IP connection are not available, or if the SAID allocation fails, an RLC message (release confirm) is returned containing the cause "Resource unavailable, unspecified". If the IPC user indicates that the establishment request has failed (reception of an RELEASE.response primitive from the IPC user), the terminating IPC signalling entity instance sends an RLC message to the peer IPC node, containing the cause received from the IPC user. The terminating IPC signalling entity instance examines the congestion level of the IPC node. If either of the two congestion thresholds is exceeded, an Automatic Congestion Control parameter is included in the RLC message, indicating the level of congestion (congestion level 1 or 2) to the adjacent IPC node.

If the terminating IPC signalling entity cannot complete a high priority connection establishment request even after application of the preferential treatment, an RLC message (release confirm) is returned containing the cause "Resource unavailable, unspecified”.

In all of the above cases, any resources allocated to the terminating IPC signalling entity instance are released and made available for new traffic. The terminating IPC signalling entity instance is released.

8.2.1.3 Normal Connection Release

8.2.1.3.1Actions at IPC Signalling Entity that Originates the Release Request

When the IPC signalling entity instance receives a RELEASE.Request primitive from the IPC user, a REL message (release request) is sent and Timer_REL is started. The REL message contains the cause received from the IPC user, which shall be "Normal, unspecified" in case of normal connection release.

If an RLC message (release confirm) is received Timer_REL is stopped. If the RLC message indicates that there has been a change in the level of congestion of the adjacent IPC node, the routing tables in the IPC node shall be updated accordingly. The absence of an Automatic Congestion Control parameter indicates that there is no reported congestion in the adjacent IPC node, whilst if the Automatic Congestion Control parameter is present it indicates whether congestion level 1 or 2 has been exceeded. After the routing tables have been updated, the Automatic Congestion Control parameter is discarded.

Any resources allocated to the IPC signalling entity instance are released and made available for new traffic. The IPC signalling entity instance is released.

8.2.1.3.2Actions at IPC Signalling Entity that Receives the Release Request

Upon receiving a REL message (release request), a RELEASE.indication primitive is sent to the IPC user to inform it of the connection release request. The RELEASE.indication primitive contains the cause received in the REL message.

The IPC signalling entity instance acknowledges the successful IP connection release by returning a RLC message (Release Confirm) to the sender of the REL message. The IPC signalling entity instance examines the congestion level of the IPC node. If either of the two congestion thresholds is exceeded, an Automatic Congestion Control parameter is included in the RLC message, indicating the level of congestion (congestion level 1 or 2) to the adjacent IPC node.

Any resources allocated to the IPC signalling entity instance are released and made available for new traffic. The IPC signalling entity instance is released.

8.2.1.4 Abnormal Connection Release

If Timer_REL expires, any resources allocated to the IPC signalling entity instance, and the IPC signalling entity instance are released, and a reset procedure is initiated (see § 8.2.2.1.1 case 2 a)).

8.2.1.5 Release Request Collision

In the case of Release Request collision, i.e. a REL message is received by an IPC signalling entity instance whilst waiting for a response to a REL message already sent, Timer_REL is stopped and an RLC message is immediately returned to the peer IPC signalling entity instance. Any resources allocated to the IPC signalling entity instance are released and made available for new traffic. The IPC signalling entity instance is released.

8.2.1.6 Successful Modification

8.2.1.6.1Actions at IPC Signalling Entity that Originates the Modification Request

When the IPC signalling entity instance receives a MODIFY.Request primitive from the IPC user, the following restrictions on the optionality of the parameters of the primitive apply:

- The Transfer Capability parameter must refer to the same transfer capability as the Transfer Capability parameter in the ESTABLISH.request primitive (for example, if the Transfer Capability parameter in the ESTABLISH.request primitive indicated a Dedicated Bandwidth

Transfer Capability, the Transfer Capability parameter in the MODIFY.request primitive may only indicate a Dedicated Bandwidth Transfer Capability).

The IPC signalling entity checks the availability of resources indicated by the IPC user. If the resources are available for the IP connection, they are reserved. A MOD message (modify request) is sent to the peer IPC signalling entity instance and Timer_MOD is started. The MOD message contains the Transfer Capability parameter provided by the IPC user.

If a MOA message (modify acknowledge) is received by the IPC signalling entity instance, Timer_MOD is stopped and the reserved additional resources are allocated to the connection, or resources no longer required for this IP connection are freed. A MODIFY.Confirm primitive is sent to the IPC user to indicate the successful modification.

8.2.1.6.2 Actions at IPC Signalling Entity that Receives the Modification Request

Upon receiving a MOD message (modify request) the IPC signalling entity instance checks the availability of resources indicated in the MOD message. If the resources are available for the connection, they are reserved.

A MODIFY.indication primitive is sent to the IPC user to inform it of the modification request. The Transfer Capability received in the MOD message shall be passed to the IPC user.

Upon reception of a MODIFY.response primitive from the IPC user, the IPC signalling entity instance acknowledges the successful modification by returning a MOA message (modify acknowledge) to the sender of the MOD message. The reserved additional resources are allocated to the connection, or resources no longer required for this IP connection are freed.

8.2.1.7 Unsuccessful Modification

8.2.1.7.1 Actions at IPC Signalling Entity that Originates the Modification Request

If the required resources are not available, a MODIFY-REJECT.Confirm primitive is returned to the IPC user with the cause “Resource unavailable, unspecified”.

If a MOR message (modify reject) is received, all additional resources reserved for the modification request are freed. A MODIFY-REJECT.Confirm primitive is sent to the IPC user with the cause received in the MOR message.

If Timer_MOD expires, the IPC user is informed by a RELEASE.indication primitive containing the cause "Recovery on timer expiry", any resources allocated to the IPC signalling entity instance, and the IPC signalling entity instance are released, and a reset procedure is initiated (see § 8.2.2.1.1 case 2 a)).

8.2.1.7.2 Actions at IPC Signalling Entity that Receives the Modification Request

If the required resources are not available, an MOR message (modify reject) is returned to the peer IPC node with the cause “Resource unavailable, unspecified”.

If the IPC user indicates that the modification request has failed (reception of an MODIFY-REJECT.response primitive from the IPC user), all additional resources reserved for the modification request are freed and the IPC signalling entity instance sends a MOR message to the peer IPC node, containing the cause received from the IPC user.

8.2.1.8 Modification Collision

In the case of modification collision, i.e. a MOD message is received by an IPC signalling entity instance whilst waiting for a response to a MOD message already sent, Timer_MOD is stopped and a MOR message is immediately returned to the peer IPC signalling entity instance. All additional resources reserved for the modification request are freed.

8.2.1.9 Connection Release during Modification

When an IPC signalling entity instance receives either a RELEASE.Request primitive from the IPC user or a REL message (Release Request) from the peer IPC node whilst a modification request is being processed, the IPC signalling entity instance shall continue with normal connection release procedures.

8.2.2 Maintenance Control

8.2.2.1 Reset

The reset procedure is invoked under abnormal conditions such as when the current status of the IP connection is unknown or ambiguous, for example, an IPC node that has suffered memory mutilation will not know the status of one or several IP connections. All the affected IP connections and any associated resources (e.g. bandwidth, etc.) between the two adjacent IPC nodes shall be released. The resources are made available for new traffic.

The reset procedure covers the following two cases:

1) Case 1: Reset all IP connections associated with a signalling association between two adjacent IPC nodes.

2) Case 2: Reset a single IP connection between two adjacent IPC nodes.

The reset procedure should be initiated when:

a) Signalling anomalies are detected by the IPC signalling entity :-
   - Timer "Timer_ERQ" expiry - Action: Reset the single IP connection associated with the originating IPC signalling entity instance.
   - Timer "Timer_REL" expiry - Reset the single IP connection associated with either originating or terminating IPC signalling entity instance.
   - Timer “Timer_MOD” expiry - Reset the single IP connection associated with either originating or terminating IPC signalling entity instance.

b) Maintenance action is required to recover from abnormal conditions such as loss or ambiguity of association information (e.g., caused by memory mutilation) between SAID(s) and the connection status of either a specific IP connection, or all IP connections associated with a signalling association between two IPC nodes - Action: Reset a single IP connection or all IP connections associated with a signalling association between two adjacent IPC nodes respectively.

The reset procedures take precedence over the modification procedures.

8.2.2.1.1 Actions at Reset Initiating IPC Node

When a request for reset is received from either layer management (via the LM-SAP interface) or due to a timer expiry, a maintenance IPC signalling entity instance is created and an SAID allocated to it.

Reset procedures can be initiated to reset:

1) all IP connections associated with a signalling association between two adjacent IPC nodes,

2) a single IP connection between two adjacent IPC nodes.

For case 1, layer management passes a RESET.Request together with the indication “All IP connections associated with a signalling association” to the maintenance IPC signalling entity instance. The maintenance IPC signalling entity instance starts Timer_RES and sends a RES message (reset request) containing an indication that all IP connections associated with a signalling association are to be reset.

For case 2 there are two possible sub-cases, one due to timer expiry and the other due to layer management action:

a) After the expiry of Timer_ERQ, Timer_REL, or Timer_MOD, the IPC signalling entity starts Timer_RES and sends a RES message (reset request) containing a specific IP Transport Sink Address.

b) Layer management passes a RESET.Request together with the indication “a specific IP connection” to the maintenance IPC signalling entity instance. The maintenance IPC signalling entity instance starts Timer_RES and sends a RES message (reset request) containing the local IP Transport Sink Address of the affected IP connection.

In cases 1) and 2 b), the maintenance IPC signalling entity instance informs any affected IPC user with a RELEASE.Indication primitive with the cause "Temporary failure".

If an RSC message (reset confirm) is received, Timer_RES is stopped. Any affected resources are made available for new connections. The SAID allocated to the maintenance IPC signalling entity instance is released and made available for new traffic. The maintenance IPC signalling entity instance is released.

In case 2 a), a RESET.Indication primitive with the local IP Transport Sink Address parameter is sent to layer management; in all other cases, a RESET.Confirm primitive is sent to the layer management.

8.2.2.1.2Actions at Reset Responding IPC Node

When a RES message (reset request) is received, a maintenance IPC signalling entity instance is created and an SAID allocated to it.

1) If an indication that all IP connections associated with a signalling association must be reset is received, then all IP connections associated with a signalling association between the two adjacent IPC nodes are reset.

2) If an indication that a specific IP connection must be reset is received, only that IP connection is reset.

If resources have been assigned to any of the IP connections that are reset, any affected resources are made available for new connections. Layer management is informed about the receipt of the reset request by sending a RESET.Indication primitive with the same IP Transport Sink Address parameter that was received in the RES message. Any affected IPC user is informed with a RELEASE.Indication primitive with the cause "Temporary failure".

A RSC message (reset confirm) is returned to the sender of the RES message, the maintenance IPC signalling entity instance is released and the allocated SAID is made available for new traffic.

8.2.2.1.3Abnormal Reset Procedures

If the SAID allocation fails at the reset initiating IPC node, an ERROR.Indication primitive including the cause "Switching equipment congestion" and the IPTA parameter is sent to layer management. The maintenance IPC signalling entity instance is released.

If the SAID allocation fails at the reset responding IPC node, the maintenance IPC signalling entity instance is released and no further action is taken.

If Timer_RES expires following the initial sending of the RES message, Timer_RES is restarted and the maintenance IPC signalling entity will re-send the RES message, containing the same parameters as in the first sending of the RES message. The maintenance IPC signalling entity shall send an ERROR.Indication primitive to layer management including the cause "Recovery on timer expiry " and the IPTA parameter.

If Timer_RES expires following the second sending, or any subsequent sending of the RES message, Timer_RES is restarted and the maintenance IPC signalling entity will re-send the RES message, containing the same parameters as in the first sending of the RES message.

Upon receiving a STOP-RESET.Request primitive with adjacent ANI identifier and IP Transport Sink Address parameters from layer management, Timer_RES is stopped. Any affected resources are made available for new connections. The SAID allocated to the maintenance IPC signalling entity instance, and the maintenance IPC signalling entity instance, are released and made available for new traffic.

8.2.2.2 Transmission Fault Handling

Fully digital transmission systems are provided between all IPC nodes. They have some inherent fault indication features that give an indication to the IPC node when faults are detected on the transmission level. On receipt of a fault indication from layer management, the routing function in the node inhibits selection of affected IP Transport Sink Addresses for the period that the fault condition persists. No special action is required for active IP connections.

8.2.2.3 IPC Signalling Congestion Control

On receipt of a CONGESTION.Indication primitive from the generic signalling transport service, the IPC signalling entity instance should alter traffic load (e.g. connection attempts) toward the affected IPC nodes to align with the congestion level indicated by the primitive.

8.2.2.4 Adjacent IPC Node Availability

On receipt of an OUT-OF-SERVICE.Indication primitive from the generic signalling transport service, the following action is required:

All IP Transport Sink Addresses associated with the affected adjacent IPC node are marked as unavailable in the routing function prohibiting new connection establishments to that IPC node. Already established IP connections need not be released even though signalling messages cannot be sent to the affected IPC node.

On receipt of an IN-SERVICE.Indication primitive from the generic signalling transport service, the following action is required:

All IP Transport Sink Addresses associated with the affected adjacent IPC node are again marked available in the routing function. Reset procedures that may have started during the period of signalling isolation continue and ensure that affected IP connections are returned to an state whereby the resources are available for new IP connections. Already established IP connections are unaffected.

8.3 General Protocol Rules

8.3.1 Error Handling

If a parameter is present more than once in a message where this parameter is allowed only once, only the first parameter shall be processed; all subsequent instances of the parameter shall be ignored.

When receiving a message, which does not contain the minimum set of parameters, required to continue processing, a protocol error is reported to layer management with an ERROR.Indication primitive with a cause "Mandatory information element is missing" and the message is discarded.

8.3.2 Handling of signalling association identifiers

The following rules relating to Signalling Association Identifiers (SAID) apply:

- The IPC signalling entity instance that does not issue the value of such a field is not allowed to modify it but shall use it in the destination signalling association identifier field in the header of a messages directed towards the issuer.

- When a message is received at the generic signalling transport service access point (GST-SAP), the destination signalling association identifier field of the incoming message is used to distribute the messages to the appropriate IPC signalling entity instance.
- If a received message contains a destination signalling association identifier set to the "unknown" value and an originating signalling association identifier, a new terminating IPC signalling entity instance or a new maintenance IPC signalling entity instance is created and marked with a newly allocated signalling association identifier. The originating signalling association identifier parameter in the first response message issued by the new IPC signalling entity instance will inform the peer IPC signalling entity instance of the newly allocated signalling association identifier.
- If an IPC signalling entity instance sends a message to its peer IPC signalling entity instance, the message includes the signalling association identifier of the peer in the destination signalling association identifier field.
- If a new maintenance IPC signalling entity instance is created as a result of an incoming maintenance message, no signalling association identifier is allocated for it and no originating signalling association identifier parameter is conveyed to the peer IPC signalling entity instance in the first (and only) message issued by the new maintenance IPC signalling entity instance.

The sequence control parameter of the TRANSFER.Request primitive across the GST-SAP is allocated on a cyclic basis per IPC signalling entity instance.

All messages are sent in a TRANSFER.Request primitive. All messages are received in a TRANSFER.Indication primitive.

8.3.3 General protocol error handling

If a message is received that is too short to contain a complete message (i.e. less than 6 octets), it shall be ignored.

The message is discarded and layer management informed with an ERROR.Indication in the following cases:

- If the parameter length points beyond the end of the message - cause "Message with unrecognised parameter, discarded" is indicated.
- If the field length points beyond the end of the parameter - cause "Message with unrecognised parameter, discarded" is indicated.
- If an unrecognised message containing a destination signalling association identifier set to the "unknown" value - cause "Message type non-existent or not implemented" is indicated.

  NOTE — If an unrecognised message containing a valid destination signalling association identifier is received, the message is conveyed to the addressed IPC signalling entity instance as if it were a recognised message.
- If the message contains a destination signalling association identifier with an illegal/invalid value - cause "Invalid information element contents" is indicated.
- If the message is considered unexpected by the signalling procedures - cause "Invalid message, unspecified" is indicated.
- If a mandatory originating signalling association identifier parameter is not present - cause "Mandatory information element is missing" is indicated.
- If the originating signalling association identifier field is set to "zero" - cause "Invalid information element contents" is indicated.

8.4 List of timers

The timers used in the procedures described in § 8.2 are listed in Table 8-1/Q.2631.1 together with a timeout value range, their cause for setting the timer, resetting the timer, and the action at expiry of the timer.

Table 8-1/Q.2631.1
List of Timers

Timer	**Time-out value**	**Cause for initiation**	**Normal termination**	**At expiry**
Timer_ERQ	5-30 s (t1)	When an ERQ message is sent	At the receipt of ECF message	Release all resources and the IP connection, send RES message.
Timer_REL	2-60 s (t2)	When an REL message is sent	At the receipt of RLC message	Release resources, send RES message.
Timer_RES	2-60 s (t3)	When an RES message is sent	At the receipt of RSC message	At first expiry: Repeat RES message, restart Timer_RES, inform layer management. At subsequent expiry: Repeat RES message, restart Timer_RES.
Timer_MOD	5-30 s (t6)	When a MOD message is sent	At the receipt of MOA message	Release all resources and the IP connection, send RES message.
NOTE - In the diagnostic field associated with a cause field indicating “Recovery on timer expiry”, the timer number is included. Timer_ERQ is coded as the IA5 character “1”; Timer_MOD is coded as the IA5 character “6”.				

Annex A

Handling of the Transfer Capability in conjunction with the Connection Set-up and Modification procedures

(This Annex forms an integral part of this Recommendation.)

NOTE – In this Annex the terms "Transfer Capability" and "Preferred Transfer Capability" and the abbreviations "TC" and "PTC" do not distinguish between the different types of Transfer Capabilities, i.e. Dedicated Bandwidth and Statistical Bandwidth.

A.1 Preferred Transfer Capability parameter present

When an Establish Request (ERQ) message includes the following parameters:

- Preferred Transfer Capapbility (PTC),
- Transfer Capability (TC), and
- Modify Support for Transfer Capability (MSTC),

the Connection Admission Control at all IPC nodes shall initially be based on the most demanding of the Preferred Transfer Capability and the Transfer Capability ("max PTC/TC"). The concept of "demanding" depends on the Connection Admission Control algorithm in use, which is outside the scope of this Recommendation.

At a terminating IPC node the following applies:

Upon reception of the ESTABLISH.response primitive from the IPC user, the existence of a Modify Support for Transfer Capability parameter is checked :-

- If the IPC user indicates that modification is supported, the Preferred Transfer Capability is used for Connection Admission Control, and the ECF message (establish confirm) shall contain the Modify Support for Transfer Capability parameter.
- If the IPC user indicates that modification is not supported, the Transfer Capability is used for Connection Admission Control, and the ECF message (establish confirm) shall not contain the Modify Support for Transfer Capability parameter.

At an originating IPC node the following applies:

Upon reception of the ECF message (establish confirm) the existence of a Modify Support for Transfer Capability parameter is checked :-

- If the ECF message contains a Modify Support for Transfer Capability parameter, the Preferred Transfer Capability is used for Connection Admission Control, and the ESTABLISH.confirm primitive sent to the originating IPC user shall contain the Modify Support for Transfer Capability parameter.
- If the ECF message does not contain a Modify Support for Transfer Capability parameter, the Transfer Capability is used for Connection Admission Control, and the ESTABLISH.confirm primitive sent to the originating IPC user shall not contain the Modify Support for Transfer Capability parameter.

A.2. Preferred Transfer Capability parameter not present

When an Establish Request (ERQ) message includes the following parameters:

- Transfer Capability (TC), and
- Modify Support for Transfer Capability (MSTC),

the Connection Admission Control at all IPC nodes shall be based on the Transfer Capability.

At a terminating IPC node the following applies:

Upon reception of the ESTABLISH.response primitive from the IPC user, the existence of a Modify Support for Transfer Capability parameter is checked :-

- If the IPC user indicates that modification is supported, the ECF message (establish confirm) shall contain the Modify Support for Transfer Capability parameter.

- If the IPC user indicates that modification is not supported, the ECF message (establish confirm) shall not contain the Modify Support for Transfer Capability parameter.

At an originating IPC node the following applies:

Upon reception of the ECF message (establish confirm) the existence of a Modify Support for Transfer Capability parameter is checked :-

- If the ECF message contains a Modify Support for Transfer Capability parameter, the ESTABLISH.confirm primitive sent to the originating IPC user shall contain the Modify Support for Transfer Capability parameter.
- If the ECF message does not contain a Modify Support for Transfer Capability parameter, and the ESTABLISH.confirm primitive sent to the originating IPC user shall not contain the Modify Support for Transfer Capability parameter.

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Introduction

This document represents the draft new ITU-T Recommendation Q.2630.3 AAL type 2 Signalling Protocol (Capability Set 3) of (2003-09-11). The text has been agreed during the WP 4/11 plenary meeting in Geneva (Sept 10, 2003).

The Table of Contents is at the end of the document.

Summary

This Recommendation specifies the inter-node protocol and nodal functions that control AAL type 2 point-to-point connections.

The AAL type 2 signalling protocol specified in this Recommendation is usable in switched and non-switched environments and can operate in public or private networks over a range of signalling transport protocol stacks.

It also provides maintenance capabilities, carriage of user-plane protocol stack information and carriage of an identifier to link the connection control protocol with other higher layer control protocols.

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New ITU-T Recommendation Q.2630.3

AAL Type 2 Signalling Protocol (Capability Set 3)

(Geneva, September 2003)

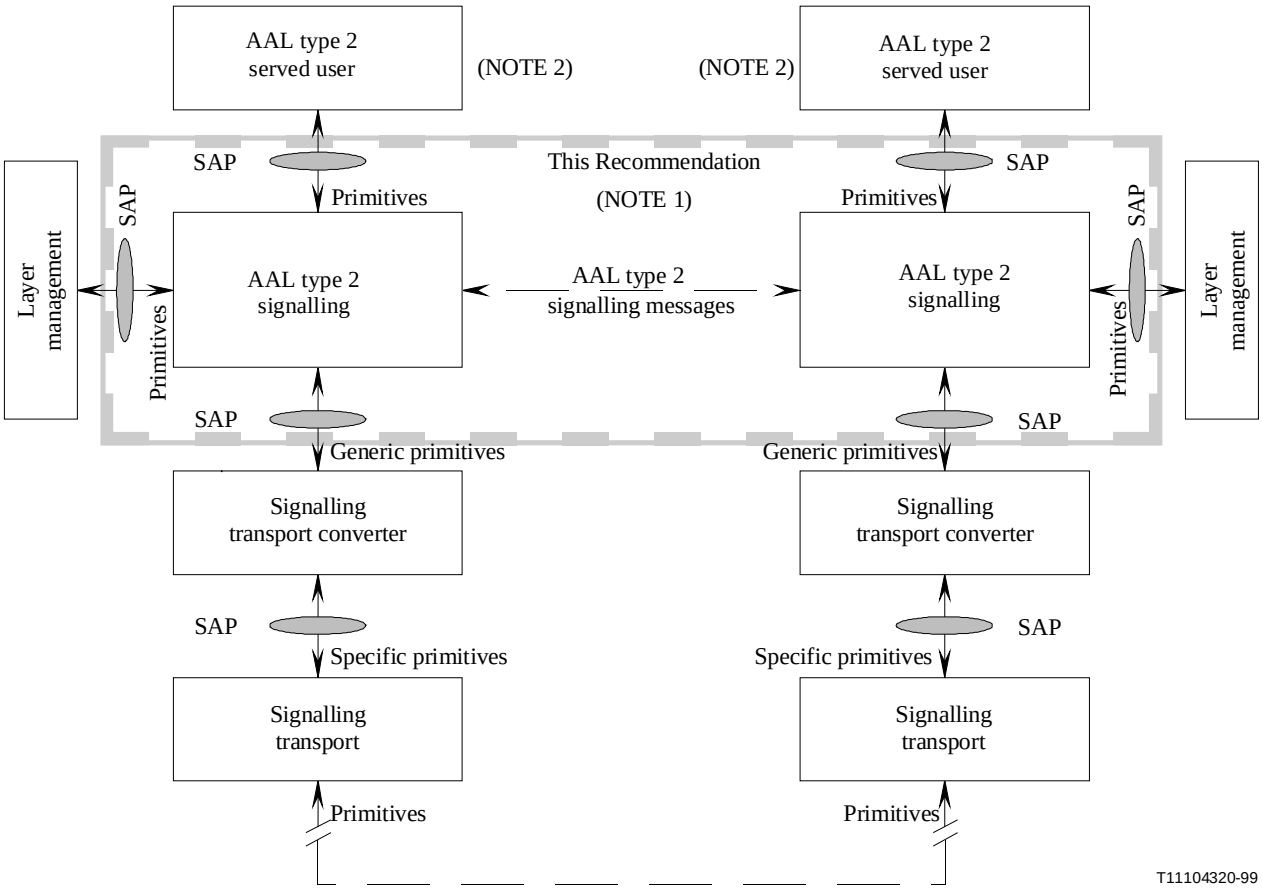
1 Scope

This Recommendation describes the AAL type 2 signalling protocol that supports the dynamic establishment and release of individual AAL type 2 point-to-point connections. It also describes the maintenance procedures, the framework of the protocol, and the interactions between an AAL type 2 signalling protocol entity and:

- The signalling protocol user;
- A signalling transport converter; and
- Layer management.

This Recommendation also describes the connection states, messages, parameters, timers, local, and peer-to-peer procedures used for the control of those connections. The scope of this Recommendation is illustrated in Figure 1-1/Q.2630.3. The AAL type 2 signalling protocol can be deployed over a range of signalling transport protocol stacks.

This Recommendation is based on the requirements defined in ITU-T Technical Report TRQ.2402[21] "Signalling Requirements for AAL type 2 Link Control Capability Set 3".



NOTE 1 - The entities and Service Access Points (SAP) bounded by the gray broken line indicate the extent of the definitions specified in this Recommendation.
NOTE 2 - There are cases where the AAL type 2 served user is not present.

FIGURE 1-1/Q.2630.3
Functional architecture of the AAL type 2 signalling

2 References

2.1 Normative references

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revisions; all users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of currently valid ITU-T Recommendations is regularly published.

[1] ITU-T Recommendation I.363.2 (2000) - B-ISDN ATM Adaptation Layer type 2 Specification.
[2] ITU-T Recommendation I.361 (1999) - B-ISDN ATM Layer Specification.
[3] ITU-T Recommendation X.200 (1994) - Information Technology - Open Systems Interconnection - Basic reference model: The basic model.
[4] ITU-T Recommendation X.210 (1993) - Information Technology - Open Systems Interconnection - Basic reference model: Conventions for the definition of OSI services.
[5] ITU-T Recommendation X.213 (2001) - Information Technology - Open Systems Interconnection - Network Service Definitions.
[6] ITU-T Recommendation Q.850 (1998) - Usage of cause and location in DSS 1 and SS No. 7 ISUP.
[7] ITU-T Recommendation Q.2610 (1999) - B-ISDN - Usage of Cause and Location in B-ISDN User Part and DSS 2.
[8] ITU-T Recommendation I.366.2 (1999) - AAL type 2 Service Specific Convergence Sublayer for Trunking.
[9] ITU-T Recommendation I.366.1 (1998) - Segmentation and Reassembly Service Specific Convergence Sub-layer for the AAL type 2.
[10] ITU-T Recommendation E.164 (1997) - The international public telecommunication numbering plan.
[11] IEEE Standard 802-1990 - IEEE Standards for Local and Metropolitan Area Networks: Overview and Architecture.
[12] ITU-T Recommendation Q.2150.0 - Generic Signalling Transport Service.
[13] ITU-T Recommendation I.356 (2000) – B-ISDN ATM layer cell transfer performance.
[14] ITU-T Recommendation I.366.2 (2000) – AAL type 2 Service Specific Convergence Sublayer for Narrowband Services.
[15] ITU-T Recommendation Q.2630.1 (1999) – AAL type 2 Signalling Protocol Capability Set 1.
[16] ITU-T Recommendation Q.2630.2 (2000) – AAL type 2 Signalling Protocol Capability Set 2.
[17] ITU-T Recommendation E.412 (1998) - Network Management Controls
[18] ITU-T Recommendation Q.542 (1993) - Digital Exchanges — Digital Exchange Design Objectives — Operations and Maintenance
[19] ITU-T Recommendation I.378 (2002) - Traffic Control and Congestion Control at the ATM Adaptation Layer Type 2

2.2 Bibliography

The documents listed in this clause provide informative background information for the reader and are not normative within this Recommendation.

[21] ITU-T Technical Report TRQ.2402 (2003) - Signalling Requirements for AAL type 2 Link Control Capability Set 3.
[22] ITU-T Recommendation Q.2150.1 - Signalling Transport Converter on MTP3 and MTP3b.
[23] ITU-T Recommendation Q.2150.2 - Signalling Transport Converter on SSCOP and SSCOPMCE.
[24] ITU-T Recommendation Q.2210 (1996) - Message Transfer Part level 3 functions and messages using the services of ITU-T Recommendation Q.2140.
[25] ITU-T Recommendation Q.2110 (1994) - B-ISDN Signalling - Service Specific Connection Oriented Protocol (SSCOP).
[26] ITU-T Recommendation Q.2130 (1994) - B-ISDN Signalling ATM Adaptation Layer - Service Specific Coordination Function for Support of Signalling at the User Network Interface (SSCF at UNI).
[27] ITU-T Recommendation Q.2941.2 (1999) - Broadband Integrated Services Digital Network (B-ISDN) - Digital Subscriber Signalling System No. 2 (DSS2) - Generic Identifier Transport Extensions.

[28] ITU-T Recommendation Q.2150.3 - Signalling Transport Converter on SCTP.
[29] ITU-T Recommendation Q.2140 - B-ISDN ATM adaptation layer - Service specific coordination function for signalling at the network node interface (SSCF at NNI)
[30] ETSI TS 126 103 Universal Mobile Telecommunications System (UMTS); Speech Codec List for GSM and UMTS (3GPP TS 26.103 version 5.1.0 Release 5)

3 Definitions

This Recommendation is based upon the concepts developed in ITU-T Recommendations X.200[3] and X.210[4].

In addition, for the purpose of this Recommendation, the following definitions apply:

AAL type 2 channel: A concept used in ITU-T Recommendation I.363.2[1] to describe transport of CPS-packets[1] associated in a common unique identifier value called CID on an ATM VCC.

AAL type 2 connection: The logical concatenation of one or more AAL type 2 links between two AAL type 2 service endpoints.

AAL type 2 connection resource: Describe the attributes of the AAL type 2 links making up the connection, and the Service Specific Convergence Sublayer resources used at the AAL type 2 service endpoints.

AAL type 2 link: The logical user plane communication facility between two adjacent AAL type 2 switching points or service endpoints. An AAL type 2 link is designated by a single CID value.

AAL type 2 link characteristics: Information that describes the attributes of the AAL type 2 link.

NOTE 1 — In this Recommendation, AAL type 2 link characteristics are only used for backward compatibility, i.e., for interworking with AAL type 2 nodes that conform only to ITU-T Recommendations Q.2630.1[15] or Q.2630.2[16] (see Annex C).

AAL type 2 node: An AAL type 2 service endpoint or an AAL type 2 switch.

AAL type 2 path: An ATM VCC between two adjacent AAL type 2 nodes. This ATM VCC can either be an SVC, SPVC, or PVC.

AAL type 2 path identifier: The identifier of the AAL type 2 path.

AAL type 2 requested path type: Information that describes the AAL type 2 path type. These path types may be “stringent class”, “tolerant class”, or “stringent bi-level class” (see ITU-T Recommendation I.356[13]).

AAL type 2 service endpoint: A termination point of an AAL type 2 connection.

AAL type 2 served user: The user of an AAL type 2 signalling protocol.

AAL type 2 signalling protocol: Control plane functions for establishing and releasing AAL type 2 connections and the maintenance functions associated with the AAL type 2 signalling.

AAL type 2 signalling transport: A facility for carrying AAL type 2 signalling messages.

AAL type 2 signalling endpoint: The termination point of an AAL type 2 signalling transport.

AAL type 2 switch: A system capable of switching AAL type 2 connections.

AAL type 2 transfer capability: Information that describes the attributes of the AAL type 2 link according to ITU-T Recommendation I.378[19].

NOTE 2 — The attributes of the AAL type 2 link as described by AAL type 2 transfer capability parameters are intended to replace the attributes of the AAL type 2 link as described by AAL type 2 link characteristics parameters. The AAL type 2 transfer capability may describe the attributes of the AAL type 2 link in greater detail than the AAL type 2 link characteristics.

ATM layer signalling: Control plane functions for establishing, clearing and maintaining ATM VCCs.

ATM VCC: The logical concatenation of one or more ATM virtual channel links between two ATM service endpoints.

Connection resource: (See AAL type 2 connection resource)

CS1 node: An AAL type 2 node conforming to capability set 1 (see ITU-T Recommendation Q.2630.1[15]).

CS1 service endpoint: An AAL type 2 service endpoint conforming to capability set 1 (see ITU-T Recommendation Q.2630.1[15]).

CS1 switch: An AAL type 2 switch conforming to capability set 1 (see ITU-T Recommendation Q.2630.1[15]).

CS2 node: An AAL type 2 node conforming to capability set 2 (see ITU-T Recommendation Q.2630.2[16]).

CS2 service endpoint: An AAL type 2 service endpoint conforming to capability set 2 (see ITU-T Recommendation Q.2630.2[16]).

CS2 switch: An AAL type 2 switch conforming to capability set 2 (see ITU-T Recommendation Q.2630.2[16]).

CS3 node: An AAL type 2 node, switch, or service endpoint conforming to capability set 3 (defined in this Recommendation).

CS3 service endpoint: An AAL type 2 service endpoint conforming to capability set 3 (defined in this Recommendation).

CS3 switch: An AAL type 2 switch conforming to capability set 3 (defined in this Recommendation).

Field: Information carried in a parameter in a message. A field can have fixed or variable length data.

Generic signalling transport: The function that enables an AAL type 2 signalling entity to communicate with a peer AAL type 2 signalling entity independently of the underlying signalling transport.

Link Associated Signalling Relationship: A logical signalling relationship that is established during AAL type 2 connection establishment between two protocol entities in adjacent AAL type 2 nodes associated with the AAL type 2 link as part of the connection. A link associated signalling relationship is uniquely identified by a pair of Signalling Association Identifiers (Originating and Destination) within a signalling transport association and for the time the link exists.

Link characteristics: (See AAL type 2 link characteristics.)

Network default stringent QoS class: A stringent QoS class as defined in ITU-T Recommendation I.356[13] and as deployed in a network operating with signalling defined in ITU-T Recommendation Q.2630.1[15].

Nodal function: The functions that provide the bridge between incoming and outgoing protocol entities, perform the routing, and keep track of the AAL type 2 path resources.

Parameter: Information carried in a message. A parameter has a fixed, defined set of fields.

Path identifier: See AAL type 2 path identifier.

Protocol entity: The functions performed within an AAL type 2 signalling entity that relate to the exchange of AAL type 2 signalling information.

Requested path type: (See AAL type 2 requested path type)

Signalling Transport Association: A signalling capability that exists between two adjacent AAL type 2 nodes to control the AAL type 2 connections that may exist in one or more AAL type 2 paths. There may be one or more signalling transport associations between two adjacent AAL type 2 nodes.

Signalling transport: A signalling link or network that connects two AAL type 2 nodes.

Signalling transport converter: A function that converts the services provided by a particular signalling transport to the services required by the generic signalling transport.

Subfield: The smallest unit of information in a field that has its own functional meaning.

Transfer capability: (See AAL type 2 transfer capability)

4 Abbreviations

A2P AAL type 2 Path Identifier
A2SU AAL type 2 Served User
AAL ATM Adaptation Layer
ACC Automatic Congestion Control
AESA ATM End System Address
AMR Adaptive Multi-rate Codec
ANI Adjacent AAL type 2 Node Identifier
ATM Asynchronous Transfer Mode
ATM VCC ATM Virtual Channel Connection
BCD Binary Coded Decimal
BLC Block Confirm Message
BLO Block Request Message
CAS Channel Associated Signalling
CAU Cause Parameter
CEID AAL type 2 Connection Element Identifier
CFN Confusion Message
CID Channel Identifier
CMD Circuit Mode Data
CP Connection Priority
CPHL CPS Packet Header Overhead Length
CPS (AAL type 2) Common Part Sublayer
CS Capability Set
CS1 Capability Set 1 (Q.2630.1[15])
CS2 Capability Set 2 (Q.2630.2[16])
CS3 Capability Set 3 (this Recommendation)
DA2EA Destination AAL type 2 Service Endpoint Address (Note 1)
DESEA Destination E.164 Service Endpoint Address Parameter (Note 1)
DNSEA Destination NSAP Service Endpoint Address Parameter (Note 1)
DSAID Destination Signalling Association Identifier
DTMF Dual Tone Multi-Frequency
ECF Establish Confirm Message
ERQ Establish Request Message
FAX Demodulated Facsimile Data
FBW Fixed Bandwidth Transfer Capability
FRM Frame Mode Data
GST Generic Signalling Transport
HBx Header Bit Rate associated with x
HC Hop Counter
ID Identifier
IEC International Electrotechnical Commission
IEEE The Institute of Electrical and Electronics Engineers
ISO International Standards Organization
LB Loopback
LC Link Characteristics (Note2)
LM Layer Management
LSB Least Significant Bit
M Mandatory
MF-R1 Multi-Frequency R1
MF-R2 Multi-Frequency R2
MOA Modification Acknowledge message
MOD Modification Request message
MOR Modification Reject message
MSSSI Modify Support for SSCS Information
MTP3b Message Transfer Part level 3 using Q.2140[29]
NF Nodal Function
NNI Network-Network Interface
NSAP Network Service Access Point
O Optional
OA2EA Origination AAL type 2 Service Endpoint Address
OESEA Origination E.164 Service Endpoint Address Parameter
ONSEA Origination NSAP Service Endpoint Address Parameter
OSAID Originating Signalling Association Identifier (Parameter)
OUI Organizational Unique Identifier
PFBW Preferred FBW
PLC Preferred Link Characteristics
PSSCS Preferred SSCS Information
PSSIAE Preferred Service Specific Information (Audio Extended)
PSSIME Preferred Service Specific Information (Multirate Extended)
PT Path Type
PTC Preferred Transfer Capability
PVBWS Preferred VBWS
PVBWT Preferred VBWT
PVC Permanent Virtual Channel
RC Rate Control
REL Release Request Message
RES Reset Request Message
RLC Release Confirm Message
RSC Reset Confirm Message
SAAL ATM Adaptation Layer for Signalling
SAID Signalling Association Identifier
SAP Service Access Point
SAR Segmentation and Reassembly (Sublayer)
SDL Specification and Description Language
SDU Service Data Unit
SPVC Soft PVC
SSCOP Service Specific Connection Oriented Protocol
SSCS Service Specific Convergence Sublayer
SSCS SSCS Information
SSIA Service Specific Information (Audio) Parameter
SSIAE Service Specific Information (Audio Extended)
SSIM Service Specific Information (Multirate) Parameter
SSIME Service Specific Information (Multirate Extended)
SSISA Service Specific Information (SAR-assured) Parameter
SSISU Service Specific Information (SAR-unassured) Parameter
SSSAR Segmentation and Reassembly Service Specific Convergence Sublayer

MSB	Most Significant Bit
MSLC	Modify Support for Link Characteristics
SUGR	Served User Generated Reference
SUT	Served User Transport
SVC	Switched Virtual Channel
SYN	Synchronization of change in SSCS operation
TAR	Temporary Alternative Routing
TC	Transfer Capability
TCC	TAR Controlled Connection
TCI	Test Connection Indication
TCS	Transfer Capability Support
TED	Transmission Error Detection
STC	Signalling Transport Converter
SUCI	Served User Correlation ID
UBC	Unblock Confirm Message
UBL	Unblock Request Message
UNI	User-Network Interface
UU	User-user
VBWS	Variable Bandwidth Stringent Transfer Capability
VBWT	Variable Bandwidth Tolerant Transfer Capability
VCC	Virtual Channel Connection
VPC	Virtual Path Connection

NOTE 1 — In ITU-T Recommendations Q.2630.1[15] and Q.2630.2[16] the abbreviation A2EA was used instead of DA2EA, ESEA instead of DESEA, and NSEA instead of DNSEA.

NOTE 2 — In ITU-T Recommendation Q.2630.1[15] the abbreviation ALC was used instead of LC.

5 General framework of the AAL type 2 signalling protocol

The AAL type 2 signalling protocol provides the signalling capability to establish, release and maintain AAL type 2 point-to-point connections across a series of ATM VCCs that carry AAL type 2 links. These services are accessible via the AAL type 2 served user service access point (A2SU-SAP).

The AAL type 2 signalling protocol also provides maintenance functions associated with the AAL type 2 signalling.

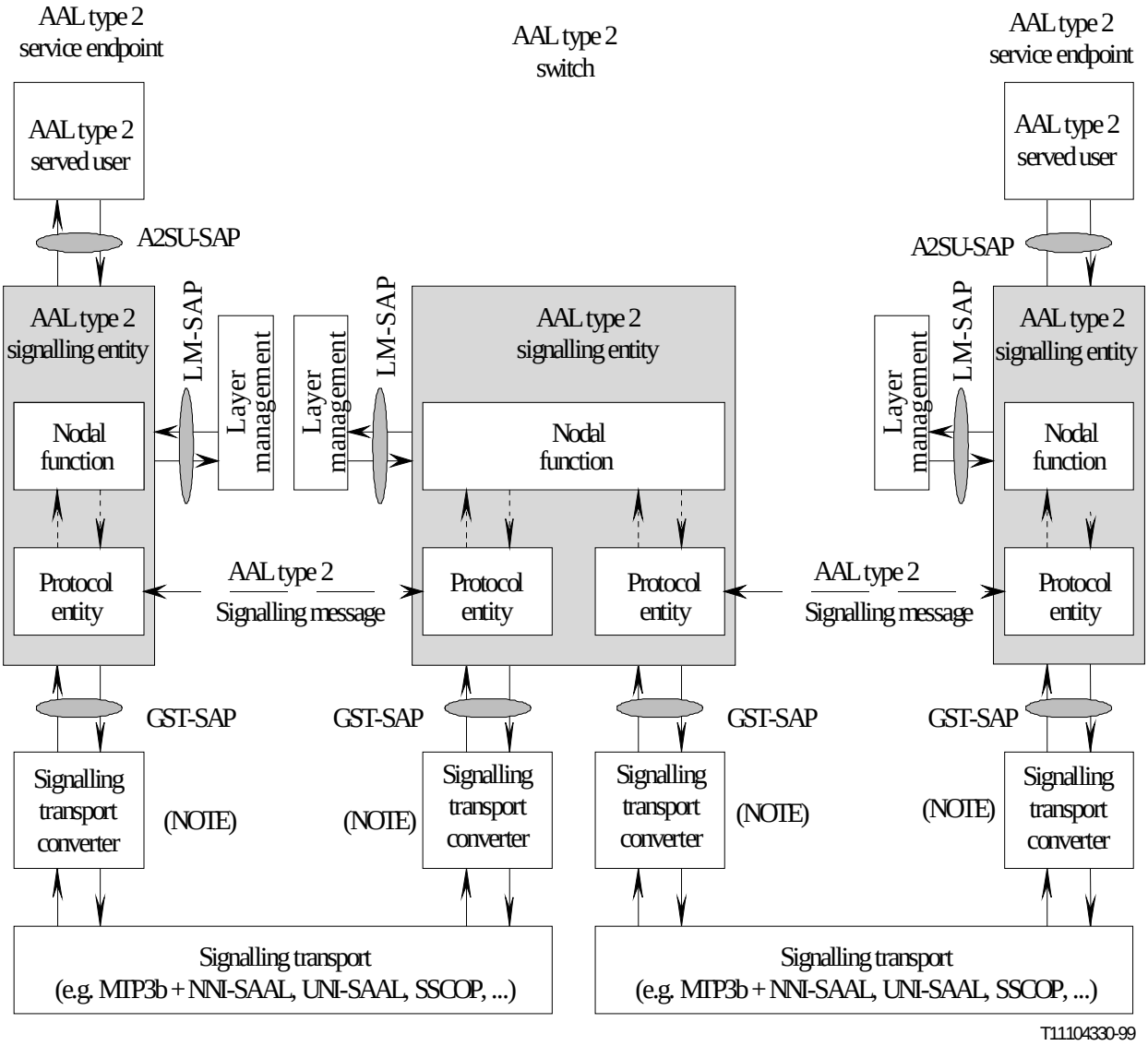
An AAL type 2 signalling endpoint shall be able to control AAL type 2 links on more than one AAL type 2 path. These AAL type 2 paths may be contained on different ATM VPCs, which in turn may be carried on different ATM physical interfaces.

Two peer AAL type 2 signalling entities rely on the generic signalling transport service to provide assured data transfer between them and service availability indications. These services are accessible via the Generic Signalling Transport Service Access Point (GST-SAP).

NOTE — Primitives over the A2SU-SAP, GST-SAP, and LM-SAP are used for descriptive purpose only. They do not imply a specific implementation.

Both peer AAL type 2 signalling entities provide the same set of services.

The AAL type 2 signalling entity is subdivided into protocol entities and nodal functions as shown in Figure 5-1/Q.2630.3. At each AAL type 2 service endpoint, the AAL type 2 signalling entity communicates with the AAL type 2 served user. At an AAL type 2 switch, the AAL type 2 signalling entity does not communicate with an AAL type 2 served user.



NOTE — In every AAL type 2 node, a signalling transport converter instance is associated with each AAL type 2 signalling transport.

FIGURE 5-1/Q.2630.3
AAL type 2 signalling protocol reference architecture

Protocol Entities define the interactions between two adjacent AAL type 2 nodes. AAL type 2 messages are exchanged between peer protocol entities using the generic signalling transport service.

The AAL type 2 signalling is independent of the signalling transport, although an assured data transport is required and a message size limit applies. The Generic Signalling Transport Service used is defined in ITU-T Recommendation Q.2150.0[12]. To adapt the Generic Signalling Transport Services to a specific signalling transport service, a signalling transport converter may be needed. The specification of signalling transport converters is beyond the scope of this Recommendation (see ITU-T Recommendation Q.2150.1[22], ITU-T Recommendation Q.2150.2[23], and ITU-T Recommendation Q.2150.3[28]).

The protocol entity is divided into several procedures as shown in Figure 5-2/Q.2630.3.

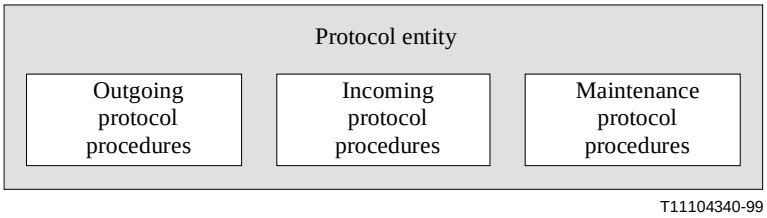


FIGURE 5-2/Q.2630.3
Internal structure of the AAL type 2 signalling protocol entity

The outgoing protocol procedures provide the mechanism to initiate an AAL type 2 connection request. The incoming protocol procedures are applied when a request for an AAL type 2 connection is received from a peer entity. Both of these procedures provide for the orderly release of an AAL type 2 connection. The maintenance protocol procedures provide the mechanisms to align the status of the AAL type 2 resources at the two adjacent AAL type 2 nodes and the procedures to block and unblock an AAL type 2 path.

The unrecognized information procedures in the nodal function as well as in the protocol entities provide the forward compatibility mechanism which enables extension of the protocol in the future.

The nodal function provides the bridge between incoming and outgoing protocol entities, performs the routing functionality, and keeps track of the AAL type 2 path resources.

5.1 Interface between the AAL type 2 signalling entity and the AAL type 2 served user

5.1.1 Service provided by the AAL type 2 signalling entity

The AAL type 2 signalling entity provides the following services to the AAL type 2 served user across the A2SU-SAP:
- Establishment of AAL type 2 connections,
- Release of AAL type 2 connections, and
- Modification of AAL type 2 connection resources.

The AAL type 2 signalling protocol entity is independent of the AAL type 2 served user.

5.1.2 Primitives between AAL type 2 signalling entities and the AAL type 2 served user

The A2SU-SAP primitives are used:

1) by the originating served user to initiate AAL type 2 connection establishment and by the originating and destination served users to initiate the release of a connection;

2) by the AAL type 2 signalling entities to indicate an incoming connection to the destination served user and notifying either the originating or destination served user of the release of a connection;

3) by the modification sending served user to originate, and the modification receiving served user to respond to, an AAL type 2 connection resource modification request; and

4) by the AAL type 2 signalling entities to indicate a modification of the AAL type 2 connection resource to the modification receiving served user and notify the modification originating served user of the successful or unsuccessful modification.

NOTE — When sending a primitive between the signalling protocol and its user, the primitive needs to be associated with a particular AAL type 2 connection instance. The mechanism used for this binding is considered to be an implementation detail and therefore is outside the scope of this Recommendation.

The services are provided through the transfer of primitives which are summarized in Table 5-1/Q.2630.3, and are defined after the table.

The AAL type 2 served user passes information in parameters in the primitives. Some of those parameters are mandatory and some are optional; the appropriate usage of the parameters is described in § 8.

TABLE 5-1/Q.2630.3

Primitives and parameters exchanged between the AAL type 2 signalling entities and the AAL type 2 served user

Primitive Generic Name	Type			
	Request	Indication	Response	Confirm
ESTABLISH	DA2EA, OA2EA, SUGR, SUT, TC, PTC, TCS, LC, PLC, MSLC, SSCS, PSSCS, MSSSI, PT, CP, TCI	OA2EA, SUGR, SUT, TC, PTC, TCS, LC, PLC, MSLC, SSCS, PSSCS, MSSSI, PT, CP, TCI	Not defined	TCS, MSLC, MSSSI
RELEASE	Cause	Cause	Not defined	Cause
MODIFY	TC, LC, SSCS, SUCI	TC, LC, SSCS, SUCI	SUCI	SUCI
MODIFY-REJECT	Not defined	Not defined	Not defined	Cause

a) **ESTABLISH.request**:
This primitive is used by the AAL type 2 served user to initiate the establishment of a new AAL type 2 connection, and optionally request the capability for subsequent modification to be performed on the requested connection.

b) **ESTABLISH.indication**:
This primitive is used by the AAL type 2 signalling entities to indicate that an incoming connection has been successfully established, and optionally indicate that the incoming connection is capable of subsequent modification.

c) **ESTABLISH.confirm**:
This primitive is used by the AAL type 2 signalling entities to indicate that the connection (which was previously requested by the served user) has successfully been established and optionally indicate that the established connection is capable of subsequent modification.

d) **RELEASE.request**:
This primitive is used by the AAL type 2 served user to initiate clearing of an AAL type 2 connection.

e) **RELEASE.indication**:
This primitive is used by the AAL type 2 signalling entities to indicate that an AAL type 2 connection has been released.

f) **RELEASE.confirm**:
This primitive is used as a negative acknowledgement for an ESTABLISH.request.

g) **MODIFY.request**:
This primitive is used by the AAL type 2 served user to originate the modification of the AAL type 2 connection resource.

h) **MODIFY.indication**:
This primitive is used by the AAL type 2 signalling entities to indicate that the modification of the AAL type 2 connection resource has been successfully performed.

i) **MODIFY.response**:
This primitive is used by the AAL type 2 served user to respond to the modification of the AAL type 2 connection resource.

j) **MODIFY.confirm**:
This primitive is used by the AAL type 2 signalling entities to indicate that the AAL type 2 connection resource modification (which was previously requested by the served user) has successfully been performed.

k) **MODIFY-REJECT.confirm**:
This primitive is used by the AAL type 2 signalling entities to indicate that the AAL type 2 connection resource modification (which was previously requested by the served user) has been rejected.

5.1.3 Parameters between AAL type 2 signalling entities and the AAL type 2 served user

a) **Destination AAL type 2 Service Endpoint Address (DA2EA)**
This parameter carries the service endpoint address of the destination. It can have the form of an E.164 address or an NSAP address.

b) **Origination AAL type 2 Service Endpoint Address (OA2EA**)
This parameter carries the service endpoint address of the origination. It can have the form of an E.164 address or an NSAP address.

c) **Served User Generated Reference (SUGR)**
This parameter carries a reference provided by the originating AAL type 2 served user and this reference is transported unmodified to the destination served user.

d) **Served User Transport (SUT)**
This parameter carries the served user data that is transported unmodified to the destination served user.

e) **Transfer Capability (TC**)
This parameter gives an indication of the AAL type 2 transfer capability required for the AAL type 2 connection. This parameter can have the form of either:
- Fixed Bandwidth Transfer Capability, or
- Variable Bandwidth Stringent Transfer Capability, or
- Variable Bandwidth Tolerant Transfer Capability.

f) **Preferred Transfer Capability (PTC)**
This parameter gives an indication that the AAL type 2 Transfer Capability shall be set as indicated in this parameter if the modification of the AAL type 2 Transfer Capability is permitted. This parameter can have the form of either:
- Preferred Fixed Bandwidth Transfer Capability, or
- Preferred Variable Bandwidth Stringent Transfer Capability, or
- Preferred Variable Bandwidth Tolerant Transfer Capability.

g) **Transfer Capability Support (TCS)**
This parameter gives an indication whether Transfer Capabilities are supported by all AAL type 2 nodes of the AAL type 2 connection.

h) **Link Characteristics (LC)**
This parameter gives an indication of the resources required for the AAL type 2 connection and is used only for AAL type 2 path selection and connection admission control.

i) **Preferred Link Characteristics (PLC)**
This parameter gives an indication that the Link Characteristics shall be set as indicated in this parameter if the modification of the Link Characteristics is permitted.

j) **Modify Support for Link Characteristics (MSLC)**
This parameter gives an indication that the AAL type 2 Link Characteristics of the AAL type 2 connection may need to be modified during the lifetime of the AAL type 2 connection (ESTABLISH.request) or is permitted to be modified (ESTABLISH.indication and ESTABLISH.confirm).

k) **SSCS Information (SSCS)**
This parameter identifies the type and the capabilities of an AAL type 2 SSCS protocol. This parameter can have the form of either:
- Service Specific Information (Multirate) (see ITU-T Recommendation I.366.2[14]),
- Service Specific Information (Audio) (see ITU-T Recommendation I.366.2[14]),
- Service Specific Information (Multirate Extended) (see note 1),
- Service Specific Information (Audio Extended) (see note 1), or
- Service Specific Information (SAR) (see ITU-T Recommendation I.366.1[9]) with or without the additional parameters necessary for the assured data transfer.

NOTE 1 — Multirate Extended and Audio Extended are used in this Recommendation to support the services of the U-Plane definitions of the 2000 version of ITU-T Recommendation I.366.2[14]. The (non-extended) Multirate and Audio are retained for backward compatibility with ITU-T Recommendation Q.2630.1[15]. For example, the Audio Extended form of the SSCS Information parameter in this Recommendation (see §

7.4.19) adds support for LB, RC, and SYN that were added as U-Plane functions in the 2000 version of ITU-T Recommendation I.366.2[14].

l) **Preferred SSCS Information (PSSCS)**
This parameter gives an indication that the SSCS Information shall be set as indicated in this parameter if the modification of the SSCS Information is permitted. This parameter can have the form of either:

- Preferred Service Specific Information (Multirate Extended) (see note 2), or
- Preferred Service Specific Information (Audio Extended) (see note 2).

NOTE 2 — Multirate Extended and Audio Extended are used in this Recommendation to support the services of the U-Plane definitions of the 2000 version of ITU-T Recommendation I.366.2[14]. The (non-extended) Multirate and Audio are retained for backward compatibility with ITU-T Recommendation Q.2630.1[15]. For example, the Audio Extended form of the SSCS Information parameter in this Recommendation (see § 7.4.19) adds support for LB, RC, and SYN that were added as U-Plane functions in the 2000 version of ITU-T Recommendation I.366.2[14].

Modification of Frame Mode Data as specified in ITU-T Recommendation I.366.2[14], or modification of SAR as specified in ITU-T Recommendation I.366.1[9] is outside the scope of this Recommendation.

m) **Modify Support for SSCS Information (MSSSI**)
This parameter gives an indication that the SSCS Information of the AAL type 2 connection may need to be modified during the lifetime of the AAL type 2 connection (ESTABLISH.request) or are permitted to be modified (ESTABLISH.indication and ESTABLISH.confirm).

n) **Path Type (PT**)
This parameter indicates a request for an AAL type 2 path with a specified Quality of Service.

o) **Connection Priority (CP)**
This parameter carries information sent in the forward direction to indicate the priority level of the connection request.

p) **Test Connection Indicator (TCI)**
By its presence, this parameter indicates that the AAL type 2 connection to be established is a test connection.

q) **Cause**
This parameter describes the reason for the release of the AAL type 2 connection. It also may indicate the reason why an AAL type 2 connection could not be established or a modification was rejected.

r) **Served User Correlation ID (SUCI**)
This parameter carries the SSCS correlation ID (as specified in ITU-T Recommendation I.366.2[14]) during the modification of SSCS information and is transported unmodified to the destination or origination served user.

5.2 Interface between the AAL type 2 signalling entity and the generic signalling transport

5.2.1. Service provided by the generic signalling transport service

The Generic Signalling Transport Service is specified in ITU-T Recommendation Q.2150.0[12]. For convenience, a summary of the primitives for accessing the service is reproduced in Table 5-2/Q.2630.3. In the event of any difference between this table and the definitions in ITU-T Recommendation Q.2150.0, the definitions in ITU-T Recommendation Q. 2150.0 take precedence.

TABLE 5-2/Q.2630.3
Primitives and parameters of the Generic Signalling Transport Sublayer

Primitive	**Type**			
Generic Name	**Request**	**Indication**	**Response**	**Confirm**
START-INFO	not defined	Max_Length CIC_Control	not defined	not defined
IN-SERVICE	not defined	Level	not defined	not defined
OUT-OF-SERVICE	not defined	(Note 1)	not defined	not defined
CONGESTION	not defined	Level	not defined	not defined
TRANSFER	Sequence Control STC User Data Priority (Note 2)	STC User Data Priority (Note 2)	not defined	not defined

NOTES
1 This primitive has no parameters
2 This parameter is a national option (and the use of this parameter is not supported by all signalling transports)

On the establishment of a signalling transport converter entity and the respective signalling transport converter user entity, for example at power up, the initial conditions is the same as if an OUT-OF-SERVICE.indication primitive had been conveyed across this SAP. Also at this time the START-INFO.indication is sent to the signalling entity.

NOTE — The CIC_Control parameter of the START-INFO.indication is ignored by the AAL type 2 signalling entity.

5.2.2 State transition diagram for sequences of primitives of the generic signalling transport service

This subclause defines the constraints on the sequences in which the primitives may occur at the layer boundaries of the generic signalling transport service. The sequences are related to the states at one generic signalling transport endpoint between the generic signalling transport service provider and its user. The possible overall sequences of primitives are shown in the state transition diagram, Figure 5-3/Q.2630.3.

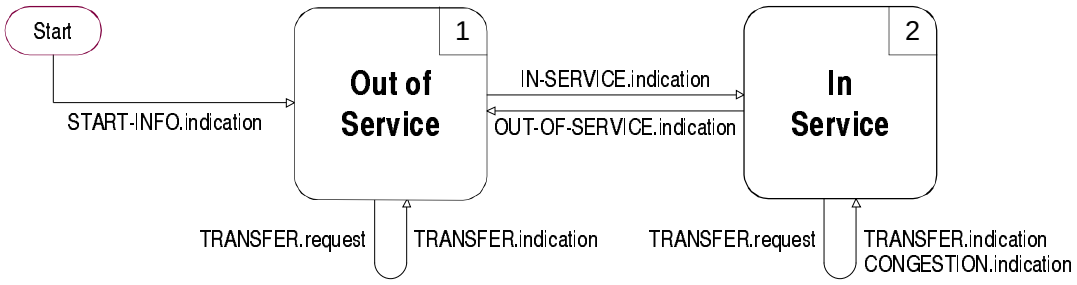


Figure 5-3/Q.2630.3
State transition diagram for sequences of primitives between the GST and its user

This model assumes that a request primitive is never issued at the same time as an indication primitive. The model also assumes that the primitives are serviced immediately and in zero time.

5.3 Interface between the AAL type 2 signalling entity and layer management

5.3.1 Service provided by layer management

This interface provides the internal interface to the network management system.

5.3.2 Primitives between AAL type 2 signalling entities and layer management

The primitives are summarized in Table 5-3/Q.2630.3, and are defined after the table.

TABLE 5-3/Q.2630.3
Primitives and parameters exchanged between the AAL type 2 signalling entities and layer management

Primitive	**Type**			
Generic Name	**Request**	**Indication**	**Response**	**Confirm**
BLOCK	ANI, A2P	Not defined	Not defined	Cause
UNBLOCK	ANI, A2P	Not defined	Not defined	Cause
RESET	ANI, CEID	ANI, CEID	Not defined	-
STOP-RESET	ANI, CEID	Not defined	Not defined	Not defined
ADD-PATH	Not defined	ANI, A2P, PT Ownership	Not defined	Not defined
REMOVE-PATH	Not defined	ANI, A2P	Not defined	Not defined
ERROR	Not defined	ANI, CEID, Cause	Not defined	Not defined
- : This primitive has no parameters				

NOTE — When sending a primitive between the AAL type 2 signalling entity and layer management, the primitive needs to be associated with a particular management action instance. The mechanism used for this binding is considered to be an implementation detail and, therefore, is outside the scope of this Recommendation.

a) **BLOCK.request**:
A primitive to request the AAL type 2 signalling entity to locally block a particular, unblocked AAL type 2 path and to indicate this to the peer AAL type 2 signalling entity.

b) **BLOCK.confirm**:
A primitive with no parameter indicates that the AAL type 2 signalling entity has successfully informed the peer AAL type 2 signalling entity of the blocking of a particular AAL type 2 path. A primitive with a cause parameter indicates that the AAL type 2 signalling entity has detected an error in the blocking procedures.

c) **UNBLOCK.request**:
A primitive to request the AAL type 2 signalling entity to locally unblock a particular, blocked AAL type 2 path and to indicate this to the peer AAL type 2 signalling entity.

d) **UNBLOCK.confirm**:
A primitive with no parameter indicates that the AAL type 2 signalling entity has successfully informed the peer signalling entity of the unblocking of a particular AAL type 2 path. A primitive with a cause parameter indicates that the AAL type 2 signalling entity has detected an error in the unblocking procedures.

e) **RESET.request**:
A primitive to request the AAL type 2 signalling entity to reset a particular channel, all channels on a particular AAL type 2 path, or all channels on all AAL type 2 paths associated with a signalling transport association to the “Idle” state and to indicate this to the peer AAL type 2 signalling entity.

f) **RESET.indication**:
A primitive indicating that the AAL type 2 signalling entity has reset a particular channel, all channels on a particular AAL type 2 path, or all channels on all AAL type 2 paths associated with a signalling transport association to the “Idle” state on the request of the peer AAL type 2 signalling entity.

g) **RESET.confirm**:
A primitive indicating that the AAL type 2 signalling entity has successfully informed the peer AAL type 2 signalling entity of the resetting of the channel or all the channels on a specific AAL type 2 path or on all AAL type 2 paths associated with a signalling transport association.

h) **STOP-RESET.request**:
A primitive to request the AAL type 2 signalling entity to stop a reset procedure.

i) **ADD-PATH. indication**:
This primitive informs the AAL type 2 signalling entity that a new AAL type 2 path has been established towards one of the adjacent AAL type 2 nodes.

j) **REMOVE-PATH. indication**:
This primitive informs the AAL type 2 signalling entity that an AAL type 2 path has been removed.

k) **ERROR.indication**:
A primitive to indicate any operational errors in the AAL type 2 signalling procedures.

5.3.3 Parameters between AAL type 2 signalling entities and layer management

a) **AAL type 2 Path Identifier (A2P)**
This parameter indicates an AAL type 2 path.

b) **Connection Element Identifier (CEID)**
This parameter allows for the identification of:
i) all AAL type 2 paths between two adjacent AAL type 2 nodes associated with a signalling transport association;
ii) a particular AAL type 2 path; or
iii) a particular channel on a particular AAL type 2 path.

c) **Cause**
This parameter gives the reason of an operational error.

d) **Ownership**
This parameter indicates whether a newly established AAL type 2 path is owned by the AAL type 2 signalling entity or by its peer.

e) **Adjacent AAL type 2 Node Identifier (ANI)**
This parameter is used to unambiguously indicate an adjacent AAL type 2 node.

f) **Path Type (PT**)
This parameter indicates the Quality of Service class of the newly established AAL type 2 path.

6 Forward and backward compatibility

The compatibility mechanism remains unchanged for all capability sets and/or subsets of the AAL type 2 protocol defined in this Recommendation. It is based on forward compatibility information associated with all signalling information.

The compatibility method eases the network operation, for example:
- For the typical case of an AAL type 2 signalling protocol mismatch during a network upgrading.
- To interconnect two networks on a different functional level.
- For networks using a different subset of the same AAL type 2 protocol, etc.

NOTE — A node may be at a different functional level due to having implemented a different capability set or another subset of the protocol specified in this Recommendation.

The coding of message and parameter compatibility information is shown in Annex B; these codings shall be used to maintain backward compatibility with AAL type 2 nodes conforming only to ITU-T Recommendation Q.2630.1[15] and with AAL type 2 nodes conforming only to ITU-T Recommendation Q.2630.2[16].

The forward compatibility mechanism specified in § 6.2 and § 8.1 applies to this and future capability sets of this Recommendation.

6.1 Backward compatibility rules

Compatible interworking between AAL type 2 protocol capability sets should be optimized by adhering to the following rules when specifying a new capability set (release):

1) Existing protocol elements, i.e. procedures, messages, parameters and subfield values, should not be changed unless a protocol error needs to be corrected or it becomes necessary to change the operation of the service that is being supported by the protocol.

2) The semantics of a message, a parameter, or of a field and subfield within a parameter should not be changed.

3) Established rules for formatting and encoding messages and parameters should not be modified.

6.2 Forward compatibility mechanism

Compatibility between this and future capability sets will be guaranteed, in the sense that any two capability sets can be interconnected directly with each other, if the following requirements are fulfilled:

i) Protocol compatibility
Connections between any two AAL type 2 protocols do not fail for the reason of not satisfying protocol requirements.

ii) Service and functional compatibility
This feature may be considered as compatibility typically between originating and destination nodes. Services and functions available at these nodes, but possibly not yet taken into account in the intermediate nodes, are supported, provided that information related to these services and functions can be passed transparently through intermediate nodes.

iii) Resource control and management compatibility
For these functions, occurring only link-by-link, at least a backward notification is needed, if correct handling is not possible.

7 Format and coding of AAL type 2 signalling protocol

7.1 Coding conventions for the AAL type 2 signalling protocol

7.1.1 Principles

The following principles shall apply for the coding of the AAL type 2 signalling protocol:

a) The order of coding of messages shall consist of “destination signalling association identifier”, “message identifier”, “message compatibility”, and any parameters.

b) Messages shall carry zero or more parameters.

c) The sequence of parameters is unconstrained.

d) The order of coding of parameters shall consist of “parameter identifier”, “parameter compatibility”, “parameter length”, and any fields.

e) Parameters shall carry zero or more fields.

f) A parameter shall always consist of the same sequence of fields.

g) If new fields need to be added to a parameter or the length of a fixed size field needs to be changed, the modifications shall be carried in a new parameter (different parameter identifier); the existing parameter shall remain unchanged.

h) Any sequence of fixed size fields and variable size fields is permissible.

i) Fixed length fields shall consist of the “field” only; no length is indicated.

j) Variable length fields shall consist of “field length” and “field”.

k) Fields shall be multiples of one octet.

l) Fields are composed of one or more subfields.

m) Reserved subfields shall be coded all zeroes and need not be interpreted by the receiver.

n) If there is no information to be carried in a variable size field, its length shall be set to zero, i.e. only the field length octet will be present.

o) If there is no information to be carried in a fixed size field, its content shall be set to zero in all octets.

p) The presence or the interpretation of a field shall not depend on the value of a field in another parameter.

Consistent with the above coding principles, it is further specified that:

- The message length shall allow for lengths of up to 4 000 octets.
- The parameter length shall allow for lengths of up to 255 octets.

7.1.2 General format of messages

The general format of a message is shown in Table 7-1/Q.2630.3.

NOTE — No "message length" needs to be carried in the message itself; the length of information passed via a primitive implicitly defines its length and the assured data transfer assures that no octets are lost or gained in transport.

TABLE 7-1/Q.2630.3
AAL type 2 message format

	8	7	6	5	4	3	2	1	
Header	Destination Signalling Association Identifier								4 octets
	Message Identifier								1 octet
	Message Compatibility								1 octet
Payload	Parameters								

The message header consists of the destination signalling association identifier field, the message identifier field, and the message compatibility field. The destination signalling association identifier field is coded the same as the signalling association identifier field (see § 7.4.2), the coding of the message identifier field is specified in § 7.2.1, and the message compatibility field is coded the same as the compatibility field (see § 7.4.1).

The message payload consists of zero, one, or more parameters.

7.1.2.1 Bit coding rules

When a field is contained within a single octet, the lowest bit number of the field represents the lowest order value.

When a field spans more than one octet, the order of bit values within each octet progressively decreases as the octet number increases; the lowest bit number associated with the field represents the lowest order value.

(This coding conforms to the coding conventions specified in section 2.1 of ITU-T Recommendation I.361[2].)

7.1.3 General format of parameters

The general format of a parameter is shown in Table 7-2/Q.2630.3.

TABLE 7-2/Q.2630.3
AAL type 2 parameter format

	8	7	6	5	4	3	2	1	
Header	Parameter Identifier								1 octet
	Parameter Compatibility								1 octet
	Parameter Length								1 octet
Payload	Fields								

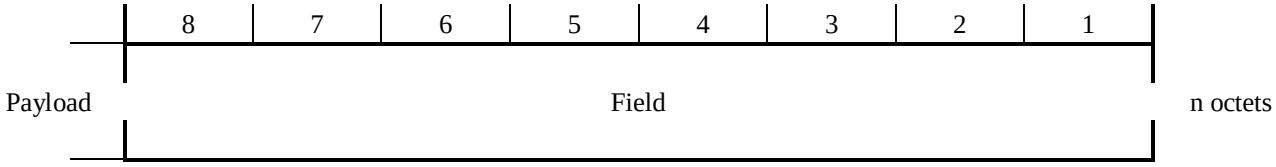
The coding of the parameter identifier field is specified in § 7.2.2 Table 7-7/Q.2630.3 and the parameter compatibility field is coded as a compatibility field (see § 7.4.1). The coding of the parameter length is a binary value indicating the number of octets in the parameter payload, i.e. the count does not include the octets in the parameter header.

Each parameter has a defined number of fields of defined type and in a particular order.

7.1.4 General format of fixed length fields

The general format of a fixed length field is shown in Table 7-3/Q.2630.3.

TABLE 7-3/Q.2630.3
AAL type 2 field - fixed length format

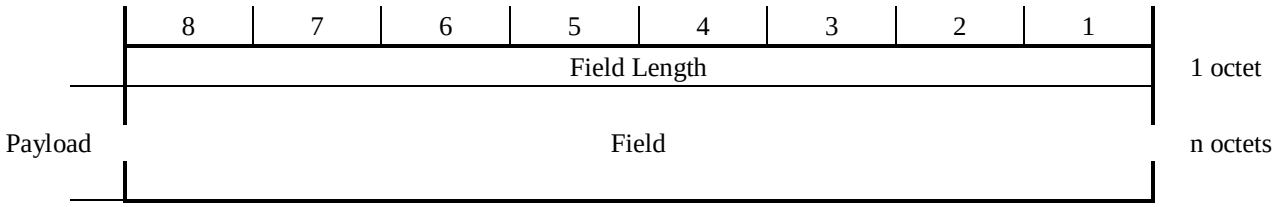


The field type is determined by the location of the field in the particular parameter.

7.1.5 General format of variable length fields

The general format of a variable length field is shown in Table 7-4/Q.2630.3.

TABLE 7-4/Q.2630.3
AAL type 2 field - variable length format



The coding of the field length is a binary value indicating the number of octets in the field payload, i.e. the count does not include the field length octet.

The field type is determined by the location of the field in the particular parameter.

7.2 Format and coding of the AAL type 2 signalling protocol messages

7.2.1 AAL type 2 signalling protocol messages

The AAL type 2 signalling protocol messages and their message identifiers are shown in Table 7-5/Q.2630.3.

TABLE 7-5/Q.2630.3
AAL type 2 messages and the coding of the message identifiers

Message	**Acronym**	**Message Identifier**
Block Confirm	BLC	0 0 0 0 0 0 0 1
Block Request	BLO	0 0 0 0 0 0 1 0
Confusion	CFN	0 0 0 0 0 0 1 1
Establish Confirm	ECF	0 0 0 0 0 1 0 0
Establish Request	ERQ	0 0 0 0 0 1 0 1
Modify Acknowledge	MOA	0 0 0 0 1 1 0 0
Modify Reject	MOR	0 0 0 0 1 1 0 1
Modify Request	MOD	0 0 0 0 1 1 1 0
Release Confirm	RLC	0 0 0 0 0 1 1 0
Release Request	REL	0 0 0 0 0 1 1 1
Reset Confirm	RSC	0 0 0 0 1 0 0 0
Reset Request	RES	0 0 0 0 1 0 0 1
Unblock Confirm	UBC	0 0 0 0 1 0 1 0
Unblock Request	UBL	0 0 0 0 1 0 1 1

7.2.2 Parameters of the AAL type 2 signalling protocol messages

The parameters of the AAL type 2 signalling protocol messages are shown in Table 7-6/Q.2630.3. The indications of “mandatory” and “optional” are for information only. The authoritative definition is given in § 8 and Annex C. If any difference between the indications in this clause and the definitions in § 8 and Annex C exists, the definitions in § 8 take precedence.

Multiple presence of the same parameter in a single message is not permitted.

TABLE 7-6/Q.2630.3 (part 1 of 3)
Parameters of the AAL type 2 signalling protocol messages

Parameter	**Message**						
	ERQ	**ECF**	**REL**	**RLC**	**MOD**	**MOA**	**MOR**
Automatic Congestion Control	—	—	O	O	—	—	—
Cause	—	—	M	[12])	—	—	M
Connection Element Identifier	M	—	—	O	—	—	—
Connection Priority	O	—	—	—	—	—	—
Destination E.164 Service Endpoint Address	[2])	—	—	—	—	—	—
Destination NSAP Service Endpoint Address	[2])	—	—	—	—	—	—
Destination Signalling Association Identifier [1])	[3])	M	M	M	M	M	M
Hop Counter	O	—	—	—	—	—	—
Link Characteristics	[4])	—	—	—	[4])	—	—
Modify Support for Service Specific Information	[4]) [17])	[4])	—	—	—	—	—
Modify Support for Link Characteristics	[4]) [15])	[4])	—	—	—	—	—
Originating Signalling Association Identifier	M	M	—	—	—	—	—
Origination E.164 Service Endpoint Address	[5])	—	—	—	—	—	—
Origination NSAP Service Endpoint Address	[5])	—	—	—	—	—	—
Path Type	[6])	—	—	—	—	—	—
Preferred Link Characteristics	[4]) [16])	—	—	—	—	—	—
Preferred Service Specific Information (Audio Extended)	[4]) [7])	—	—	—	—	—	—
Preferred Service Specific Information (Multirate Extended)	[4]) [7])	—	—	—	—	—	—
Preferred Transfer Capability (FBW)	[4]) [8])	—	—	—	—	—	—
Preferred Transfer Capability (VBW-S)	[4]) [8])	—	—	—	—	—	—
Preferred Transfer Capability (VBW-T)	[4]) [8])	—	—	—	—	—	—
Served User Correlation ID	—	—	—	—	O	O	—
Served User Generated Reference	O	—	—	—	—	—	—
Served User Transport	O	—	—	—	—	—	—
Service Specific Information (Audio Extended)	[9]) [10])	—	—	—	[13]) [18])	—	—
Service Specific Information (Audio)	[4]) [9]) [10])	—	—	—	—	—	—
Service Specific Information (Multirate Extended)	[9]) [10])	—	—	—	[13]) [18])	—	—
Service Specific Information (Multirate)	[4]) [9]) [10])	—	—	—	—	—	—
Service Specific Information (SAR-assured)	[9])	—	—	—	—	—	—
Service Specific Information (SAR-unassured)	[9])	—	—	—	—	—	—
TAR Controlled Connection	O	—	—	—	—	—	—
Test Connection Indicator	O	—	—	—	—	—	—
Transfer Capability (FBW)	[11])	—	—	—	[14]) [18])	—	—
Transfer Capability (VBW-S)	[11])	—	—	—	[14]) [18])	—	—
Transfer Capability (VBW-T)	[11])	—	—	—	[14]) [18])	—	—
Transfer Capability Support (TCS)	[4])	[4])	—	—	—	—	—

TABLE 7-6/Q.2630.3 (part 2 of 3)
Parameters of the AAL type 2 signalling protocol messages

Notes to TABLE 7-6/Q.2630.3 (part 1 of 2)	
M	Mandatory parameter
O	Optional parameter
—	Parameter not present
NOTES	
1	This row designates the Destination Signalling Association Identifier field in the message header.
2	Exactly one of these parameters must be present in an instance of the message.
3	The Destination Signalling Association Identifier field contains the value “unknown”.
4	This parameter is only used for backward compatibility, i.e., for interworking with AAL type 2 nodes that conform only to ITU-T Recommendations Q.2630.1[15] or Q.2630.2[16] (see Annex C).
5	At most one of these parameters is present in an instance of the message.
6	If the path type parameter is not included the path type shall be considered to be the network default stringent QoS class.
7	This parameter may only be included if “Modify Support for Service Specific Information” is included; at most one of these parameters is present in an instance of the message. If present it must refer to the same service specific information as the Service Specific Information parameter present in the same Establish Request message, i.e., Audio or Multirate.
8	This parameter must be included if a “Preferred Link Characteristics” and/or a “Preferred Service Specific Information” is included. At most one of these parameters is present in an instance of the message. If present it must refer to the same transfer capability as the Transfer Capability parameter present in the same Establish Request message.
9	At most one of these parameters is present in an instance of the message.
10	If the Modify Support for Service Specific Information parameter is included, this parameter shall be included also.
11	Exactly one of these parameters is present in an instance of the message.
12	The “Cause” parameter is present in the Release Confirm message if a) the RLC is used to reject a connection establishment, or b) the cause reports unrecognized information received in the REL message.
13	At most one of these parameters is present in an instance of the message and only the same parameter that was present in the Establish Request message may be present.
14	At most one of these parameters is present in an instance of the message and only the same parameter that was present in the Establish Request message may be present.
15	This parameter may be present only if the parameter “Link Characteristics” is present also.
16	This parameter may be present only if the parameter “Modify Support for Link Characteristics” is present also.
17	This parameter may be present only if one of the parameters “Service Specific Information (Audio)”, “Service Specific Information (Audio Extended)”, “Service Specific Information (Multirate)”, and “Service Specific Information (Multirate Extended)” is present also.
18	At least one of these parameters is present in an instance of the message

TABLE 7-6/Q.2630.3 (part 3 of 3)
Parameters of the AAL type 2 signalling protocol messages

Parameter	**Message**						
	RES	**RSC**	**BLO**	**BLC**	**UBL**	**UBC**	**CFN**
Cause	—	[4])	—	[4])	—	[4])	M
Connection Element Identifier	M	—	M [3])	—	M [3])	—	—
Destination Signalling Association Identifier [1])	[2])	M	[2])	M	[2])	M	M
Originating Signalling Association Identifier	M	—	M	—	M	—	—

M Mandatory parameter
O Optional parameter
— Parameter not present

NOTES

1 This row designates the Destination Signalling Association Identifier field in the message header.

2 The Destination Signalling Association Identifier field contains the value “unknown”.

3 The Channel Identifier field is set to “Null”, but the Path Identifier includes a value identifying an AAL type 2 path.

4 The “Cause” parameter is present only if the cause reports unrecognized information received.

The identifiers of the AAL type 2 message parameters are defined in Table 7-7/Q.2630.3.

TABLE 7-7/Q.2630.3
Identifiers of the AAL type 2 message parameters

AAL type 2 Parameter	**Ref.**	**Acronym**	**Identifier**
Automatic Congestion Control	7.3.25	ACC	0 0 0 1 1 0 0 0
Cause	7.3.1	CAU	0 0 0 0 0 0 0 1
Connection Element Identifier	7.3.2	CEID	0 0 0 0 0 0 1 0
Connection Priority	7.3.26	CP	0 0 0 1 1 0 0 1
Destination E.164 Service Endpoint Address	7.3.3	DESEA	0 0 0 0 0 0 1 1
Destination NSAP Service Endpoint Address	7.3.4	DNSEA	0 0 0 0 0 1 0 0
Hop Counter	7.3.27	HC	0 0 0 1 1 0 1 0
Link Characteristics (Note)	7.3.5	LC	0 0 0 0 0 1 0 1
Modify Support for Link Characteristics (Note)	7.3.20	MSLC	0 0 0 0 1 1 1 0
Modify Support for Service Specific Information (Note)	7.3.21	MSSSI	0 0 0 0 1 1 1 1
Originating Signalling Association Identifier	7.3.6	OSAID	0 0 0 0 0 1 1 0
Origination E.164 Service Endpoint Address	7.3.23	OESEA	0 0 0 1 1 0 1 1
Origination NSAP Service Endpoint Address	7.3.24	ONSEA	0 0 0 1 0 1 0 1
Path Type	7.3.14	PT	0 0 0 1 0 0 0 0
Preferred Link Characteristics (Note)	7.3.19	PLC	0 0 0 1 0 0 0 1
Preferred Service Specific Information (Audio Extended) (Note)	7.3.17	PSSIAE	0 0 0 1 0 0 1 0
Preferred Service Specific Information (Multirate Extended) (Note)	7.3.18	PSSIME	0 0 0 1 0 0 1 1
Preferred Transfer Capability (FBW) (Note)	7.3.29	PFBW	0 0 0 1 1 1 0 0
Preferred Transfer Capability (VBW-S) (Note)	7.3.30	PVBWS	0 0 0 1 1 1 0 1
Preferred Transfer Capability (VBW-T) (Note)	7.3.31	PVBWT	0 0 0 1 1 1 1 0
Served User Correlation ID	7.3.22	SUCI	0 0 0 1 0 1 0 0
Served User Generated Reference	7.3.7	SUGR	0 0 0 0 0 1 1 1
Served User Transport	7.3.8	SUT	0 0 0 0 1 0 0 0
Service Specific Information (Audio Extended)	7.3.15	SSIAE	0 0 0 1 0 1 1 0
Service Specific Information (Audio) (Note)	7.3.9	SSIA	0 0 0 0 1 0 0 1
Service Specific Information (Multirate Extended)	7.3.16	SSIME	0 0 0 1 0 1 1 1
Service Specific Information (Multirate) (Note)	7.3.10	SSIM	0 0 0 0 1 0 1 0
Service Specific Information (SAR-assured)	7.3.11	SSISA	0 0 0 0 1 0 1 1
Service Specific Information (SAR-unassured)	7.3.12	SSISU	0 0 0 0 1 1 0 0
TAR Controlled Connection	7.3.28	TCC	0 0 0 1 1 1 1 1
Test Connection Indicator	7.3.13	TCI	0 0 0 0 1 1 0 1
Transfer Capability (FBW)	7.3.32	FBW	0 0 1 0 0 0 0 0
Transfer Capability (VBW-S)	7.3.33	VBWS	0 0 1 0 0 0 0 1
Transfer Capability (VBW-T)	7.3.34	VBWT	0 0 1 0 0 0 1 0
Transfer Capability Support (Note)	7.3.35	TCS	0 0 1 0 0 0 1 1
NOTE — In this Recommendation, this parameter is only used for backward compatibility, i.e., for interworking with AAL type 2 nodes that conform only to ITU-T Recommendations Q.2630.1[15] or Q.2630.2[16].			

7.3 Parameter specification of the AAL type 2 signalling protocol messages

7.3.1 Cause

The sequence of fields in the cause parameter is shown in Table 7-8/Q.2630.3.

TABLE 7-8/Q.2630.3
Sequence of fields in the cause parameter

Field No.	Field	Ref.
1	Cause Value	7.4.16
2	Diagnostics	7.4.17

7.3.2 Connection element identifier

The sequence of fields in the connection element identifier parameter is shown in Table 7-9/Q.2630.3.

TABLE 7-9/Q.2630.3
Sequence of fields in the connection element identifier parameter

Field No.	Field	Ref.
1	Path Identifier	7.4.3
2	Channel Identifier	7.4.4

AAL type 2 Path Identifier	Channel Identifier	Meaning
Null	ignored	All AAL type 2 paths associated with a signalling transport association
Value	Null	AAL type 2 path identifier “Value”
Value	CID	Channel “CID” in AAL type 2 path identifier “Value”

7.3.3 Destination E.164 service endpoint address

The sequence of fields in the destination E.164[10] service endpoint address parameter is shown in Table 7-10/Q.2630.3.

TABLE 7-10/Q.2630.3
Sequence of fields in the destination E.164 service endpoint address parameter

Field No.	Field	Ref.
1	Nature of Address	7.4.13
2	E.164 Address	7.4.14

7.3.4 Destination NSAP service endpoint address

The sequence of fields in the destination NSAP[5] service endpoint address parameter is shown in Table 7-11/Q.2630.3.

TABLE 7-11/Q.2630.3
Sequence of fields in the destination NSAP service endpoint address parameter

Field No.	Field	Ref.
1	NSAP Address	7.4.15

7.3.5 Link characteristics

The sequence of fields in the link characteristics parameter is shown in Table 7-12/Q.2630.3.

TABLE 7-12/Q.2630.3
Sequence of fields in the link characteristics parameter

Field No.	Field	Ref.
1	Maximum CPS-SDU Bit Rate	Note 1
2	Average CPS-SDU Bit Rate	Note 1
3	Maximum CPS-SDU Size	Note 2
4	Average CPS-SDU Size	Note 2
NOTE 1 - This field is coded as a CPS-SDU Bit Rate field (see 7.4.11). NOTE 2 - This field is coded as a CPS-SDU Size field (see 7.4.12).		

7.3.6 Originating signalling association identifier

The sequence of fields in the originating signalling association identifier parameter is shown in Table 7-13/Q.2630.3.

TABLE 7-13/Q.2630.3
Sequence of fields in the originating signalling association identifier parameter

Field No.	Field	Ref.
1	Originating Signalling Association	Note
NOTE - This field is coded as a Signalling Association Identifier field (see 7.4.2).		

7.3.7 Served user generated reference

The sequence of fields in the served user generated reference parameter is shown in Table 7-14/Q.2630.3.

TABLE 7-14/Q.2630.3
Sequence of fields in the served user generated reference parameter

Field No.	Field	Ref.
1	Served User Generated Reference	7.4.10

7.3.8 Served user transport

The sequence of fields in the served user transport parameter is shown in Table 7-15/Q.2630.3.

TABLE 7-15/Q.2630.3
Sequence of fields in the served user transport parameter

Field No.	Field	Ref.
1	Served User Transport	7.4.18

7.3.9 Service specific information (Audio)

The sequence of fields in the service specific information (audio) parameter is shown in Table 7-16/Q.2630.3.

TABLE 7-16/Q.2630.3
Sequence of fields in the service specific information (audio) parameter

Field No.	Field	Ref.
1	Audio Service	7.4.6
2	Organizational Unique Identifier	7.4.5

7.3.10 Service specific information (Multirate)

The sequence of fields in the service specific information (multirate) parameter is shown in Table 7-17/Q.2630.3.

TABLE 7-17/Q.2630.3
Sequence of fields in the service specific information (multirate) parameter

Field No.	Field	Ref.
1	Multirate Service	7.4.7

7.3.11 Service specific information (SAR-assured)

The sequence of fields in the service specific information (SAR-assured) parameter is shown in Table 7-18/Q.2630.3.

TABLE 7-18/Q.2630.3
Sequence of fields in the service specific information (SAR-assured) parameter

Field No.	Field	Ref.
1	Segmentation and Reassembly (Assured Data Transfer)	7.4.8

7.3.12 Service specific information (SAR-unassured)

The sequence of fields in the service specific information (SAR-unassured) parameter is shown in Table 7-19/Q.2630.3.

TABLE 7-19/Q.2630.3
Sequence of fields in the service specific information (SAR-unassured) parameter

Field No.	Field	Ref.
1	Segmentation and Reassembly (Unassured Data Transfer)	7.4.9

7.3.13 Test connection indicator

The test connection indicator parameter has no fields, i.e. the parameter length is always zero.

7.3.14 Path Type

The sequence of fields in the path type parameter is shown in Table 7-20/Q.2630.3.

Table 7-20/Q.2630.3
Sequence of fields in the path type parameter

Field No.	Field	Ref.
1	AAL Type 2 Path QoS Codepoint	7.4.21

If the path type parameter is not included the path type shall be considered to be the network default stringent QoS class.

7.3.15 Service specific information (Audio Extended)

The sequence of field in the service specific information (Audio Extended) parameter is shown in Table 7-21/Q.2630.3.

Table 7-21/Q.2630.3
Sequence of field in the service specific information (Audio Extended) parameter

Field No.	Field	Ref.
1	Audio extended service	7.4.19
2	Organizational unique identifier	7.4.5

7.3.16 Service specific information (Multirate Extended)

The sequence of field in the service specific information (Multirate Extended) parameter is shown in Table 7-22/Q.2630.3.

Table 7-22/Q.2630.3
Sequence of field in the service specific information (Multirate Extended) parameter

Field No.	Field	Ref.
1	Multirate extended service	7.4.20

7.3.17 Preferred service specific information (Audio Extended)

The sequence of field in the preferred service specific information (Audio Extended) parameter is shown in Table 7-23/Q.2630.3.

Table 7-23/Q.2630.3
Sequence of field in the preferred service specific information (Audio Extended) parameter

Field No.	Field	Ref.
1	Audio extended service	7.4.19
2	Organizational unique identifier	7.4.5

7.3.18 Preferred Service specific information (Multirate Extended)

The sequence of field in the preferred service specific information (Multirate Extended) parameter is shown in Table 7-24/Q.2630.3.

Table 7-24/Q.2630.3
Sequence of field in the preferred service specific information (Multirate Extended) parameter

Field No.	Field	Ref.
1	Multirate extended service	7.4.20

7.3.19 Preferred Link Characteristics

The sequence of fields in the preferred link characteristics parameter is shown in Table 7-25/Q.2630.3.

Table 7-25/Q.2630.3
Sequence of fields in the preferred link characteristics parameter

Field No.	Field	Ref.
1	Maximum CPS-SDU Bit Rate	Note 1
2	Average CPS-SDU Bit Rate	Note 1
3	Maximum CPS-SDU Size	Note 2
4	Average CPS-SDU Size	Note 2
NOTE 1 - This field is coded as a CPS-SDU Bit Rate field (see 7.4.11). NOTE 2 - This field is coded as a CPS-SDU Size field (see 7.4.12).		

7.3.20 Modify Support for Link Characteristics

The modify support for link characteristics parameter has no fields, i.e., the parameter length is always zero.

7.3.21 Modify Support for Service Specific Information

The modify support for service specific information parameter has no fields, i.e. the parameter length is always zero.

7.3.22 Served User Correlation ID

The sequence of field in the served user correlation ID parameter is shown in Table 7-26/Q.2630.3.

Table 7-26/Q.2630.3
Sequence of field in the served user correlation ID parameter

Field No.	Field	Ref.
1	Served User Correlation ID value	7.4.22

7.3.23 Origination E.164 Service Endpoint Address

The sequence of fields in the origination E.164[10] service endpoint address parameter is shown in Table 7-27/Q.2630.3.

Table 7-27/Q.2630.3
Sequence of fields in the origination E.164 service endpoint address parameter

Field No.	Field	Ref.
1	Nature of Address	7.4.13
2	E.164 Address	7.4.14

7.3.24 Origination NSAP Service Endpoint Address

The sequence of fields in the origination NSAP[5] service endpoint address parameter is shown in Table 7-28/Q.2630.3.

Table 7-28/Q.2630.3
Sequence of fields in the origination NSAP service endpoint address parameter

Field No.	Field	Ref.
1	NSAP Address	7.4.15

7.3.25 Automatic Congestion Control

The sequence of fields in the Congestion Control parameter is shown in Table 7-29/Q.2630.3.

Table 7-29/Q.2630.3
Sequence of fields in the Congestion Control parameter

Field No.	Field	Ref.
1	AAL type 2 Node Automatic Congestion Level	7.4.23

7.3.26 Connection Priority

The sequence of fields in the Connection Priority parameter is shown in Table 7-30/Q.2630.3.

Table 7-30/Q.2630.3
Sequence of fields in the Connection Priority parameter

Field No.	Field	Ref.
1	Priority	7.4.24

7.3.27 Hop Counter

The sequence of fields in the Hop Counter parameter is shown in Table 7-31/Q.2630.3.

Table 7-31/Q.2630.3
Sequence of fields in the Hop Counter parameter

Field No.	Field	Ref.
1	AAL type 2 Hop Counter	7.4.25

7.3.28 TAR Controlled Connection

The TAR Controlled Connection parameter has no fields, i.e., the parameter length is always zero.

7.3.29 Preferred Fixed Bandwidth Transfer Capability

The sequence of fields in the preferred fixed bandwidth transfer capability parameter is shown in Table 7-32/Q.2630.3.

TABLE 7-32/Q.2630.3
Sequence of fields in the preferred fixed bandwidth transfer capability parameter

Field No.	Field	Ref.
1	Peak CPS bit rate	Note 1
2	CPS token bucket size associated with Peak CPS bit rate	Note 2
3	Maximum allowed CPS packet size	7.4.28
NOTE 1 - This field is coded as a CPS Bit rate field (see 7.4.26). NOTE 2 - This field is coded as a CPS Token Bucket Size field (see 7.4.27).		

7.3.30 Preferred Variable Bandwidth Stringent Transfer Capability

The sequence of fields in the preferred variable bandwidth stringent transfer capability parameter is shown in Table 7-33/Q.2630.3.

TABLE 7-33/Q.2630.3
Sequence of fields in the preferred variable bandwidth stringent transfer capability parameter

Field No.	Field	Ref.
1	Peak CPS bit rate	Note 1
2	CPS token bucket size associated with Peak CPS bit rate	Note 2
3	Maximum allowed CPS packet size	7.4.28
4	Source Traffic Type	7.4.29
NOTE 1 - This field is coded as a CPS Bit rate field (see 7.4.26). NOTE 2 - This field is coded as a CPS Token Bucket Size field (see 7.4.27).		

7.3.31 Preferred Variable Bandwidth Tolerant Transfer Capability

The sequence of fields in the preferred variable bandwidth tolerant transfer capability parameter is shown in Table 7-34/Q.2630.3.

TABLE 7-34/Q.2630.3
Sequence of fields in the preferred variable bandwidth tolerant transfer capability parameter

Field No.	Field	Ref.
1	Peak CPS bit rate	Note 1
2	CPS token bucket size associated with Peak CPS bit rate	Note 2
3	Sustainable CPS bit rate	Note 1
4	CPS token bucket size associated with Sustainable CPS bit rate	Note 2
5	Maximum allowed CPS packet size	7.4.28
NOTE 1 - This field is coded as a CPS Bit rate field (see 7.4.26). NOTE 2 - This field is coded as a CPS Token Bucket Size field (see 7.4.27).		

7.3.32 Fixed Bandwidth Transfer Capability

The sequence of fields in the fixed bandwidth transfer capability parameter is shown in Table 7-35/Q.2630.3.

TABLE 7-35/Q.2630.3
Sequence of fields in the fixed bandwidth transfer capability parameter

Field No.	Field	Ref.
1	Peak CPS bit rate	Note 1
2	CPS token bucket size associated with Peak CPS bit rate	Note 2
3	Maximum allowed CPS packet size	7.4.28
NOTE 1 - This field is coded as a CPS Bit rate field (see 7.4.26). NOTE 2 - This field is coded as a CPS Token Bucket Size field (see 7.4.27).		

7.3.33 Variable Bandwidth Stringent Transfer Capability

The sequence of fields in the variable bandwidth stringent transfer capability parameter is shown in Table 7-36/Q.2630.3.

TABLE 7-36/Q.2630.3
Sequence of fields in the variable bandwidth stringent transfer capability parameter

Field No.	Field	Ref.
1	Peak CPS bit rate	Note 1
2	CPS token bucket size associated with Peak CPS bit rate	Note 2
3	Maximum allowed CPS packet size	7.4.28
4	Source Traffic Type	7.4.29
NOTE 1 - This field is coded as a CPS Bit rate field (see 7.4.26). NOTE 2 - This field is coded as a CPS Token Bucket Size field (see 7.4.27).		

7.3.34 Variable Bandwidth Tolerant Transfer Capability

The sequence of fields in the variable bandwidth tolerant transfer capability parameter is shown in Table 7-37/Q.2630.3.

TABLE 7-37/Q.2630.3
Sequence of fields in the variable bandwidth tolerant transfer capability parameter

Field No.	Field	Ref.
1	Peak CPS bit rate	Note 1
2	CPS token bucket size associated with Peak CPS bit rate	Note 2
3	Sustainable CPS bit rate	Note 1
4	CPS token bucket size associated with Sustainable CPS bit rate	Note 2
5	Maximum allowed CPS packet size	7.4.28
NOTE 1 - This field is coded as a CPS Bit rate field (see 7.4.26). NOTE 2 - This field is coded as a CPS Token Bucket Size field (see 7.4.27).		

7.3.35 Transfer Capability Support

The transfer capability support parameter has no fields, i.e., the parameter length is always zero.

7.4 Field specification of the AAL type 2 signalling protocol parameters

7.4.1 Compatibility

The structure of the compatibility field is shown in Table 7-38/Q.2630.3; the field is a fixed size field of 1 octet.

TABLE 7-38/Q.2630.3
Structure of the compatibility field

8	7	6	5	4	3	2	1	
pass-on not possible				general action				Octet 1
reserved	send notification indicator	instruction indicator		reserved	send notification indicator	instruction indicator		

The following codes are used in the subfields of the compatibility information field.

a) Send notification indicator
- 0 Do not send notification.
- 1 Send notification.

b) Instruction indicator
- 00 Pass on message or parameter (see Note 1).
- 01 Discard parameter (see Note 2).
- 10 Discard message.
- 11 Release Connection.

NOTE 1 — When used in a “pass-on not possible” instruction indicator, value “00” is interpreted so as to release the connection.
NOTE 2 — When used as message compatibility field, value “01” should not be used. If received, it is interpreted so as to discard the message.

7.4.2 Signalling association identifier

The structure of the signalling association identifier field is shown in Table 7-39/Q.2630.3; the field is a fixed size field of 4 octets.

TABLE 7-39/Q.2630.3
Structure of the signalling association identifier field

8	7	6	5	4	3	2	1	
Signalling Association Identifier								Octet 1 Octet 2 Octet 3 Octet 4

The coding is implementation dependent.

If the signalling association identifier is used as a destination signalling association identifier that is not known, the field is set to zero indicating the value “unknown”.

If the signalling association identifier is used as an originating signalling association identifier, the value zero shall not be used.

7.4.3 AAL type 2 path identifier

The structure of the AAL type 2 path identifier field is shown in Table 7-40/Q.2630.3; the field is a fixed size field of 4 octets.

TABLE 7-40/Q.2630.3
Structure of the AAL type 2 path identifier field

8	7	6	5	4	3	2	1	
AAL type 2 path identifier								Octet 1 Octet 2 Octet 3 Octet 4

The coding is implementation dependent. It identifies unambiguously an AAL type 2 path between a pair of adjacent AAL type 2 nodes. A value of "0" in all octets indicates "Null", therefore, the all zero code cannot be used to identify an AAL type 2 path.

NOTE — When the AAL type 2 path is a switched VCC between two adjacent AAL type 2 nodes, the procedure defined in subclause 9.2 of ITU-T Recommendation Q.2941.2[27] may be used to assign the AAL type 2 path identifier field value at the time of the VCC establishment.

7.4.4 Channel identifier

The structure of the channel identifier field is shown in Table 7-41/Q.2630.3; the field is a fixed size field of 1 octet.

TABLE 7-41/Q.2630.3
Structure of the channel identifier field

8	7	6	5	4	3	2	1	
								Octet 1

The coding reflects the Channel Identifier (CID) as specified in ITU-T Recommendation I.363.2[1]. CID values permitted in this field range from "8" to "255" inclusive. A value of "0" indicates "Null".

7.4.5 Organizational unique identifier

The structure of the organizational unique identifier field is shown in Table 7-42/Q.2630.3; the field is a fixed size field of 3 octets.

TABLE 7-42/Q.2630.3
Structure of the organizational unique identifier field

8	7	6	5	4	3	2	1	
Organizational Unique Identifier								Octet 1 Octet 2 Octet 3

The coding reflects the Organizational Unique Identifier (OUI) specified by IEEE 802-1990[11] § 5.1.

7.4.6 Audio service

The audio service for the AAL type 2 is defined in ITU-T Recommendation I.366.2[8]. The structure of the audio service field is shown in Table 7-43/Q.2630.3; the field is a fixed size field of 5 octets.

TABLE 7-43/Q.2630.3
Structure of the audio service field

8	7	6	5	4	3	2	1	
Profile Type		Reserved						Octet 1
Profile Identifier								Octet 2
FRM	CMD	MF-R2	MF-R1	DTMF	CAS	FAX	A/μ-Law	Octet 3
maximum length of								Octet 4
Frame Mode Data								Octet 5

The following codes are used in the subfields of the audio service field:

a) Profile type:
- 00 The "Profile Identifier" designates a profile specified in ITU-T Recommendation I.366.2[8]; the organizational unique identifier field in the same parameter is ignored.
- 01 The "Profile Identifier" designates a profile specified by an organization designated by the organizational unique identifier field in the same parameter.
- 10 The "Profile Identifier" designates a custom profile; the organizational unique identifier field in the same parameter is ignored.
- 11 Reserved.

b) Profile Identifier
The "Profile Identifier" designates a profile as specified in either ITU-T Recommendation I.366.2[8], by an organization designated by the organizational unique identifier field in the same parameter, or a custom profile depending of the value of the "Profile Type".

c)

FRM	0:	Transport of frame mode data disabled
	1:	Transport of frame mode data enabled
CMD	0:	Transport of circuit mode data (64 kbit/s) disabled
	1:	Transport of circuit mode data (64 kbit/s) enabled
MF-R2	0:	Transport of multi-frequency R2 dialed digits disabled
	1:	Transport of multi-frequency R2 dialed digits enabled
MF-R1	0:	Transport of multi-frequency R1 dialed digits disabled
	1:	Transport of multi-frequency R1 dialed digits enabled
DTMF	0:	Transport of dual tone multi-frequency dialed digits disabled
	1:	Transport of dual tone multi-frequency dialed digits enabled
CAS	0:	Transport of channel associated signalling disabled
	1:	Transport of channel associated signalling enabled
FAX	0:	Transport of demodulated facsimile data disabled
	1:	Transport of demodulated facsimile data enabled
A/μ-Law	0:	Interpretation of generic PCM coding: A-Law
	1:	Interpretation of generic PCM coding: μ-Law

7.4.7 Multirate service

The multirate service for the AAL type 2 is defined in ITU-T Recommendation I.366.2[8]. The structure of the multirate service field is shown in Table 7-44/Q.2630.3; the field is a fixed size field of 3 octets.

TABLE 7-44/Q.2630.3
Structure of the multirate service field

8	7	6	5	4	3	2	1	
FRM	Reserved		Multiplier n for n×64 kbit/s					Octet 1
maximum length of								Octet 2
Frame Mode Data								Octet 3

FRM	0:	Transport of frame mode data disabled
	1:	Transport of frame mode data enabled
n	1≤n≤31	Multiplier for n×64 kbit/s

7.4.8 Segmentation and reassembly (assured data transfer)

The segmentation and reassembly service for the AAL type 2 is defined in ITU-T Recommendation I.366.1[9]. The structure of the segmentation and reassembly (assured data transfer) field is shown in Table 7-45/Q.2630.3; the field is a fixed size field of 14 octets.

TABLE 7-45/Q.2630.3
Structure of the segmentation and reassembly (assured data transfer) field

8	7	6	5	4	3	2	1	
maximum length of								Octet 1
SSSAR-SDU								Octet 2
in the forward direction								Octet 3
maximum length of								Octet 4
SSSAR-SDU								Octet 5
in the backward direction								Octet 6
maximum length of SSCOP-SDU								Octet 7
in the forward direction								Octet 8
maximum length of SSCOP-SDU								Octet 9
in the backward direction								Octet 10
maximum length of SSCOP-UU								Octet 11
in the forward direction								Octet 12
maximum length of SSCOP-UU								Octet 13
in the backward direction								Octet 14

7.4.9 Segmentation and reassembly (unassured data transfer)

The structure of the segmentation and reassembly (unassured data transfer) field is shown in Table 7-46/Q.2630.3; the field is a fixed size field of 7 octets.

TABLE 7-46/Q.2630.3
Structure of the segmentation and reassembly (unassured data transfer) field

8	7	6	5	4	3	2	1	
maximum length of								Octet 1
SSSAR-SDU								Octet 2
in the forward direction								Octet 3
maximum length of								Octet 4
SSSAR-SDU								Octet 5
in the backward direction								Octet 6
TED		Reserved						Octet 7

TED	0:	Transmission Error Detection disabled
	1:	Transmission Error Detection enabled

7.4.10 Served user generated reference

The structure of the served user generated reference field is shown in Table 7-47/Q.2630.3; the field is a fixed size field of 4 octets.

TABLE 7-47/Q.2630.3
Structure of the served user generated reference field

8	7	6	5	4	3	2	1	
Served User Generated Reference								Octet 1 Octet 2 Octet 3 Octet 4

7.4.11 CPS-SDU bit rate

The structure of the CPS-SDU bit rate field is shown in Table 7-48/Q.2630.3; the field is a fixed size field of 4 octets.

TABLE 7-48/Q.2630.3
Structure of the CPS-SDU bit rate field

8	7	6	5	4	3	2	1	
CPS-SDU bit rate in the forward direction								Octet 1 Octet 2
CPS-SDU bit rate in the backward direction								Octet 3 Octet 4

This field may be used to convey the maximum CPS-SDU bit rate or the average CPS-SDU bit rate.

The maximum CPS-SDU bit rate is defined as the maximum bandwidth, available to the AAL type 2 served user in the specified direction. The maximum bandwidth is the maximum ratio of the amount of bits transported during the inter-departure time between two subsequent CPS-SDUs, and that inter-departure time. Allowed values are 0 to 2 048 kbit/s. The granularity is 64 bit/s.

The average CPS-SDU bit rate is defined as the total expected amount of bits transported in the specified direction during the holding time of the connection, divided by the holding time of the connection. The average bit rate is also expected to be valid for the time interval between any two active periods. Allowed values are 0 to 2 048 kbit/s. The granularity is 64 bit/s.

7.4.12 CPS-SDU size

The structure of the CPS-SDU size field is shown in Table 7-49/Q.2630.3; the field is a fixed size field of 2 octets.

TABLE 7-49/Q.2630.3
Structure of the CPS-SDU size field

8	7	6	5	4	3	2	1	
CPS-SDU size in the forward direction								Octet 1
CPS-SDU size in the backward direction								Octet 2

This field may be used to convey the maximum CPS-SDU size or the average CPS-SDU size.

The maximum CPS-SDU size is defined as the largest CPS-SDU size, in octets, allowed to be sent in the specified direction during the holding time of the connection. Allowed values are 1 to 45.

The average CPS-SDU size is defined in the specified direction as the expected number of transported octets divided by the number of transported CPS-SDUs during the holding time of the connection. The average CPS-SDU size is also expected to be valid for the time interval between any two active periods. Allowed values are 1 to 45.

7.4.13 Nature of address

The structure of the nature of address field is shown in Table 7-50/Q.2630.3; the field is a fixed size field of 1 octet.

TABLE 7-50/Q.2630.3
Structure of the nature of address field

8	7	6	5	4	3	2	1	
Reserved	nature of address code							Octet 1

The "nature of address code" has the following meaning:

0000000 spare
0000001 subscriber number (national use)
0000010 unknown (national use) (note 1)
0000011 national (significant) number
0000100 international number
0000101 network-specific number (national use) (note 2)
0000110 to 1101111 spare
1110000 to 1111110 reserved for national use
1111111 spare

NOTE 1 — This code point is used when the type of number is indicated using the digits in the E.164 Address field. The E.164 Address field is organized according to the network dialing plan; e.g. prefix digits might be present; in addition, escape digits may also be present.

NOTE 2 — This code point is used to indicate an administration/service number specific to the serving network.

7.4.14 E.164 address

The structure of the E.164 address field is shown in Table 7-51/Q.2630.3; the field is a variable size field.

TABLE 7-51/Q.2630.3
Structure of the E.164 address field

8	7	6	5	4	3	2	1	
Field Length								Octet 1
Reserved				First hexadecimal digit of address - - - - Last hexadecimal digit of address				Octet 2 Octet n

7.4.15 NSAP address

The structure of the NSAP[5] address field is shown in Table 7-52/Q.2630.3; the field is a fixed size field of 20 octets.

TABLE 7-52/Q.2630.3
Structure of the NSAP address field

8	7	6	5	4	3	2	1	
								Octet 1
NSAP								
								Octet 20

7.4.16 Cause value

The structure of the cause value field is shown in Table 7-53/Q.2630.3; the field is a fixed size field of 2 octets.

TABLE 7-53/Q.2630.3
Structure of the cause value field

8	7	6	5	4	3	2	1	
Reserved						Coding Standard		Octet 1
Reserved	Cause							Octet 2

Coding Standard
00 ITU-T standardized coding as described in Q.850[6] and Q.2610[7]
01 ISO/IEC standard (Note)
10 national standard (Note)
11 standard defined for the network (either public of private) present on the network side of the interface (Note)

NOTE — These other coding standards should be used only when the parameter contents cannot be represented with the ITU-T standardized coding.

The procedures defined in § 8 make use of ITU-T standardized codes described in Q.850[6] and Q.2610[7]. The codes are listed here for convenience. If there exists any difference in the names and code points of the following causes, the definitions in Q.850 and Q.2610 take precedence.

Code	Cause Description
1	Unallocated (unassigned) number
3	No route to destination
25	Exchange routing error
31	Normal, unspecified
34	No circuit/channel available
38	Network out of order
41	Temporary failure
42	Switching equipment congestion
44	Requested circuit/channel not available
47	Resource unavailable, unspecified
93	AAL parameters cannot be supported
95	Invalid message, unspecified
96	Mandatory information element is missing
97	Message type non-existent or not implemented
99	Information element/parameter non-existent or not implemented
100	Invalid information element contents
102	Recovery on timer expiry
110	Message with unrecognized parameter, discarded
111	Protocol error, unspecified

7.4.17 Diagnostics

The structure of the diagnostics field is shown in Table 7-54/Q.2630.3; the field is a variable size field.

TABLE 7-54/Q.2630.3
Structure of the diagnostic field

8	7	6	5	4	3	2	1	
Field Length								Octet 1
								Octet 2
Diagnostic								
								Octet n

The coding is specified in ITU-T Recommendation Q.2610[7] except when associated with one of the following causes:

- Message type non-existent or not implemented,
- Information element/parameter non-existent or not implemented, or
- Message with unrecognized parameter, discarded.

In these cases, the Diagnostics field is shown in Table 7-55/Q.2630.3; the field is a variable size field.

Table 7-55/Q.2630.3
Structure of the diagnostic field for compatibility causes

8	7	6	5	4	3	2	1	
Field Length								Octet 1
Message Identifier								Octet 2
first			Parameter Identifier					Octet 3
pair			Field Number					Octet 4
second			Parameter Identifier					Octet 5
pair			Field Number					Octet 6
last			Parameter Identifier					
pair			Field Number					Octet n

The diagnostic field for compatibility always starts — after the field length — with an octet containing the copy of the Message Identifier (of the message that gave rise to a compatibility diagnostic) followed by 0 to 125 octet pairs each containing a parameter identifier and a field number. If the field number octet is zero, the whole parameter is designated.

7.4.18 Served user transport

The structure of the served user transport field is shown in Table 7-56/Q.2630.3; the field is a variable size field.

TABLE 7-56/Q.2630.3
Structure of the served user transport field

8	7	6	5	4	3	2	1	
Field Length								Octet 1
								Octet 2
Served User Transport								
								Octet n

The served user transport length can be from 1 to 254 octets.

7.4.19 Audio Extended service

The Audio Extended service for the AAL type 2 is defined as “audio service” in ITU-T Recommendation I.366.2[14]. The structure of the audio extended service field is shown in Table 7-57/Q.2630.3; the field is a fixed size field of 5 octets.

Table 7-57/Q.2630.3
Structure of the audio extended service field

8	7	6	5	4	3	2	1	
Profile Type		Reserved			LB	RC	SYN	Octet 1
Profile Identifier								Octet 2
FRM	CMD	MF-R2	MF-R1	DTMF	CAS	FAX	A/μ-Law	Octet 3
Maximum length of frame mode data								Octet 4 Octet 5

The following codes are used in the subfields of the audio service field:

a) Profile type:

00 The "Profile Identifier" designates a profile specified in ITU-T Recommendation I.366.2[14], the organizational unique identifier field in the same parameter is ignored.

01 The "Profile Identifier" designates a profile specified by an organization designated by the organizational unique identifier field in the same parameter.

10 The "Profile Identifier" designates a custom profile, the organizational unique identifier field in the same parameter is ignored.

11 Reserved.

b) Profile Identifier

The "Profile Identifier" designates a profile as specified in either ITU-T Recommendation I.366.2[14], by an organization designated by the organizational unique identifier field in the same parameter, or a custom profile depending of the value of the "profile Type".

c)

LB	0:	Loopback disabled
	1:	Loopback enabled
RC	0:	Transport of rate control commands disabled
	1:	Transport of rate control commands enabled
SYN	0:	Transport of synchronization of change in SSCS operation disabled
	1:	Transport of synchronization of change in SSCS operation enabled
FRM	0:	Transport of frame mode data disabled
	1:	Transport of frame mode data enabled
CMD	0:	Transport of circuit mode data (64 kbit/s) disabled
	1:	Transport of circuit mode data (64 kbit/s) enabled
MF-R2	0:	Transport of multi-frequency R2 dialed digits disabled
	1:	Transport of multi-frequency R2 dialed digits enabled
MF-R1	0:	Transport of multi-frequency R1 dialed digits disabled
	1:	Transport of multi-frequency R1 dialed digits enabled
DTMF	0:	Transport of dual tone multi-frequency dialed digits disabled
	1:	Transport of dual tone multi-frequency dialed digits enabled
CAS	0:	Transport of channel associated signalling disabled
	1:	Transport of channel associated signalling enabled
FAX	0:	Transport of demodulated facsimile data disabled
	1:	Transport of demodulated facsimile data enabled
A/μ-Law	0:	Interpretation of generic PCM coding: A-Law
	1:	Interpretation of generic PCM coding: μ-Law

7.4.20 Multirate Extended service

The structure of the multirate extended service field is shown in Table 7-58/Q.2630.3; the field is a fixed size field of 3 octets.

Table 7-58/Q.2630.3
Structure of the multirate extended service field

8	7	6	5	4	3	2	1	
FRM	LB	Reserved	Multiplier n for n×64 kbit/s					Octet 1
Maximum length of frame mode data								Octet 2 Octet 3

FRM 0: Transport of frame mode data disabled
1: Transport of frame mode data enabled

LB 0: Loopback disabled
1: Loopback enabled

n $1 \leq n \leq 31$ Multiplier for n×64 kbit/s

7.4.21 AAL type 2 Path QoS Codepoint

The structure of the AAL type 2 path QoS codepoint field is shown in Table 7-59/Q.2630.3; the field is a fixed size field of 1 octet.

Table 7-59/Q.2630.3
Structure of the AAL type 2 path QoS codepoint field

8	7	6	5	4	3	2	1	
AAL type 2 path QoS codepoint								Octet 1

The "AAL type 2 path QoS codepoint" has the following meaning:

0: reserved for assignment by ITU-T
1: stringent class
2: tolerant class
3,4: reserved for assignment by ITU-T
5: stringent bi-level class
6 to 127: reserved for assignment by ITU-T
128 to 255: reserved for network specific assignment

The attributes of "stringent class", "tolerant class", and "stringent bi-level class" are those defined in ITU-T Recommendation I.356[13].

7.4.22 Served User Correlation ID value

The structure of the Served User Correlation ID value field is shown in Table 7-60/Q.2630.3; the field is a fixed size field of 1 octet.

Table 7-60/Q.2630.3
Structure of the Served User Correlation ID value field

8	7	6	5	4	3	2	1	
Served User Correlation ID value								Octet 1

The Served User Correlation ID value adheres to the specifications in ITU-T Recommendation I.366.2[14].

7.4.23 AAL Type 2 Node Automatic Congestion Level

The structure of the AAL type 2 Node Automatic Congestion Level field is shown in Table 7-61/Q.2630.3; the field is a fixed size field of 1 octets.

Table 7-61/Q.2630.3
Structure of the AAL type 2 Node Automatic Congestion Level field

8	7	6	5	4	3	2	1	
AAL type 2 Node Automatic Congestion Level codepoint								Octet 1

The "AAL type 2 Node Automatic Congestion Level Codepoint" has the following meaning:

0000000 spare
0000001 congestion level 1 exceeded
0000010 congestion level 2 exceeded
0000011 to 1111111 spare

7.4.24 Priority

The structure of the Priority field is shown in Table 7-62/Q.2630.3; the field is a fixed size field of 1 octets.

Table 7-62/Q.2630.3
Structure of the Priority field

8	7	6	5	4	3	2	1	
Reserved					Priority			Octet 1

The priority code-point has the following meaning:

0 0 0 level 1 (highest)
0 0 1 level 2
0 1 0 level 3
0 1 1 level 4
1 0 0 level 5 (lowest)
1 0 1 to 1 1 1 reserved

7.4.25 AAL Type 2 Hop Counter

The structure of the AAL type 2 Hop Counter field is shown in Table 7-63/Q.2630.3; the field is a fixed size field of 1 octets.

Table 7-63/Q.2630.3
Structure of the AAL type 2 Hop Counter field

8	7	6	5	4	3	2	1	
AAL type 2 Hop Counter codepoint								Octet 1

The “AAL type 2 Hop Counter Codepoint” has the following meaning: The hop counter contains the binary value of the number of contiguous connection segments / bearer control associations that are allowed to complete the connection.

7.4.26 CPS bit rate

The structure of the CPS bit rate field is shown in Table 7-64/Q.2630.3; the field is a fixed size field of 6 octets.

TABLE 7-64/Q.2630.3
Structure of the CPS bit rate field

8	7	6	5	4	3	2	1	
CPS bit rate in the forward direction								Octet 1 Octet 2 Octet 3
CPS bit rate in the backward direction								Octet 4 Octet 5 Octet 6

A CPS bit rate may be used as a Peak CPS bit rate or a Sustainable CPS bit rate according to ITU-T Recommendation I.378[19]. Allowed values are 0 to 16384 kbit/s. The granularity is 64 bit/s.

7.4.27 CPS token bucket size

The structure of the CPS token bucket size field is shown in Table 7-65/Q.2630.3; the field is a fixed size field of 4 octets.

TABLE 7-65/Q.2630.3
Structure of the CPS token bucket size field

8	7	6	5	4	3	2	1	
CPS token bucket size in the forward direction								Octet 1
								Octet 2
CPS token bucket size in the backward direction								Octet 3
								Octet 4

A CPS token bucket size represents a CPS token bucket size associated either with a Peak CPS bit rate or a Sustainable CPS bit rate according to ITU-T Recommendation I.378[19]. Allowed values are 48 to 4096 octets.

7.4.28 Maximum allowed CPS packet size

The structure of the CPS packet size field is shown in Table 7-66/Q.2630.3; the field is a fixed size field of 2 octets.

TABLE 7-66/Q.2630.3
Structure of the CPS packet size field

8	7	6	5	4	3	2	1	
CPS packet size in the forward direction								Octet 1
CPS packet size in the backward direction								Octet 2

A CPS packet size may be used as maximum CPS packet size, in octets, allowed to be sent in the specified direction during the holding time of the connection according to ITU-T Recommendation I.378[19]. Allowed values are 4 to 48 octets.

7.4.29 Source traffic type

The structure of the source traffic type field is shown in Table 7-67/Q.2630.3; the field is a fixed size field of 1 octet.

Table 7-67/Q.2630.3
Structure of source traffic type field

8	7	6	5	4	3	2	1	
Source traffic type codepoint								Octet 1

A source traffic type may be used in the specification of a variable bandwidth stringent transfer capability according to ITU-T Recommendation I.378[19].

Each source traffic type represented by a codepoint in the Source Traffic Type field must be compliant to the definition of source traffic type in I.378[19].

The following codes are used for the Source Traffic Type field:

00000000 STT unknown
00000001 AMR[30] coded speech
00000010 to 01111111 } reserved for ITU-T assignment
10000000 to 00111111 } reserved for assignment by IMT-2000 family members
11000000 to 11111111 } reserved for network specific assignment

8 Procedure of the AAL type 2 signalling protocol

Before an ATM VCC (AAL type 2 path) is put into service between a pair of adjacent AAL type 2 nodes, certain actions need to be performed. An identifier called the AAL type 2 path identifier is assigned to the ATM VCC. This identifier is used to refer to the ATM VCC in the AAL type 2 signalling protocol messages. The AAL type 2 path identifier shall uniquely identify the ATM VCC between the two adjacent AAL type 2 nodes.

On any ATM VCC used for AAL type 2 connections, all CID values from "8" to "255" are available for assignment.

Any time a new ATM VCC is put into service, the ownership of the ATM VCC shall be determined before AAL type 2 connections are established in it. In case of switched ATM VCC, the owner of the VCC shall be the AAL type 2 node that initiated the establishment of the VCC. In case of PVC and soft PVC, it is the responsibility of the management system to determine the owner of the VCC.

The nodal function is informed by layer management of a newly established AAL type 2 path by the use of the ADD-PATH.indication primitive containing the adjacent AAL type 2 node identifier, the AAL type 2 path identifier, and the ownership. The nodal function is informed by layer management of the removal of an AAL type 2 path by use of the REMOVE-PATH.indication primitive containing the adjacent AAL type 2 node identifier and the AAL type 2 path identifier.

In order to minimize the likelihood of CID collision, the following CID allocation mechanism shall be used:

- if the AAL type 2 node owns the AAL type 2 path that carries the new connection, it allocates CID values from CID value 8 upwards; and
- if the AAL type 2 node does not own the AAL type 2 path that carries the new connection, it allocates CID values from CID value 255 downwards.

Each AAL type 2 connection request (regardless of coming directly from an AAL type 2 served user or from an adjacent AAL type 2 node) shall contain an AAL type 2 service endpoint address which indicates the destination of the intended AAL type 2 connection instance. This information is used to route the AAL type 2 connection via the AAL type 2 network to its destination service endpoint. In capability set 3, the supported address formats are: NSAP and E.164.

It is up to the application area or the operator of a particular network to decide what addressing plan is used in the AAL type 2 network. The addressing plan in the AAL type 2 network can be a reuse of the addressing plan in the underlying ATM network but it can also be an independent addressing plan defined exclusively for the AAL type 2 network.

NOTE — Causes in the procedures defined in § 8 specify which ITU-T standardized code should be used in cause parameters of AAL type 2 signalling protocol messages. Implementation dependent non-standardized causes may be used for AAL type 2 signalling entity internal processing and for A2SU-SAP and LM-SAP cause primitive parameters.

The following procedures may be supported as a network option:
a) Connection priority
b) Automatic congestion control (see Recommendation Q.542[18])
c) Hop Counter Procedure
d) Temporary Alternative Routing Procedure (see ITU-T Recommendation E.412[17])

8.1 Compatibility

8.1.1 General requirements on receipt of unrecognized signalling information

It may happen that a node receives unrecognized signalling information, i.e. messages, parameter types or subfield values. This can typically be caused by the upgrading of the signalling system used by other nodes in the network. In these cases the following compatibility procedures are invoked to ensure the predictable network behavior.

All messages and parameters shall include a compatibility field generated by the nodal function.

The procedures to be used on receipt of unrecognized information make use of:
- compatibility field received in the same message as the unrecognized information;
- the cause parameter containing a cause value and diagnostics;
- the confusion message and the release request message (maintaining the link associated signalling relationship); and
- the release confirm message, the reset confirm message, the block confirm message, and the unblock confirm message (terminating the link associated signalling relationship).

The following causes are used:

- "message type non-existent or not implemented";
- "information element/parameter non-existent or not implemented"; or
- "message with unrecognized parameter, discarded".

For all the above causes a diagnostic field is included containing, dependant on the cause, the message identifier and zero, one, or more pairs of parameter identifier and field number.

The procedures are based on the following assumptions:

i) Since nodes can be both national and international nodes, the compatibility mechanism is applicable to the national and international network.

ii) If a node receives a confusion message, a release request message, a release confirm message, a reset confirm message, a block confirm message, or an unblock confirm message indicating an unrecognized message or parameter received, it assumes interaction with a node supporting a different functional level.

NOTE — A node may be at a different functional level due to having implemented a different capability set or another subset of the protocol specified in this Recommendation.

When an unrecognized parameter or message is received, the node will find some corresponding instructions contained in the parameter compatibility information or message compatibility field respectively. The message compatibility field contains the instructions specific for the handling of the complete message.

The instruction indicators consist of two subfields, one to indicate how to handle unrecognized parameters or messages and the other to indicate what to do when an unrecognized parameter or message cannot be passed on. The following general rules apply to the interpretation of these instruction indicators:

a) "Reserved" subfields of the compatibility field are not examined. They may be used by future capability sets of this Recommendation; in this case, the future capability sets will set the currently defined instruction indicators to a reasonable value for nodes implementing the current capability set. This rule ensures that more types of instructions can be defined in the future without creating a backward compatibility problem.

b) At an AAL type 2 node, the connection is released, using normal release procedures, if the instruction indicator is set to "release connection".

c) At an AAL type 2 node if the instruction indicator is set to: "Discard message", or "Discard parameter", the message or parameter is discarded, as instructed. If the send notification indicator is set to "send notification", the appropriate message is issued towards the node that sent the unrecognized information:
   - A confusion message is sent in response to an establish request message, an establish confirm message or in response to an unrecognized message.
   - The appropriate confirm message is sent in response to a release request message, block request message, unblock request message, or reset request message.
   - No response is returned in response to a confusion message, release confirm message, block confirm message, unblock confirm message, or reset confirm message.

d) At an AAL type 2 node, if the instruction indicator is set to "pass-on", the unrecognized message or parameter is passed to the link associated signalling relationship on the other side of the AAL type 2 switch used for this connection. If the ability to "pass-on" is not possible at an AAL type 2 switch, then the instruction indicators "pass-on not possible" are examined.

   NOTE — Examples of where "pass-on" might not be possible are: At AAL type 2 service endpoints, or in AAL type 2 switches in inter-operator situations, where "pass-on" might depend on bilateral agreements.

e) For the case of an unrecognized parameter, it is possible for the instruction to require that either the unrecognized parameter or the whole message be discarded. This provides for the case where the sending node determines that it is not acceptable for the message to continue being processed without this parameter.

8.1.2 Procedures for the handling of the unrecognized messages or parameters

If the unrecognized signalling information is received, an ERROR.indication primitive with an appropriate cause (described in the following sections) is sent to layer management, except when the action taken is to pass on the message or parameter transparently.

A confusion message must not be issued in response to the following messages:

- Confusion
- Release request
- Release confirm
- Block request
- Unblock request
- Reset request
- Block confirm
- Unblock confirm
- Reset confirm

Any unrecognized parameters received in the following messages are discarded:

- Confusion
- Release confirm
- Block confirm
- Reset confirm
- Unblock confirm

8.1.2.1 Unrecognized messages

Depending on the instructions received in the message compatibility field, a node receiving an unrecognized message will either:

a) transfer the message transparently;

b) discard the message;

c) discard the message and send notification; or

d) release the connection.

The release request in case d) and the confusion message in case c) shall include the cause “Message type non-existent or not implemented”, followed by a diagnostic field containing only the message identifier.

8.1.2.2 Unrecognized parameters

Unexpected parameters (a parameter in the “wrong” message) are handled like unrecognized parameters.

Depending on the instructions received in the parameter compatibility information field, a node receiving an unrecognized parameter will either:

a) transfer the parameter transparently;
b) discard the parameter;
c) discard the parameter and send notification;
d) discard the message;
e) discard the message and send notification; or
f) release the connection.

In case c), the confusion message shall include the cause “Information element/parameter non-existent or not implemented” followed by a diagnostic field containing the message identifier and containing pairs of parameter identifier and field number for each unrecognized parameter; the field number in each pair is set to “zero”.

In case e), the confusion message shall include the cause “Message with unrecognized parameter, discarded”, followed by a diagnostic field containing the message identifier and a parameter identifier (of the first detected unrecognized parameter which caused the message to be discarded) and a field number set to “zero”. A confusion message may refer to multiple unrecognized parameters.

A node receiving a message including multiple unrecognized parameters shall process the different instruction indicators, associated with those parameters, according to the following order:

1) release the connection;
2) discard the message and send notification;
3) discard the message.

A release request message shall include the cause “Information element/parameter non-existent or not implemented” followed by a diagnostic field containing the message identifier, the parameter identifier (of the first detected unrecognized parameter which caused the connection to be released), and a field number set to “zero”.

If a release request message is received containing an unrecognized parameter, depending on the instructions received in the parameter compatibility field the node will either:

- transfer the parameter transparently;
- discard the parameter; or
- discard the parameter and send a cause “Information element/parameter non-existent or not implemented”, in the release confirm message; the diagnostic field contains the message identifier and one or more pairs of parameter identifier and field number indicating all parameters that match the cause value; the field number of all pairs contains the null value.

If a block request message is received containing an unrecognized parameter, depending on the instructions received in the parameter compatibility field the node will either:

- discard the parameter; or
- discard the parameter and send a cause "Information element/parameter non-existent or not implemented", in the block confirm message; the diagnostic field contains the message identifier and one or more pairs of parameter identifier and field number indicating all parameters that match the cause value; the field number of all pairs contains the null value.

If an unblock request message is received containing an unrecognized parameter, depending on the instructions received in the parameter compatibility field the node will either:

- discard the parameter; or
- discard the parameter and send a cause "Information element/parameter non-existent or not implemented", in the unblock confirm message; the diagnostic field contains the message identifier and one or more pairs of parameter identifier and field number indicating all parameters that match the cause value; the field number of all pairs contains the null value.

If a reset request message is received containing an unrecognized parameter, depending on the instructions received in the parameter compatibility field the node will either:

- discard the parameter; or
- discard the parameter and send a cause "Information element/parameter non-existent or not implemented", in the reset confirm message; the diagnostic field contains the message identifier and one or more pairs of parameter identifier and field number indicating all parameters that match the cause value; the field number of all pairs contains the null value.

8.1.2.3 Unrecognized fields

There exists no specific compatibility information for each field. For all fields contained in a parameter, the compatibility information of the parameter applies.

Any value in a subfield that is marked as "spare", "reserved" or "national use" is regarded as unrecognized and the procedures as stated for unrecognized parameters apply except that the field number is coded in the diagnostics field.

8.1.3 Procedures for the handling of responses indicating unrecognized information has been sent

Action taken on receipt of responses indicating unrecognized information has been sent at an originating or terminating AAL type 2 node will depend on the connection state and the affected service.

The definition of any procedure that is outside the basic connection setup protocol, as defined in this Recommendation, should include procedures for handling responses that indicate that another node has received, but not recognized, information belonging to that procedure. The procedure receiving this response should take the appropriate actions.

The default action taken on receipt of a confusion message is to discard the message without disrupting normal connection processing.

8.2 Nodal functions

Interworking with AAL type 2 nodes that conform only to ITU-T Recommendations Q.2630.1[15] or Q.2630.2[16] is specified in Annex C; the procedures in the main body of the Recommendation exclusively describe the AAL type 2 signalling control protocol capability set 3.

8.2.1 Nodal functions for AAL type 2 nodes with served user interaction

8.2.1.1 Connection control

8.2.1.1.1 Successful connection set up

8.2.1.1.1.1 Actions at the originating AAL type 2 service endpoint

When the nodal function receives an ESTABLISH.request primitive from the AAL type 2 served user, the following parameters are mandatory:

- Destination Endpoint Address; and
- Transfer Capability.

When the nodal function receives an ESTABLISH.request primitive from the AAL type 2 served user, the restrictions on the optionality of the parameters used only for interworking with CS1 or CS2 nodes is described in Annex C. These optional parameters are the following:

- The Preferred Transfer Capability;
- Transfer Capability Support;
- Link Characteristics;
- Preferred Link Characteristics;
- Modify Support for Link Characteristics;
- Preferred Service Specific Information;
- Modify Support for Service Specific Information;
- Service Specific Information (Audio); and
- Service Specific Information (Multirate).

No optionality restrictions apply to the other parameters.

The nodal function analyses the routing information and selects a route with sufficient AAL type 2 path resources on a path with the requested path type (or network default if the path type is not specified) to the succeeding AAL type 2 node. It then selects an AAL type 2 path from within that route which is able to accommodate the new connection.

NOTE 1 — Routing typically is based on:

- Addressing information,
- The Test Connection Indicator,
- Transfer Capability,
- Requested Path Type,
- Automatic congestion control and the congestion level in the routing tables, and
- Temporary Alternative Routing control (see ITU-T Recommendation E.412[17]).

When the nodal functions selects a route, the connection priority information, if received from the AAL Type 2 served user is used to select a route that has sufficient AAL type 2 path resources to the succeeding AAL type 2 node.

Under the normal condition, when the network is not congested and the AAL Type 2 service endpoint has the necessary resources to complete it, the connection establishment is processed without special treatments.

NOTES

1 In times of network congestion, when the AAL Type 2 service endpoint does not have sufficient resources to complete all of the incoming connection establishment requests, as one option, the AAL Type 2 service endpoint may give preferential treatments based on the priority level.

2 The preferential treatment should include access to reserved network resources, e.g.:
   - the highest priority connections are given access to available network resources including the resources reserved for highest priority connections;
   - the second highest priority connections are given access to available network resources including the resources reserved for the second highest priority connections, except for the resources reserved for the highest priority connections, and so on;

3 Allocation of reserved network resources to specific priority levels is implementation specific, and is not a subject for standardization.

AAL type 2 service endpoint internal resources are allocated for the new connection from the originating AAL type 2 served user to the outgoing AAL type 2 path. The connection priority information, if received, is taken into consideration when allocating these resources.

On the selected outgoing AAL type 2 path, the CID and other resources (e.g. indicated by the Transfer Capability parameter) are allocated for the outgoing AAL type 2 link. The handling of interworking with CS1 and CS2 nodes is specified in Annex C.

The following parameters — if they were conveyed by the originating AAL type 2 served user — shall not be modified by the nodal function:

- the Destination Service Endpoint Address,
- the Origination Service Endpoint Address,
- the Served User Generated Reference,
- the Served User Transport,
- the Transfer Capability,
- the Preferred Transfer Capability,
- the Transfer Capability Support,
- the Link Characteristics,
- the Preferred Link Characteristics,
- the Modify Support for Link Characteristics,
- the SSCS Information,
- the Preferred SSCS Information,
- the Modify Support for SSCS Information,
- the Path Type,
- the Connection Priority, and
- the Test Connection Indicator.

The following parameters — if they were conveyed by the originating AAL type 2 served user — have significance to the served user only, therefore, they shall not be examined by the nodal function:

- the Origination Service Endpoint Address,
- the Served User Generated Reference,
- the Served User Transport,
- the SSCS Information,
- the Preferred SSCS Information, and
- the Modify Support for SSCS Information.

An outgoing protocol entity instance is invoked and the following parameters are passed to it:

- the Destination AAL type 2 Service Endpoint Address,
- the Transfer Capability,
- the AAL type 2 Path Identifier, and
- a CID value.

The nodal function shall pass the following parameters to the outgoing protocol entity instance only if they were conveyed by the originating AAL type 2 served user:

- the Origination AAL type 2 Service Endpoint Address,
- the Served User Generated Reference,
- the Served User Transport,
- the Preferred Transfer Capability,
- the Transfer Capability Support,
- the Link Characteristics,
- the Preferred Link Characteristics,
- the Modify Support for Link Characteristics,
- the SSCS Information,
- the Preferred SSCS Information,
- the Modify Support for SSCS Information,
- the Path Type,
- the Connection Priority, and
- the Test Connection Indicator.

If the Temporary Alternative Routing control is applied a “TAR controlled connection” indication shall be passed to the outgoing protocol entity instance.

If the hop counter procedure has been activated a Hop Counter containing an initial count value shall be passed to the outgoing protocol entity instance. The initial count value of the Hop Counter shall be provisioned by the network operator on a per AAL type 2 node basis (31 maximum).

NOTE 2 — Through-connection at AAL type 2 service endpoints is not specified by this Recommendation. It may be controlled by the AAL type 2 served user.

After receiving an indication of the successful AAL type 2 connection setup from the outgoing protocol entity instance, an ESTABLISH.confirm primitive is sent to the AAL type 2 served user. If a Transfer Capability Support parameter, a Modify Support for Link Characteristics, or a Modify Support for SSCS Information parameter was received from the outgoing protocol instance, the respective parameter shall be included in the ESTABLISH.confirm primitive.

8.2.1.1.1.2 Actions at the destination AAL type 2 service endpoint

Upon receiving an indication from an incoming protocol entity instance requesting a new connection, the nodal function checks the availability of the CID value and other resources (e.g., indicated by the Transfer Capability parameter), in the incoming AAL type 2 path.

NOTE — In case of interworking, the Transfer Capability and the Preferred Transfer Capability may be generated by the AAL type 2 service endpoint (see Annex C).

The following parameters — if they were conveyed by the incoming protocol entity instance — shall not be modified by the nodal function:

- the Destination Service Endpoint Address,
- the Origination Service Endpoint Address,
- the Served User Generated Reference,
- the Served User Transport,
- the Transfer Capability,
- the Preferred Transfer Capability,
- the Transfer Capability Support,
- the Link Characteristics,
- the Preferred Link Characteristics,
- the Modify Support for Link Characteristics,
- the SSCS Information,
- the Preferred SSCS Information,
- the Modify Support for SSCS Information,
- the Path Type,
- the Connection Priority, and
- the Test Connection Indicator.

The following parameters — if they were conveyed by the incoming protocol entity instance — have significance to the served user only, therefore, they shall not be examined by the nodal function:

- the Origination Service Endpoint Address,
- the Served User Generated Reference,
- the Served User Transport,
- the SSCS Information,
- the Preferred SSCS Information, and
- the Modify Support for SSCS Information.

If the Test Connection Indicator parameter is present, a “locally blocked” or “remotely blocked” AAL type 2 path shall be acceptable for the incoming connection.

If the CID and the other resources are available for the new connection, they are allocated to the new connection and then the AAL type 2 service endpoint address is examined. The nodal function determines that the destination AAL type 2 service endpoint has been reached.

When the nodal function checks the availability of resources in the incoming AAL type 2 path, the Connection Priority information, if received, is taken into consideration.

Under the normal condition, when the network is not congested and the AAL Type 2 service endpoint has the necessary resources to complete it, the connection establishment is processed without special treatments (see notes in § 8.2.1.1.1.1).

If a Temporary Alternative Routing (TAR) control parameter or a Hop Counter parameter is received, they shall be ignored.

AAL type 2 service endpoint internal resources are allocated for the new connection from the incoming AAL type 2 path to the destination AAL type 2 served user. The connection priority information, if received, is taken into consideration when allocating these resources.

The nodal function acknowledges the successful AAL type 2 connection establishment towards the incoming protocol entity instance. The nodal function shall pass the following parameters to the incoming protocol entity instance only if they were conveyed by the incoming protocol entity instance:

- the Transfer Capability Support,
- the Modify Support for Link Characteristics, and
- the Modify Support for SSCS Information.

An ESTABLISH.indication primitive is sent to the AAL type 2 served user to inform it of the successfully established new connection. The nodal function shall pass the following parameters to the destination AAL type 2 served user only if they were conveyed by the incoming protocol entity instance:

- the Origination AAL type 2 Service Endpoint Address,
- the Served User Generated Reference,
- the Served User Transport,
- the Transfer Capability,
- the Preferred Transfer Capability,
- the Transfer Capability Support,
- the Link Characteristics,
- the Preferred Link Characteristics,
- the Modify Support for Link Characteristics,
- the SSCS Information,
- the Preferred SSCS Information,
- the Modify Support for SSCS Information,
- the Path Type,
- the Connection Priority, and
- the Test Connection Indicator.

NOTE 2 — Through-connection at AAL type 2 service endpoints is not specified by this Recommendation. It may be controlled by the AAL type 2 served user.

8.2.1.1.2 Unsuccessful/abnormal connection set up

8.2.1.1.2.1 Actions at the originating AAL type 2 service endpoint

If the AAL type 2 path selection or the allocation of a CID and other resources for the outgoing AAL type 2 link described in § 8.2.1.1.1.1 fails, a RELEASE.confirm primitive is returned to the AAL type 2 served user with one of the following causes:

- “Unallocated (unassigned) number”;
- “No route to destination”;
- “No circuit/channel available”;
- “Resource unavailable, unspecified”;
- “Network out of order”; or
- “Temporary failure”.

NOTE — Path selection failure may be due to the unavailability of an AAL type 2 path with the requested path type.

If AAL type 2 service endpoint internal resources are not available for the new connection, a RELEASE.confirm primitive is sent to the AAL type 2 served user with the cause “Switching equipment congestion”.

If the AAL Type 2 service endpoint cannot complete a high priority connection establishment request even after application of the preferential treatment, a RELEASE.confirm primitive is sent to the AAL type 2 served user with the cause “Resource unavailable, unspecified”.

Upon receiving a negative acknowledgement for the connection setup request from the outgoing protocol entity instance, all the resources associated with this AAL type 2 link are released and made available for new traffic. The association to the outgoing protocol entity instance is released.

Features that enable a further connection attempt, involving the selection of a different AAL type 2 path within the same route or of an alternative route, may be implemented. Such reattempts may use the CEID parameter returned in the Release Confirm (RLC) message and may select a different AAL type 2 path within the same route only. If the CEID parameter specifies an AAL Type 2 path with insufficient resources available for the connection attempt, no connection attempt is made on that path.

If no further connection attempt is made, the AAL type 2 service endpoint internal resources are released and a RELEASE.confirm primitive is sent to the AAL type 2 served user with the cause received from the outgoing protocol entity instance.

When an indication is received from the outgoing protocol entity that the establishment request has been rejected, and there has been a change in the level of congestion of the adjacent node, the routing tables in the nodal function shall be updated accordingly. The absence of an Automatic Congestion Control parameter indicates that there is no reported congestion in the adjacent node, whilst if the Automatic Congestion Control parameter is present it indicates whether congestion level 1 or 2 has been exceeded. After the routing tables have been updated, the Automatic Congestion Control parameter is discarded.

Upon receiving an indication from the outgoing protocol entity instance that a timer has expired, the association to the outgoing protocol entity instance is released and a reset procedure is started (see § 8.2.1.2.1.1 case 3 a)). The AAL type 2 service endpoint internal resources are released. A RELEASE.confirm primitive is sent to the AAL type 2 served user with the cause received from the outgoing protocol entity instance, i.e. “Recovery on timer expiry”.

8.2.1.1.2.2 Actions at the destination AAL type 2 service endpoint

If resources on the incoming AAL type 2 path are not available, the nodal function requests the incoming protocol entity instance to reject the AAL type 2 connection with one of the following causes as applicable:

- “Resource unavailable, unspecified”; or
- “Requested circuit/channel not available”.

If the nodal function detects that the destination is not reachable it may issue a redirection request by rejecting the AAL type 2 connection with the cause “No route to destination” and include an alternative AAL type 2 path identifier in a Connection Element Identifier parameter.

If the nodal function is aware that the SSCS parameters are not supported, it requests the incoming protocol entity instance to reject the AAL type 2 connection with the cause “AAL parameters cannot be supported”.

The association between the nodal function entity and its incoming protocol entity instance is released.

If an AAL type 2 path is “locally blocked” and an indication from an incoming protocol entity instance of the request for a new connection other than a test connection is received, the following actions are taken:

1) The indication of the request for a new connection establishment is ignored and the incoming protocol entity instance is instructed to terminate and enter state “Idle”; the association with the incoming protocol entity instance is released and an ERROR.indication primitive with the CEID and the cause “Temporary failure” is sent to layer management.

2) The blocking procedure specified in § 8.2.1.2.2.1 case b) is initiated for the AAL type 2 path on which the new connection was requested to be established.

If an AAL type 2 path is “remotely blocked” and an indication from an incoming protocol entity instance of the request for a new connection other than a test connection is received, the following actions are taken:

1) The AAL type 2 path is set to “remotely unblocked”.

   NOTE — This procedure shall not be considered as the normal way to remove the “remotely blocked” condition.

2) The incoming connection establishment request is processed normally, i.e. as if the AAL type 2 path was not “remotely blocked” to begin with.

If AAL type 2 service endpoint internal resources are not available for the new connection, a negative acknowledgement for the connection setup request shall be returned to the incoming protocol entity instance with the cause “Switching equipment congestion”. The resources allocated to the incoming AAL type 2 path are released and the association between the incoming protocol entity instance and the nodal function is released.

If the AAL Type 2 service endpoint cannot complete a high priority connection establishment request even after application of the preferential treatment, a negative acknowledgement for the connection setup request shall be returned to the incoming protocol entity instance with the cause “Resource unavailable, unspecified”. The resources allocated to the incoming AAL type 2 path are released and the association between the incoming protocol entity instance and the nodal function is released.

Upon receiving an indication from an incoming protocol entity instance requesting a new connection and the connection request is to be rejected, the nodal function checks the level of congestion of the node. If either of the two congestion thresholds is exceeded, an Automatic Congestion Control parameter is passed to the protocol entity with the rejection indication. This parameter indicates the level of congestion (congestion level 1 or 2) to the adjacent AAL Type 2 node.

8.2.1.1.3 Normal connection release

8.2.1.1.3.1 Actions at the AAL type 2 service endpoint that originates the release

When the nodal function at an AAL type 2 service endpoint receives a RELEASE.request primitive from the AAL type 2 served user, it requests the protocol entity instance to release the connection. The request carries the cause of the release which shall be “Normal, unspecified” in case of normal connection release or “AAL parameters cannot be supported” if the AAL type 2 served user determines that it cannot support the SSCS parameters.

The Cause parameters shall not be modified by the nodal function.

When a release is to be initiated, the nodal function checks the level of congestion of the node. If either of the two congestion thresholds is exceeded, an Automatic Congestion Control parameter is passed to the protocol entity with the release indication. This parameter indicates the level of congestion (congestion level 1 or 2) to the adjacent AAL Type 2 node.

Upon acknowledgement of the successful connection release from the protocol entity instance, all the resources associated with this AAL type 2 link are released and made available for new traffic, and the AAL type 2 service endpoint internal resources are released. The association to the protocol entity instance is released.

8.2.1.1.3.2 Actions at the AAL type 2 service endpoint that receives the release

When the nodal function at an AAL type 2 service endpoint receives a request from a protocol entity instance to clear the connection, all the resources associated with this AAL type 2 link are released and made available for new traffic, and the AAL type 2 service endpoint internal resources are released. The release is confirmed to the protocol entity instance and a RELEASE.indication primitive with the cause received from the protocol entity instance is sent to the AAL type 2 served user. The Cause parameters shall not be modified by the nodal function. The association between the nodal function and the protocol entity instance is released.

When a Release indication containing an Automatic Congestion Control parameter is received from the incoming or outgoing protocol entity, and there has been a change in the level of congestion of the adjacent node, the routing tables in the nodal function shall be updated according to the indicated congestion level. The absence of an Automatic Congestion Control parameter indicates that there is no reported congestion in the adjacent node, whilst if the Automatic Congestion Control parameter is present it indicates whether congestion level 1 or 2 has been exceeded. After the routing tables have been updated, the Automatic Congestion Control parameter is discarded.

8.2.1.1.4 Abnormal connection release procedures

When the nodal function at an AAL type 2 service endpoint receives an indication from the protocol entity instance that a timer has expired, the association to the protocol entity instance is released and a maintenance protocol entity instance is ordered to start a reset procedure.

8.2.1.1.5 Successful modification

NOTE 1 — Modification of connection resources and SSCS layer resources are mandatory capabilities in this Recommendation (as in ITU-T Recommendation Q.2630.2[16]). Modify Support parameters and the Transfer Capability Support parameter are only required for interworking with CS1 and CS2 nodes (see Annex C).

NOTE 2 —The effect of SSCS information in AAL type 2 CS3 nodes is restricted to the allocation, configuration and management of the respective SSCS layer resources in AAL type 2 CS3 service endpoints.

8.2.1.1.5.1 Actions at the AAL type 2 service endpoint originating the modification request

When the nodal function receives a MODIFY.request primitive from the AAL type 2 served user, the following restrictions on the optionality of the parameters of the primitive apply:

- A Transfer Capability parameter or an SSCS Information parameter must be present.
- If a Transfer Capability parameter is present, this parameter has to refer to the same AAL type 2 transfer capability as the AAL type 2 Transfer Capability parameter in the ESTABLISH.request primitive.
  NOTE —For example, if the AAL type 2 Transfer Capability parameter in the ESTABLISH.request primitive indicated a Variable Bandwidth Stringent Transfer Capability, the AAL type 2 Transfer Capability parameter in the MODIFY.request primitive, if present, may only indicate a Variable Bandwidth Stringent Transfer Capability.
- If an SSCS Information parameter is present, this parameter has to refer to the same SSCS Information as the SSCS Information parameter in the ESTABLISH.request primitive.
  NOTE — For example, if the SSCS Information parameter in the ESTABLISH.request primitive indicated an audio service specific information, the SSCS Information parameter in the MODIFY.request primitive, if present, may only indicate an audio service specific information.
- **HK1d:** If an SSCS Information parameter is present, it must be either an “SSCS Information (Audio Extended)” parameter or an “SSCS Information (Multirate Extended)” parameter.

When the nodal function receives a MODIFY.request primitive from the AAL type 2 served user, the restrictions on the optionality of the Link Characteristics parameter that is used only for interworking with CS1 or CS2 nodes is described in Annex C.

When the nodal function receives a MODIFY.request primitive from the AAL type 2 served user that conveys a Transfer Capability parameter, it checks the availability of resources indicated by the AAL type 2 connection resource in the AAL type 2 path. If the resources are available for the connection, they are reserved for the connection.

The protocol entity instance is informed of the modification request. The nodal function shall pass the following parameters to the protocol entity instance only if they were conveyed by the AAL type 2 served user:

- the Served User Correlation ID,
- the Transfer Capability,
- the Link Characteristics, and
- the SSCS Information.

The following parameters — if they were conveyed by the originating AAL type 2 served user — shall not be modified by the nodal function:

- the Served User Correlation ID,
- the Transfer Capability,
- the Link Characteristics, and
- the SSCS Information.

The following parameters — if they were conveyed by the originating AAL type 2 served user — have significance to the served user only, therefore, they shall not be examined by the nodal function:

- the Served User Correlation ID, and
- the SSCS Information.

After receiving an indication of the successful modification from the protocol entity instance and AAL type 2 connection resources were requested to be modified, the reserved additional resources are allocated to the connection or resources no longer required for this AAL type 2 connection are freed.

A MODIFY.confirm primitive is then sent to the AAL type 2 served user. If a Served User Correlation ID parameter was received from the protocol entity instance, it shall be included in the MODIFY.confirm primitive. The Served User Correlation ID parameter has significance to the served user only, therefore, it shall not be examined by the nodal function.

8.2.1.1.5.2 Actions at the AAL type 2 service endpoint receiving the modification request

Upon receiving an indication from a protocol entity instance requesting modification of the AAL type 2 connection resource, i.e., a Transfer Capability parameter is conveyed, the nodal function checks the availability of resources indicated by the AAL type 2 connection resource information in the incoming AAL type 2 path. If the resources are available for the connection, they are reserved for the connection.

NOTE — In case of interworking, the Transfer Capability may be generated by the AAL type 2 service endpoint (see Annex C).

A MODIFY.indication primitive is sent to the AAL type 2 served user to inform it of the modification of AAL type 2 connection resource. The nodal function shall pass the following parameters to the AAL type 2 served user only if they were conveyed by the protocol entity instance:

- the Served User Correlation ID,
- the Transfer Capability,
- the Link Characteristics, and
- the SSCS Information.

The following parameters — if they were conveyed by the originating AAL type 2 served user — have significance to the served user only, therefore, they shall not be examined by the nodal function:

- the Served User Correlation ID, and
- the SSCS Information.

Upon receiving a MODIFY.response from the served user and AAL type 2 connection resources were requested to be modified, the reserved additional resources are allocated to the connection or resources no longer required for this AAL type 2 connection are freed. The nodal function acknowledges the successful AAL type 2 connection resource modification towards the protocol entity instance. If a Served User Correlation ID parameter was contained in the MODIFY.response primitive, this parameter is passed to the protocol entity. The Served User Correlation ID parameter has significance to the served user only, therefore, it shall not be examined by the nodal function.

8.2.1.1.6 Unsuccessful/abnormal modification

8.2.1.1.6.1 Actions at the AAL type 2 service endpoint originating the modification request

If resources on the AAL type 2 path are not available, a MODIFY-REJECT.confirm primitive is returned to the AAL type 2 served user with the cause “Resource unavailable, unspecified”.

Upon receiving a negative acknowledgement for the modification request from the protocol entity instance, all additional resources reserved for the modification request are freed. A MODIFY-REJECT.confirm primitive is sent to the AAL type 2 served user with the cause received from the protocol entity instance. The Cause parameters shall not be modified by the nodal function.

Upon receiving an indication from the outgoing protocol entity instance that a timer has expired, the association to the outgoing protocol entity instance is released and a reset procedure is started (see § 8.2.1.2.1.1 case 3a). The AAL type 2 service endpoint internal resources are released. A RELEASE.indication primitive is sent to the AAL type 2 served user with the cause received from the outgoing protocol entity instance, i.e., “Recovery on timer expiry”.

8.2.1.1.6.2 Actions at the AAL type 2 service endpoint receiving the modification request

If the resources on the AAL type 2 path are not available, the nodal function requests the protocol entity instance to reject the AAL type 2 modification request with the cause “Resource unavailable, unspecified”.

8.2.1.1.7 Connection release during modification

The release procedures take precedence over the modification procedures.

8.2.1.1.7.1 Actions at the AAL type 2 service endpoint

When the nodal function receives a RELEASE.request primitive from the AAL type 2 served user or an indication of connection release from the protocol entity instance during the modification procedures, the nodal function will continue with normal connection release procedures.

8.2.1.2 Maintenance control

8.2.1.2.1 Reset

The reset procedure is invoked under abnormal conditions such as when the current status of the channels is unknown or ambiguous, for example, an AAL type 2 switching system that has suffered memory mutilation will not know the status of channels in one or several AAL type 2 paths. All the affected channels and any associated resources (e.g. bandwidth, etc.) between the two adjacent AAL type 2 nodes shall be released. The resources are made available for new traffic.

The reset procedure covers the following three cases:

1) Case 1: Reset all channels used for user plane traffic (see note) in all AAL type 2 paths associated with a signalling transport association between two adjacent AAL type 2 nodes.

2) Case 2: Reset all channels used for user plane traffic (see note) in a single AAL type 2 path between two adjacent AAL type 2 nodes represented by an AAL type 2 Path Identifier.

3) Case 3: Reset a single channel between two adjacent AAL type 2 nodes.

NOTE — Channels used for user plane traffic refers to channels that are under the control of the AAL type 2 signalling entity. They are identified by CID values "8" … "255". Other channels are unaffected by the reset procedure.

The reset procedure should be initiated when:

a) Signalling anomalies are detected by the AAL type 2 signalling entity. The following anomalies are detected by the protocol procedures and are indicated to the nodal function:
   - Timer "Timer_ERQ" expiry - Action: Reset the single AAL type 2 channel associated with the outgoing protocol entity instance.
   - Timer "Timer_REL" expiry - Action: Reset the single AAL type 2 channel associated with the incoming or outgoing protocol entity instance.
   - Timer "Timer_MOD" expiry - Action: Reset the single AAL type 2 channel associated with the incoming or outgoing protocol entity instance.

b) Maintenance action is required to recover from abnormal conditions such as loss or ambiguity of association information (e.g., caused by memory mutilation) between SAID(s) and the channel status of either a specific channel in a specific AAL type 2 path, all channels in a specific AAL type 2 path, or all AAL type 2 paths associated with a signalling transport association between two AAL type 2 signalling nodes. Action: Reset a single AAL type 2 channel in a specific AAL type 2 path, all AAL type 2 channels in a single AAL type 2 path or all AAL type 2 channels in all AAL type 2 paths associated with a signalling transport association between two adjacent AAL type 2 nodes respectively.

The reset procedures take precedence over the modification procedures.

8.2.1.2.1.1 Actions at reset initiating AAL type 2 node

Reset procedures can be initiated to reset:

1) all AAL type 2 paths associated with a signalling transport association between two adjacent AAL type 2 nodes,

2) a specific AAL type 2 path;

3) a single AAL type 2 channel.

For case 1, layer management passes a RESET.request together with the indication "All AAL type 2 paths associated with a signalling transport association" to the nodal function which in turn invokes a maintenance protocol entity and passes a request for reset to that entity together with an indication that all AAL type 2 paths associated with a signalling transport association must be reset.

For case 2, layer management passes a RESET.request together with the AAL type 2 path identifier to the nodal function which in turn invokes a maintenance protocol entity and passes a request for reset together with the AAL type 2 path identity.

For case 3 there are two possible subcases, one due to timer expiry and the other due to layer management action:

a) After the expiry of Timer_ERQ, Timer_REL, or Timer_MOD, the nodal function invokes a maintenance protocol entity by passing a request for a reset together with the identity of the AAL type 2 path and the channel.

b) Layer management invokes the nodal function which in turn invokes a maintenance protocol entity by passing a request for a reset together with the identity of the AAL type 2 path and the channel.

In cases 1), 2), and 3 b), the nodal function requests any affected incoming or outgoing protocol entity instances to terminate and enter state "Idle". The associations to the incoming or outgoing protocol entity instances are released. The affected AAL type 2 served users are informed with a RELEASE.indication primitive with the cause "Temporary failure".

For cases 1) and 2), the remote blocking state for the affected path(s) is set to “remotely unblocked”.

Upon receiving a reset confirmation from the maintenance protocol entity instance, the nodal function will make the affected resources available for new connections, and the AAL type 2 node internal resources are released. The association to the maintenance protocol entity instance is released. In case 3 a), a RESET.indication primitive with a CEID parameter is sent to layer management; in all other cases, a RESET.confirm primitive is sent to the layer management.

NOTE — The local blocking states are not affected.

8.2.1.2.1.2 Actions at reset responding node

Upon receiving a reset indication from the maintenance protocol entity, the nodal function analyses the received information to determine which AAL type 2 channels are to be reset.

1) If an indication that all AAL type 2 paths associated with a signalling transport association must be reset is received, then all AAL type 2 channels associated with a signalling transport association between the two adjacent AAL type 2 nodes are reset.

2) If an indication that all the channels within the identified AAL type 2 path must be reset is received, all AAL type 2 channels within that path are reset.

3) If an indication that a specific channel within an AAL type 2 path must be reset is received, only that channel is reset.

In cases 1) and 2), for “locally blocked” AAL type 2 paths, blocking procedures (refer to § 8.2.1.2.2.1 case b)) are initiated prior to the sending of the reset confirmation.

If resources have been assigned to any of the channels that are reset, the nodal functions make the affected resources available for new connections, and the AAL type 2 node internal resources are released. It also returns a reset confirmation to the maintenance protocol entity. The association between the nodal function and the maintenance protocol entity instance is released. The nodal function informs layer management about the receipt of the reset request by sending a RESET.indication primitive with the same CEID parameter as has been received in the RES message (reset request).

The nodal function also requests the affected incoming or outgoing protocol entity instances (if any) to terminate and enter state “Idle”. The associations to the incoming or outgoing protocol entity instances are released. The affected AAL type 2 served user is informed with a RELEASE.indication primitive with the cause “Temporary failure”.

8.2.1.2.1.3 Abnormal reset procedures

Upon receiving a negative acknowledgement with a cause “Switching equipment congestion” from the maintenance protocol entity instance, the nodal function repeats the request for the reset.

Upon receiving a negative acknowledgement with another cause from the maintenance protocol entity instance, an ERROR.indication primitive including the cause received from the maintenance protocol entity instance and the CEID parameter is sent to layer management.

Upon receiving a STOP-RESET.request primitive with adjacent AAL type 2 node identifier and connection element identifier parameters from layer management, the nodal function will make the affected resources available for new connections. The nodal function requests the maintenance protocol entity instance to terminate and enter state “Idle”. The association between the nodal function and the maintenance protocol entity instance is released.

8.2.1.2.2 Blocking and unblocking of AAL type 2 paths

The AAL type 2 path blocking procedure is provided to prevent an AAL type 2 path from being selected for carrying new connections other than test connections. Existing connections on the AAL type 2 path are not affected.

Blocking can be initiated by either signalling endpoint that controls an AAL type 2 path. When blocking is invoked, both ends of the AAL type 2 path are put into a blocked state. A blocked AAL type 2 path cannot be selected for new, non-test traffic by either AAL type 2 node.

An acknowledgment is required for each blocking and unblocking request. The acknowledgment is not sent until the appropriate action - blocking or unblocking - has been taken.

Unblocking can only be initiated by the same AAL type 2 node which initiated the blocking procedures. It is performed by sending an unblocking request. At either end, the blocked state is removed and the AAL type 2 path is made available again for all new connections.

An AAL type 2 path is considered “unblocked” if it is both “locally unblocked” and “remotely unblocked”.

The blocking and unblocking procedures do not affect the modification procedures.

8.2.1.2.2.1 Initiating blocking

Blocking can be initiated either by layer management, by the reset procedure, or by the connection establishment procedure.

Case a): When a BLOCK.request primitive is received from layer management for an AAL type 2 path that is currently “locally unblocked”, the AAL type 2 path becomes “locally blocked”. The AAL type 2 path is made unavailable for the selection to accommodate new non-test connections.

Case b): A request for blocking can also be received from the reset procedure (§ 8.2.1.2.1.2) or from establishment procedure (§ 8.2.1.1.2.2).

In both cases, a maintenance protocol entity is then invoked and the AAL type 2 path identifier and a request for blocking is passed to it.

When confirmation of the blocking is received from the maintenance protocol entity, a BLOCK.confirm primitive is sent to layer management and the association to the maintenance protocol entity instance is released.

8.2.1.2.2.2 Initiating unblocking

When an UNBLOCK.request is received from layer management for an AAL type 2 path that is currently “locally blocked”, a maintenance protocol entity is invoked and the AAL type 2 path identifier and a request for unblocking is passed to it.

When confirmation of the unblocking is received from the maintenance protocol entity, the AAL type 2 path becomes “locally unblocked” and the AAL type 2 path is made available again to accommodate new connections (if it is not “remotely blocked”). An UNBLOCK.confirm is sent to layer management and the association to the maintenance protocol entity instance is released.

8.2.1.2.2.3 Receiving blocking

When an indication of blocking is received from a maintenance protocol entity for an AAL type 2 path that is currently “remotely unblocked”, the AAL type 2 path becomes “remotely blocked” and the AAL type 2 path is made unavailable to accommodate new non-test connections. A response is then sent to the maintenance protocol entity indicating the acceptance of the blocking and the association to the maintenance protocol entity instance is released.

8.2.1.2.2.4 Receiving unblocking

When an indication of unblocking is received from a maintenance protocol entity for an AAL type 2 path that is currently “remotely blocked”, the AAL type 2 path becomes “remotely unblocked” and the AAL type 2 path is made available to accommodate new connections (if it is not “locally blocked”). A response is then issued to the maintenance protocol entity indicating the acceptance of the unblocking and the association to the maintenance protocol entity instance is released.

8.2.1.2.2.5 Abnormal blocking and unblocking procedures

a) If an indication for blocking is received from a maintenance protocol entity for an AAL type 2 path which is already “remotely blocked”, a blocking confirmation is sent to the maintenance protocol entity and the association to the maintenance protocol entity instance is released. No further actions are performed.

b) If an indication for unblocking is received from a maintenance protocol entity for an AAL type 2 path which is “remotely unblocked”, an unblocking confirmation is sent to the maintenance protocol entity and the association to the maintenance protocol entity instance is released. No further actions are performed.

c) If a BLOCK.request primitive is received from layer management for an AAL type 2 path that is already “locally blocked”, the procedure in § 8.2.1.2.2.1 is performed.

d) If an UNBLOCK.request primitive is received from layer management for an AAL type 2 path that is already “locally unblocked”, the procedure in § 8.2.1.2.2.2 is performed.

e) If an indication of an error is received from the maintenance protocol entity, a BLOCK.confirm primitive or an UNBLOCK.confirm primitive with the cause received from the maintenance protocol entity instance is sent to layer management. The association to the maintenance protocol entity is released.

8.2.1.2.3 Transmission fault handling

Fully digital transmission systems are provided between all AAL type 2 nodes. They have some inherent fault indication features that give an indication to the switching system when faults are detected on the transmission path level and/or on the virtual path level. On receipt of a fault indication from layer management, the routing function in the switching system inhibits selection of the AAL type 2 path (or paths) concerned for the period that the fault condition persists. No special action is required for active connections.

8.2.1.2.4 AAL type 2 signalling entity signalling congestion control

On receipt of a CONGESTION.indication primitive from the generic signalling transport service, the AAL type 2 signalling entity should alter traffic load (e.g. connection attempts) toward the affected AAL type 2 nodes to align with the congestion level indicated by the primitive.

8.2.1.2.5 Adjacent AAL type 2 node availability

On receipt of an OUT-OF-SERVICE.indication primitive from the generic signalling transport service, the following action is required: All AAL type 2 paths to the affected adjacent AAL type 2 node are marked as unavailable in the routing function prohibiting new (test or user) connection establishments to that AAL type 2 node. Already established connections need not be released even though signalling messages cannot be sent to the affected node.

On receipt of an IN-SERVICE.indication primitive from the generic signalling transport service, the following action is required: All AAL type 2 paths to the affected adjacent AAL type 2 node, that are both “locally unblocked” and “remotely unblocked”, are again marked available in the routing function and any of the unallocated channels can be used for connections immediately consistent with the congestion level in the primitive. Reset procedures that may have started during the period of signalling isolation continue and ensure that affected channels are returned to state “Idle”. Connections that are in state “Established” are unaffected.

8.2.1.3 Error handling

A message received indicating an AAL type 2 path or CID value that is not controlled by the nodal function shall be discarded and layer management shall be informed with an ERROR.indication primitive with a cause “Invalid information element contents”.

If a parameter is present more than once in a message where this parameter is allowed only once, only the first parameter shall be processed; all subsequent instances of the parameter shall be ignored.

When receiving a message which does not contain the minimum set of parameters required to continue processing, a protocol error is reported to layer management with an ERROR.indication primitive with a cause “Mandatory information element is missing” and the message is discarded.

8.2.2 Nodal functions for AAL type 2 nodes without served user interaction

8.2.2.1 Connection control

8.2.2.1.1 Successful connection set up

Upon receiving notification from an incoming protocol entity instance requesting a new connection, the nodal function checks the availability of the CID value and other resources (e.g., indicated by Transfer Capability parameter), in the incoming AAL type 2 path.

NOTE — In case of interworking, the Transfer Capability and the Preferred Transfer Capability may be generated by the AAL type 2 switch (see Annex C).

If the Test Connection Indicator parameter is present, “locally blocked” or “remotely blocked” AAL type 2 paths shall be acceptable for the incoming connection.

If the CID and the other resources are available for the incoming AAL type 2 link, the resources are allocated to the new connection.

If the Hop Counter is received, and the hop counter procedure is activated, the nodal functions shall decrement the Hop Counter value by 1. If the result is greater than 0, the nodal function shall pass the updated Hop Counter to the outgoing protocol entity instance when it is invoked. If the Hop Counter is received, and the hop counter procedure is not activated, the nodal functions shall pass the Hop Counter unmodified to the outgoing protocol entity instance when it is invoked.

NOTE — If the result is 0, see § 8.2.2.1.2.

The AAL type 2 service endpoint address is then examined. The nodal function determines that the AAL type 2 connection needs to be routed further to reach the destination AAL type 2 service endpoint and analyses the routing information. It selects a route with sufficient AAL type 2 path resources on a path with the requested path type (or network default if the path type is not specified) to the next AAL type 2 node. It then selects an AAL type 2 path from within the route which is able to accommodate the new connection.

NOTE 1 — Routing typically is based on:
- Addressing information,
- Transfer Capability,
- Test Connection Indicator,
- Requested Path Type,
- Automatic congestion control and the congestion level in the routing tables, and
- Temporary Alternative Routing (TAR) control (see ITU-T Recommendation E.412[17]).

When the nodal functions selects a route, the Connection Priority information, if received from the incoming protocol entity instance is used to select a route that has sufficient AAL type 2 path resources to the succeeding AAL type 2 node.

If the "TAR controlled connection" indication is received, the nodal functions shall not apply network management Temporary Alternative Routing (TAR) to the same connection.

If a Hop Counter is not received, and the hop counter procedure is activated, the nodal function shall pass the Hop Counter containing an initial count value to the outgoing protocol entity instance when it is invoked. The initial count value shall be provisioned by the network operator on a per AAL type 2 node basis (31 maximum).

AAL type 2 node internal resources are allocated for the new connection from the incoming AAL type 2 path to the outgoing AAL type 2 path. The connection priority information, if received, is taken into consideration when allocating these resources.

Under the normal condition, when the network is not congested and the AAL Type 2 node has the necessary resources to complete it, the connection establishment is processed without special treatments.

NOTES

1 In times of network congestion, when the AAL Type 2 node does not have sufficient resources to complete all of the incoming connection establishment requests, as one option, the AAL Type 2 node may give preferential treatments based on the priority level.

2 The preferential treatment should include access to reserved network resources, e.g.:
- the highest priority connections are given access to available network resources including the resources reserved for highest priority connections;
- the second highest priority connections are given access to available network resources including the resources reserved for the second highest priority connections, except for the resources reserved for the highest priority connections, and so on;

3 Allocation of reserved network resources to specific priority levels is implementation specific, and is not a subject for standardization.

On the selected outgoing AAL type 2 path, the CID and other resources (e.g., indicated by Transfer Capability, Link Characteristics, or SSCS information) are allocated for the outgoing AAL type 2 link. The handling of Transfer Capability, Link Characteristics, and SSCS information is specified in Annex C.

The following parameters — if they were conveyed by the incoming protocol entity instance — shall not be modified by the nodal function:

- the Destination Service Endpoint Address,
- the Origination Service Endpoint Address,
- the Served User Generated Reference,
- the Served User Transport,
- the Transfer Capability,
- the Preferred Transfer Capability,
- the Transfer Capability Support,
- the Link Characteristics,
- the Preferred Link Characteristics,
- the Modify Support for Link Characteristics,
- the SSCS Information,
- the Preferred SSCS Information,
- the Modify Support for SSCS Information,
- the Path Type,
- the Connection Priority, and
- the Test Connection Indicator.

The following parameters — if they were conveyed by the incoming protocol entity instance — have significance to the served user only, therefore, they shall not be examined by the nodal function:

- the Origination Service Endpoint Address,
- the Served User Generated Reference,
- the Served User Transport,
- the SSCS Information,
- the Preferred SSCS Information, and
- the Modify Support for SSCS Information.

An outgoing protocol entity instance is invoked and the following parameters are passed to it:

- the Destination AAL type 2 Service Endpoint Address,
- the AAL type 2 Path Identifier,
- a CID value, and
- the Transfer Capability.

The nodal function shall pass the following parameters to the outgoing protocol entity instance only if they were conveyed by the incoming protocol entity instance:

- the Origination AAL type 2 Service Endpoint Address,
- the Served User Generated Reference,
- the Served User Transport,
- the Preferred Transfer Capability,
- the Transfer Capability Support,
- the Link Characteristics,
- the Preferred Link Characteristics,
- the Modify Support for Link Characteristics,
- the SSCS Information,
- the Preferred SSCS Information,
- the Modify Support for SSCS Information,
- the Path Type,
- the Connection Priority, and
- the Test Connection Indicator.

A received “TAR controlled connection” indication shall be passed to the invoked outgoing protocol entity instance unchanged; alternatively, if the “TAR controlled connection” indication is not received and the nodal function applies network management Temporary Alternative Routing to the connection, the nodal function shall pass a “TAR controlled connection” parameter to the invoked outgoing protocol entity instance.

If the Hop Counter has been received or generated by the nodal function, it is passed to the invoked outgoing protocol entity instance.

Through-connection in both directions will then be completed.

After receiving an indication of the successful AAL type 2 connection setup from the outgoing protocol entity instance, the incoming protocol entity instance is informed of the successful AAL type 2 connection setup. If one or more of the parameters Transfer Capability Support, Modify Support for Link Characteristics, or Modify Support for SSCS Information parameter, was received from the outgoing protocol instance they shall be conveyed to the incoming protocol entity instance.

8.2.2.1.2 Unsuccessful/abnormal connection set up

If resources on the incoming AAL type 2 path are not available, the nodal function requests the incoming protocol entity instance to reject the connection with one of the following causes as applicable:

- "Resource unavailable, unspecified"; or
- "Requested circuit/channel not available".

The association between the nodal function entity and its incoming protocol entity instance is released.

If an AAL type 2 path is "locally blocked" and an indication from an incoming protocol entity instance of the request for a new connection other than a test connection is received, the following actions are taken:

1) The indication of the request for a new connection establishment is ignored and the incoming protocol entity instance is instructed to terminate and enter state "Idle"; the association with the incoming protocol entity instance is released and an ERROR.indication primitive with the CEID and the cause "Temporary failure" is sent to layer management.

2) The blocking procedure specified in § 8.2.1.2.2.1 case b) is initiated for the AAL type 2 path on which the new connection was requested to have been established.

If an AAL type 2 path is "remotely blocked" and an indication from an incoming protocol entity instance of the request for a new connection other than a test connection is received, the following actions are taken:

1) The AAL type 2 path is set to "remotely unblocked".

   NOTE — This procedure shall not be considered as the normal way to remove the "remotely blocked" condition.

2) The incoming connection establishment request is processed normally, i.e. as if the AAL type 2 path was not "remotely blocked" to begin with.

If the Hop Counter is received, the nodal functions shall decrement the Hop Counter value by 1. If the result equals 0, the nodal function shall request the incoming protocol entity instance to reject the connection with cause value "exchange routing error". The association between the nodal function entity and its incoming protocol entity instance is released and all the resources associated with the incoming AAL type 2 link are released and made available for new traffic.

In all cases where the request from an incoming protocol entity instance to establish a new connection has to be rejected, the nodal function checks the level of congestion of the node. If either of the two congestion thresholds is exceeded, an Automatic Congestion Control parameter is passed to the protocol entity with the rejection indication. This parameter indicates the level of congestion (congestion level 1 or 2) to the adjacent AAL Type 2 node.

If AAL type 2 node internal resources are not available for the new connection, a negative acknowledgement for the connection setup request shall be returned to the incoming protocol entity instance with the cause "Switching equipment congestion". The resources allocated to the incoming AAL type 2 path are released and the association between the incoming protocol entity instance and the nodal function is released.

If the AAL Type 2 node cannot complete a high priority connection establishment request even after application of the preferential treatment, a negative acknowledgement for the connection setup request shall be returned to the incoming protocol entity instance with the cause "Resource unavailable, unspecified". The resources allocated to the incoming AAL type 2 path are released and the association between the incoming protocol entity instance and the nodal function is released.

If the AAL type 2 path selection or the allocation of a CID and other resources for the outgoing AAL type 2 link described in § 8.2.2.1.1 fails, a negative acknowledgement for the connection setup request shall be returned to the incoming protocol entity instance with one of the following causes:

- "Unallocated (unassigned) number";
- "No route to destination";
- "No circuit/channel available";
- "Resource unavailable, unspecified";
- "Network out of order"; or
- "Temporary failure".

NOTE — Path selection failure may be due to the unavailability of an AAL type 2 path with the requested path type.

The resources allocated to the preceding AAL type 2 path are released and the association between the incoming protocol entity instance and the nodal function is released.

Upon receiving a negative acknowledgement from the outgoing protocol entity instance, all resources associated with the outgoing AAL type 2 link are released and made available for new traffic. The association to the outgoing protocol entity instance is released.

Features that enable a further connection attempt, involving the selection of a different AAL type 2 path within the same route or of an alternative route, may be implemented. Such reattempts may use the CEID parameter returned in the Release Confirm (RLC) message and may select a different AAL type 2 path within the same route only. If the CEID parameter specifies an AAL Type 2 path with insufficient resources available for the connection attempt, no connection attempt is made on that path.

If no further connection attempt is made, the AAL type 2 node internal resources are released, the rejection of the connection establishment is forwarded to the incoming protocol entity instance with the cause received from the outgoing protocol entity instance; a Connection Element Identifier parameter possibly received in the Release Confirm (RLC) message is not forwarded to the incoming protocol entity instance. All the resources associated with the incoming AAL type 2 link are freed. The association to the incoming protocol entity instance is released.

When an indication is received from the outgoing protocol entity that the establishment request has been rejected, and there has been a change in the level of congestion of the adjacent node, the routing tables in the nodal function shall be updated accordingly. The absence of an Automatic Congestion Control parameter indicates that there is no reported congestion in the adjacent node, whilst if the Automatic Congestion Control parameter is present it indicates whether congestion level 1 or 2 has been exceeded. After the routing tables have been updated, the Automatic Congestion Control parameter is discarded.

Upon receiving an indication from the outgoing protocol entity instance that a timer has expired, the association to the outgoing protocol entity instance is released and a reset procedure is started (see § 8.2.1.2.1.1 case 3 a)). The AAL type 2 node internal resources are released. The rejection of the connection establishment is forwarded to the incoming protocol entity instance with the cause received from the outgoing protocol entity instance (i.e. "Recovery on timer expiry") and all the resources associated with the incoming AAL type 2 link are released and made available for new traffic. The association to the incoming protocol entity instance is released.

8.2.2.1.3 Normal connection release

When the nodal function has received a request from a (first) protocol entity instance to release the connection, an acknowledgement is returned to that protocol entity instance and all the resources associated with the AAL type 2 link being governed by the protocol entity instance are released and made available for new traffic. The association to the protocol entity instance is released.

When a Release indication containing an Automatic Congestion Control parameter is received from the incoming or outgoing protocol entity, and there has been a change in the level of congestion of the adjacent node, the routing tables in the nodal function shall be updated according to the indicated congestion level. The absence of an Automatic Congestion Control parameter indicates that there is no reported congestion in the adjacent node, whilst if the Automatic Congestion Control parameter is present it indicates whether congestion level 1 or 2 has been exceeded. After the routing tables have been updated, the Automatic Congestion Control parameter is discarded.

The AAL type 2 node internal resources are released.

When a release is to be forwarded, the nodal function checks the level of congestion of the node. If either of the two congestion thresholds is exceeded, an Automatic Congestion Control parameter is passed to the protocol entity with the

release indication. This parameter indicates the level of congestion (congestion level 1 or 2) to the adjacent AAL Type 2 node.

The request to release the connection is forwarded to the companion incoming or outgoing (second) protocol entity instance with the Cause parameter received from the first protocol entity instance. The Cause parameter shall not be modified by the nodal function.

After receiving the acknowledgement of the successful connection release from the second protocol entity instance, all the resources associated with the AAL type 2 link being governed by the protocol entity instance are released and made available for new traffic. The association to the protocol entity instance is released.

8.2.2.1.4 Abnormal connection release procedures

8.2.2.1.4.1 Actions at the AAL type 2 switch that initiates the release

When the nodal function receives an indication from the second protocol entity instance that a timer has expired, the association to that protocol entity instance is released and a reset procedure is started (see § 8.2.2.2.1.1, case 3 a)).

8.2.2.1.5 Successful modification

NOTE 1 — In this subclause the following conventions apply:
- The term “AAL type 2 connection resource information” refers to Transfer Capability.
- The term “modify receiving” refers to the AAL type 2 connection element identifier for which the Modify Request (MOD) message is received and the Modify Acknowledge (MOA) or Modify Reject (MOR) message is sent; conversely, the term “modify sending” refers to the AAL type 2 connection element identifier for which the Modify Request (MOD) message is sent and the Modify Acknowledge (MOA) or Modify Reject (MOR) message is received.

NOTE 2 — The effect of SSCS information in AAL type 2 CS3 nodes is restricted to the allocation, configuration and management of the respective SSCS layer resources in AAL type 2 CS3 service endpoints.

Upon receiving an indication from a protocol entity instance requesting modification of the AAL type 2 connection resource, i.e., a Transfer Capability parameter is conveyed, the nodal function checks the availability of the requested internal resources on the indicated AAL type 2 path. If the modification is requesting additional internal resources and they are available, they are reserved for the connection.

NOTE 3 — In case of interworking, the Transfer Capability may be generated by the AAL type 2 switch (see Annex C).

The nodal function checks the availability of the requested resources on the modify sending AAL type 2 path. If the modification is requesting additional resources and they are available, they are reserved for the connection.

The companion (modify sending) protocol entity instance is informed of the modification. The nodal function shall pass the following parameters to the protocol entity instance only if they were conveyed by the AAL type 2 served user:
- the Served User Correlation ID,
- the Transfer Capability,
- the Link Characteristics, and
- the SSCS Information.

The following parameters — if they were received from the modify receiving protocol entity — shall not be modified by the nodal function:
- the Served User Correlation ID,
- the Transfer Capability,
- the Link Characteristics, and
- the SSCS Information.

The following parameters — if they were received from the modify receiving protocol entity— have significance to the served user only, therefore, they shall not be examined by the nodal function:
- the Served User Correlation ID, and
- the SSCS Information.

After receiving an indication of the successful AAL type 2 connection resource modification from the modify sending protocol entity instance and AAL type 2 connection resources were requested to be modified, the nodal function allocates the reserved additional resources to the modify receiving and modify sending connection or frees resources no longer required for this AAL type 2 connection.

The modify receiving protocol entity instance is informed of the successful modification. The nodal function shall pass the Served User Correlation ID parameter to the modify receiving protocol entity instance only if it was conveyed by the modify sending protocol entity instance. The Served User Correlation ID parameter has significance to the served user only, therefore, it shall not be examined by the nodal function.

8.2.2.1.6 Unsuccessful/abnormal modification

If additional resources on the modify receiving AAL type 2 path are not available, the nodal function requests the modify receiving protocol entity instance to reject the AAL type 2 modification request with the cause "Resource unavailable, unspecified".

If the resources on the modify sending AAL type 2 path are not available, the nodal function requests the modify receiving protocol entity instance to reject the AAL type 2 modification request with the cause "Resource unavailable, unspecified". The additional resources reserved for the modify receiving AAL type 2 path are freed.

Upon receiving a negative acknowledgement for the modification request from the modify sending protocol entity instance, the nodal function frees all the additional resources reserved for the modification request. The rejection of the modification is forwarded to the modify receiving protocol entity instance with the cause received from the modify sending protocol entity instance. The Cause parameters shall not be modified by the nodal function.

Upon receiving an indication from the modify sending protocol entity instance that a timer has expired (in this case Timer_MOD), the association to the modify sending protocol entity instance is released and a reset procedure is started (see § 8.2.2.2.1.1 case 3a). The AAL type 2 node internal resources for this AAL type 2 connection are released. The nodal function requests the modify receiving protocol entity instance to release the connection with the cause "Recovery on timer expiry". All resources associated with the modify receiving AAL type 2 link are freed. The association to the modify receiving protocol entity instance is released.

8.2.2.1.7 Connection release during modification

The release procedures take precedence over the modification procedures.

When the nodal function receives an indication of connection release from the modify receiving or modify sending protocol entity instance during the modification procedures, the nodal function will continue with normal connection release procedures.

8.2.2.2 Maintenance control

8.2.2.2.1 Reset

Refer to section § 8.2.1.2.1.

8.2.2.2.1.1 Actions at reset initiating node

Reset procedures can be initiated to reset:

1) all AAL type 2 paths between two adjacent AAL type 2 nodes associated with a signalling transport association;

2) a specific AAL type 2 path;

3) a single AAL type 2 channel.

For case 1, layer management passes a RESET.request together with the indication "All AAL type 2 paths associated with a signalling transport association" to the nodal function which in turn invokes a maintenance protocol entity and passes the request for reset to that entity together with an indication that all AAL type 2 paths associated with a signalling transport association must be reset.

For case 2), layer management passes a RESET.request together with the AAL type 2 path identifier to the nodal function which in turn invokes a maintenance protocol entity and passes a request for reset to that entity together with the identity of the AAL type 2 path.

For case 3) there are two possible subcases, one due to timer expiry and the other due to layer management action:

a) After the expiry of Timer_ERQ, Timer_REL, or Timer_MOD, the nodal function invokes a maintenance protocol entity by passing a request for a reset together with the identity of the AAL type 2 path and the channel.

b) Layer management invokes the nodal function which in turn invokes a maintenance protocol entity by passing a request for a reset together with the identity of the AAL type 2 path and the channel.

In cases 1), 2), and 3 b), the nodal function requests any affected incoming or outgoing protocol entity instances to terminate and enter state “Idle”. The associations to the incoming or outgoing protocol entity instances are released.

For cases 1) and 2), the remote blocking state for the affected path(s) is set to “remotely unblocked”.

Upon receiving a reset confirmation from the maintenance protocol entity instance, the nodal function will make the affected resources available for new connections, and the AAL type 2 node internal resources are released. The association to the maintenance protocol entity instance is released. In case 3 a), a RESET.indication primitive with a CEID parameter is sent to layer management; in all other cases, a RESET.confirm primitive is sent to the layer management.

NOTE — The local blocking states are not affected.

8.2.2.2.1.2 Actions at reset responding node

Upon receiving a reset indication from the maintenance protocol entity, the nodal functions analyses the received information to determine which AAL type 2 channels are to be reset.

1) If an indication that all AAL type 2 paths associated with a signalling transport association must be reset is received, then all AAL type 2 channels associated with a signalling transport association between the two adjacent AAL type 2 nodes are reset.

2) If an indication that all the channels within the identified AAL type 2 path must be reset is received, all AAL type 2 channels within that path are reset.

3) If an indication that a specific channel within an AAL type 2 path must be reset is received, only that channel is reset.

In cases 1) and 2), for “locally blocked” AAL type 2 paths, blocking procedures (refer to § 8.2.1.2.2 case b)) are initiated prior to the sending of the reset confirmation.

If resources have been assigned to one of the channels that are reset, the nodal functions make the affected resources available for new connections, and the AAL type 2 node internal resources are released. It also returns a reset confirmation to the maintenance protocol entity. The association between the nodal function and the maintenance protocol entity instance is released. The nodal function informs layer management about the receipt of the reset request by sending a RESET.indication primitive with the same CEID parameter as has been received in the RES message (Reset Request).

The nodal function also requests the affected incoming or outgoing protocol entity instances (if any) to terminate and enter state “Idle”. The associations to the incoming or outgoing protocol entity instances are released.

8.2.2.2.1.3 Abnormal reset procedures

Refer to § 8.2.1.2.1.3.

8.2.2.2.2 Blocking and unblocking of AAL type 2 path

Refer to § 8.2.1.2.2.

8.2.2.2.3 Transmission fault handling

Refer to § 8.2.1.2.3.

8.2.2.2.4 AAL type 2 signalling entity signalling congestion control

Refer to § 8.2.1.2.4.

8.2.2.2.5 Adjacent AAL type 2 node availability

Refer to § 8.2.1.2.5.

8.2.2.3 Error handling

Refer to § 8.2.1.3.

8.3 Protocol entity

The following rules relating to Signalling Association Identifiers (SAID) apply:

- The AAL type 2 signalling system that does not issue the value of such a field is not allowed to modify it but shall use it in the destination signalling association identifier field in the header of a messages directed towards the issuer.
- When a message is received at the generic signalling transport service access point (GST-SAP), the destination signalling association identifier field of the incoming message is used to distribute the messages to the appropriate protocol entity instance.
- If a received message contains a destination signalling association identifier set to the "unknown" value and an originating signalling association identifier, a new incoming protocol entity instance or a new maintenance protocol entity instance is created and marked with a newly allocated signalling association identifier. The originating signalling association identifier parameter in the first response message issued by the new protocol entity instance will inform the peer protocol entity instance of the newly allocated signalling association identifier.
- If a new protocol entity instance is created by the nodal function, a signalling association identifier is allocated for it and the signalling association identifier is conveyed to the peer AAL type 2 signalling entity as the originating signalling association identifier parameter in the first message issued by the new protocol entity instance. The DSAID field in the header in this message is set to "unknown".
- If a protocol entity instance sends a message to its peer, the message includes the signalling association identifier of the peer in the destination signalling association identifier field.
- If a new maintenance protocol entity instance is created as a result of an incoming maintenance message, no signalling association identifier is allocated for it and no originating signalling association identifier parameter is conveyed to the peer AAL type 2 signalling entity in the first (and only) message issued by the new maintenance protocol entity instance.

The sequence control parameter of the TRANSFER.request primitive across the GST-SAP is allocated on a cyclic basis per protocol entity instance.

Example message sequences are shown in Appendix I where usage of originating and destination signalling association identifiers is also described.

All messages are sent in a TRANSFER.request primitive. All messages are received in a TRANSFER.indication primitive.

Appendix I of this Recommendation provides examples for modification.

8.3.1 General protocol error handling

If a message is received that is too short to contain a complete message (i.e. less than 6 octets), it shall be ignored.

The message is discarded and layer management informed with an ERROR.indication in the following cases:

- If the parameter length points beyond the end of the message - cause “Message with unrecognized parameter, discarded” is indicated.
- If the field length points beyond the end of the parameter - cause “Message with unrecognized parameter, discarded” is indicated.
- If an unrecognized message containing a destination signalling association identifier set to the “unknown” value - cause “Message type non-existent or not implemented” is indicated.
  NOTE — If an unrecognized message containing a valid destination signalling association identifier is received, the message is conveyed to the addressed protocol entity instance as if it were a recognized message.
- If the message contains a destination signalling association identifier with an illegal/invalid value - cause “Invalid information element contents” is indicated.
- If the message is considered unexpected by the signalling procedures - cause “Invalid message, unspecified” is indicated.
- If a mandatory originating signalling association identifier parameter is not present - cause “Mandatory information element is missing” is indicated.
- If the originating signalling association identifier field is set to “zero” - cause “Invalid information element contents” is indicated.

8.3.2 Outgoing protocol procedures

8.3.2.1 Successful connection setup

When an outgoing protocol entity instance in state “Idle” receives a request for a new connection from the nodal function, a free Signalling Association Identifier (SAID) is allocated for the outgoing protocol entity instance.

Upon allocating an SAID, an ERQ message (establish request) is sent to the adjacent AAL type 2 node, entering state “Outgoing establishment pending” and starting Timer_ERQ. The ERQ message contains a destination signalling association identifier field set to the “unknown” value and an originating signalling association identifier parameter in addition to those parameters given by the nodal function.

If an ECF (establish confirm) message is received in state “Outgoing establishment pending”, Timer_ERQ is stopped, the nodal function is informed and state “Established” is entered.

8.3.2.2 Unsuccessful connection setup

If the SAID allocation specified in section § 8.3.2.1 fails, the nodal function is informed by passing the cause “Resource unavailable, unspecified”.

If the ERQ message (establish request) is longer than the signalling transport allows, the nodal function is informed by passing the cause “Protocol error, unspecified”. The SAID allocated to this particular outgoing protocol entity instance is released and made available for new traffic and state “Idle” is entered.

NOTE — If AAL type 2 signalling is used in an MTP3 signalling network (e.g., via the Signalling Transport Converter on MTP3 and MTP3b, see ITU-T Recommendation Q.2150.1) is it possible that the ERQ message (establish request) may be longer than the minimum transport capability of 272 octets. This is due to the potential size of the Served User Transport (SUT) parameter. However, AAL type 2 signalling is specified to be deployed only in MTP3b networks.

If Timer_ERQ expires, the nodal function is informed by passing the cause “Recovery on timer expiry”. The SAID allocated to this particular outgoing protocol entity instance is released and made available for new traffic and state “Idle” is entered.

If an RLC (release confirm) message is received in state “Outgoing establishment pending”, the nodal function is informed about the rejection of the establishment request (including the cause and the Automatic Congestion Control parameter, if present, from the RLC message).

Timer_ERQ is stopped. The SAID allocated to this particular outgoing protocol entity instance is released and made available for new traffic and state “Idle” is entered.

8.3.2.3 Normal connection release

In state “Established”, an REL message (Release Request) containing a cause parameter can be received. The protocol entity instance informs the nodal function with the received cause and the Automatic Congestion Control parameter, if

present. It then enters state “Incoming Release Pending”. After the nodal function acknowledges the release, an RLC message (Release Confirm) is sent to the peer protocol entity instance (without a cause parameter). The SAID allocated to the protocol entity instance is released and made available for new traffic and state “Idle” is entered.

In state “Established”, the nodal function can request the release of the connection. In this case an REL message is sent, Timer_REL is started and state “Outgoing release pending” is entered. The REL message contains the cause received from the nodal function.

If an RLC message is received, Timer_REL is stopped and the nodal function is informed. The SAID allocated to the protocol entity instance is released and made available for new traffic and state “Idle” is entered.

8.3.2.4 Release request collision

If an REL message (Release Request) is received in state “Outgoing Release Pending”, an RLC message (Release Confirm) is immediately sent back to the peer protocol entity instance and state “Release Collision” is entered.

When an RLC message is received in state “Release collision”, Timer_REL is stopped and the nodal function is informed. The SAID allocated to the protocol procedure entity instance is released and made available for new traffic and state “Idle” is entered.

8.3.2.5 Abnormal connection release procedures

If Timer_REL expires in states “Outgoing release pending” or “Release collision” the nodal function is informed with a cause “Recovery on timer expiry”. The SAID allocated to the protocol entity instance is released and made available for new traffic and state “Idle” is entered.

If in any state except state “Idle” a request to terminate an outgoing protocol procedure entity instance from the nodal function is received, all timers are stopped. The SAID allocated to the protocol entity instance is released and made available for new traffic and state “Idle” is entered.

8.3.2.6. Successful modification

When an outgoing protocol entity instance in state “Established” receives a request for modification from the nodal function, an MOD message (Modify Request) is sent to the adjacent AAL type 2 node, entering state “Outgoing Modification Pending” and starting Timer_MOD. The MOD message contains the DSAID which was received during the connection establishment phase and the parameter given by the nodal function, i.e. the Transfer Capability, Link Characteristics and/or SSCS information and the Served User Correlation ID if it was received from the nodal function.

If an MOA (Modify Acknowledge) message is received in state “Outgoing Modification Pending”, Timer_MOD is stopped, the nodal function is informed of the successful modification, and the outgoing protocol entity instance returns to state “Established”.

Upon receiving an MOD message (Modify Request) in state “Established” with the DSAID which was received during the connection establishment phase, the outgoing protocol entity instance informs the nodal function of the request for the modification and state “Incoming Modification Pending” is entered.

After receiving an acknowledgement from the nodal function that the connection modification is accepted, an MOA message (Modify Acknowledge) is sent to the preceding AAL type 2 node, and the outgoing protocol entity instance returns to state “Established”.

8.3.2.7 Unsuccessful modification

If Timer_MOD expires, the nodal function is informed by passing the cause “Recovery on timer expiry”. The SAID allocated to this particular outgoing protocol entity instance is released and made available for new traffic and state “Idle” is entered.

If an MOR (Modify Reject) message is received in state “Outgoing Modification Pending”, the nodal function is informed about the rejection of the modification request. Timer_MOD is stopped and the outgoing protocol entity instance returns to state “Established”.

When an outgoing protocol entity instance in state “Incoming Modification Pending” receives a request to reject the requested modification from the nodal function, an MOR message is issued towards the adjacent AAL type 2 node with the cause provided by the nodal function. The MOD message contains the DSAID which was received during the connection establishment phase. The outgoing protocol entity instance returns to state “Established”.

8.3.2.8 Connection release during modification

In state “Outgoing Modification Pending” or “Incoming Modification Pending”, an REL message (Release Request) containing a cause parameter can be received. The normal connection release procedures specified in § 8.3.2.3 shall apply.

In state “Outgoing Modification Pending” or “Incoming Modification Pending”, the nodal function can request the release of the connection. The normal connection release procedures specified in § 8.3.2.3 shall apply.

8.3.2.9 Modification request collision

If an MOD message is received in state “Outgoing Modify Pending”, an MOR message is immediately sent back to the peer protocol entity instance and “Modification Collision” state is entered.

§ 8.3.2.7 and § 8.3.2.8 shall apply with the replacement of “Modification Collision” with “Outgoing Modify Pending”.

8.3.2.10 Unrecognized information procedures

When an unrecognized message, parameter, or subfield value is received, the message, the parameter, or the subfield value respectively is conveyed to the nodal function for appropriate action.

When a request to pass on an unrecognized message, parameter, or subfield value is received from the nodal function, the unrecognized message is passed on and an unrecognized parameter or subfield value is sent in the recognized message being constructed respectively.

When a request to send a CFN message (confusion) is received from the nodal function in any state except “Idle” and “Outgoing establishment pending”, the message is sent. The CFN message (confusion) contains a cause parameter provided by the nodal function.

When a request to send a cause parameter in an RLC message (release confirm) as a response to an unrecognized parameter or subfield value received in an REL message (release request) is received from the nodal function in any State except “Incoming release pending” and “Outgoing release pending”, the cause parameter provided by the nodal function is sent in the RLC message (release confirm).

When a CFN message (confusion) is received in any state except “Idle”, the message is conveyed to the nodal function for appropriate action.

When a cause parameter is received in an RLC message (release confirm) in state “Outgoing release pending”, the cause parameter is conveyed to the nodal function for appropriate action.

8.3.2.11 State transition model

8.3.2.11.1 State transition

The state transition diagram for the outgoing protocol procedure is shown in Figure 8-1/Q.2630.3.

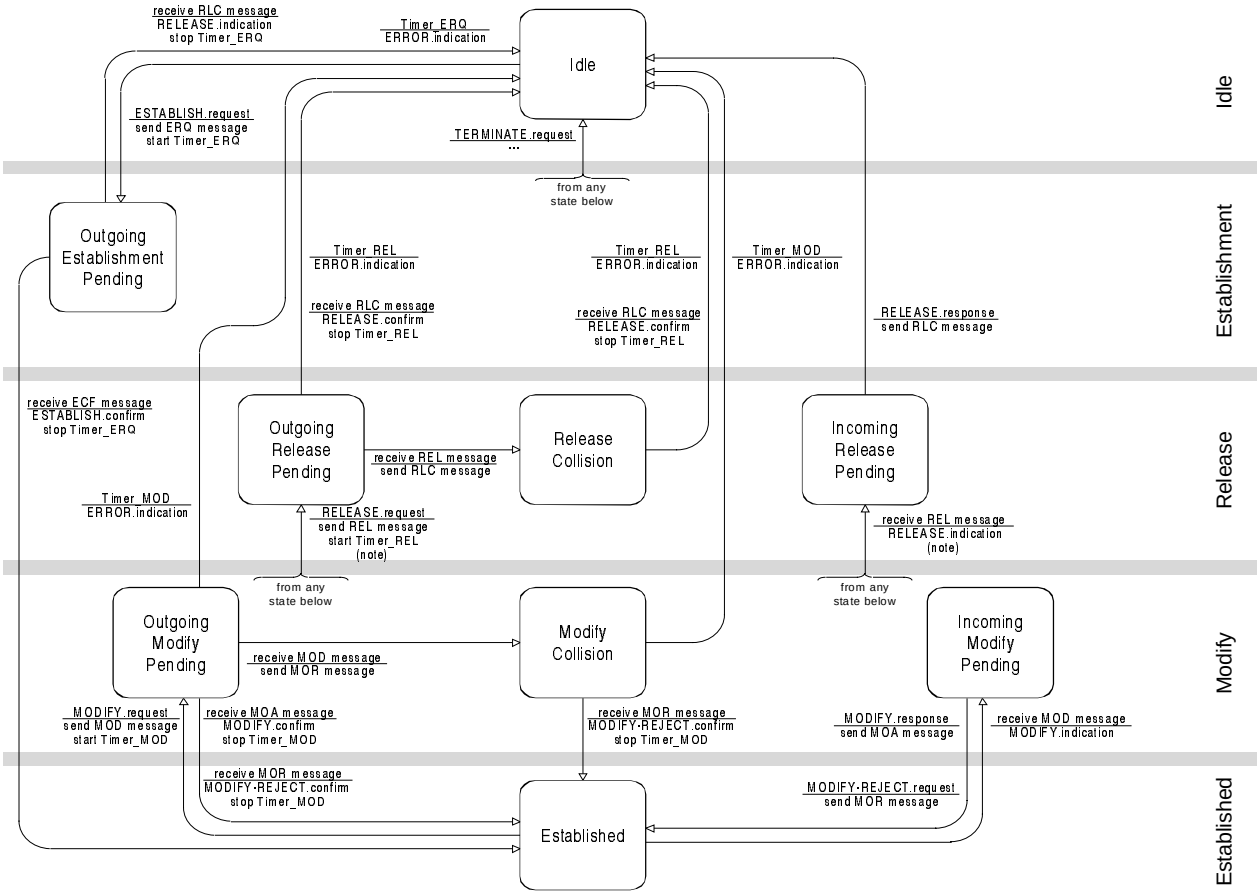


FIGURE 8-1/Q.2630.3
State transition diagram for the outgoing protocol procedure

8.3.2.11.2 SDL diagrams for the outgoing protocol procedures

The SDL diagram for the outgoing protocol procedure is shown in Figure 8-2/Q.2630.3 (parts 1 to 6).

The SDL diagrams contained in Figure 8-4/Q.2630.3 (parts 1 to 6) are an introduction to the procedures described in detail in § 8.3.3 of this Recommendation.

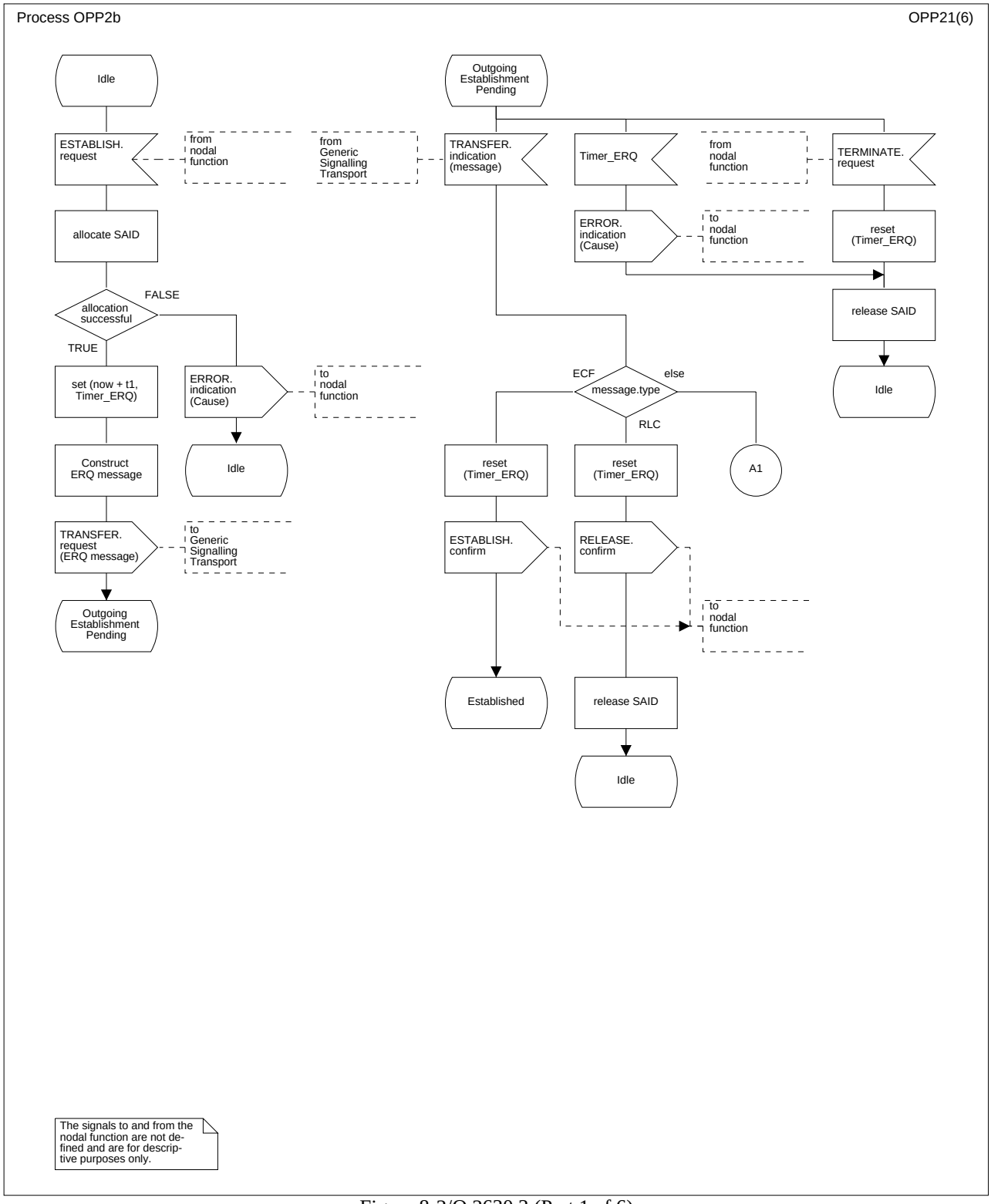


Figure 8-2/Q.2630.3 (Part 1 of 6)

SDL Diagram for the Outgoing Protocol Procedure

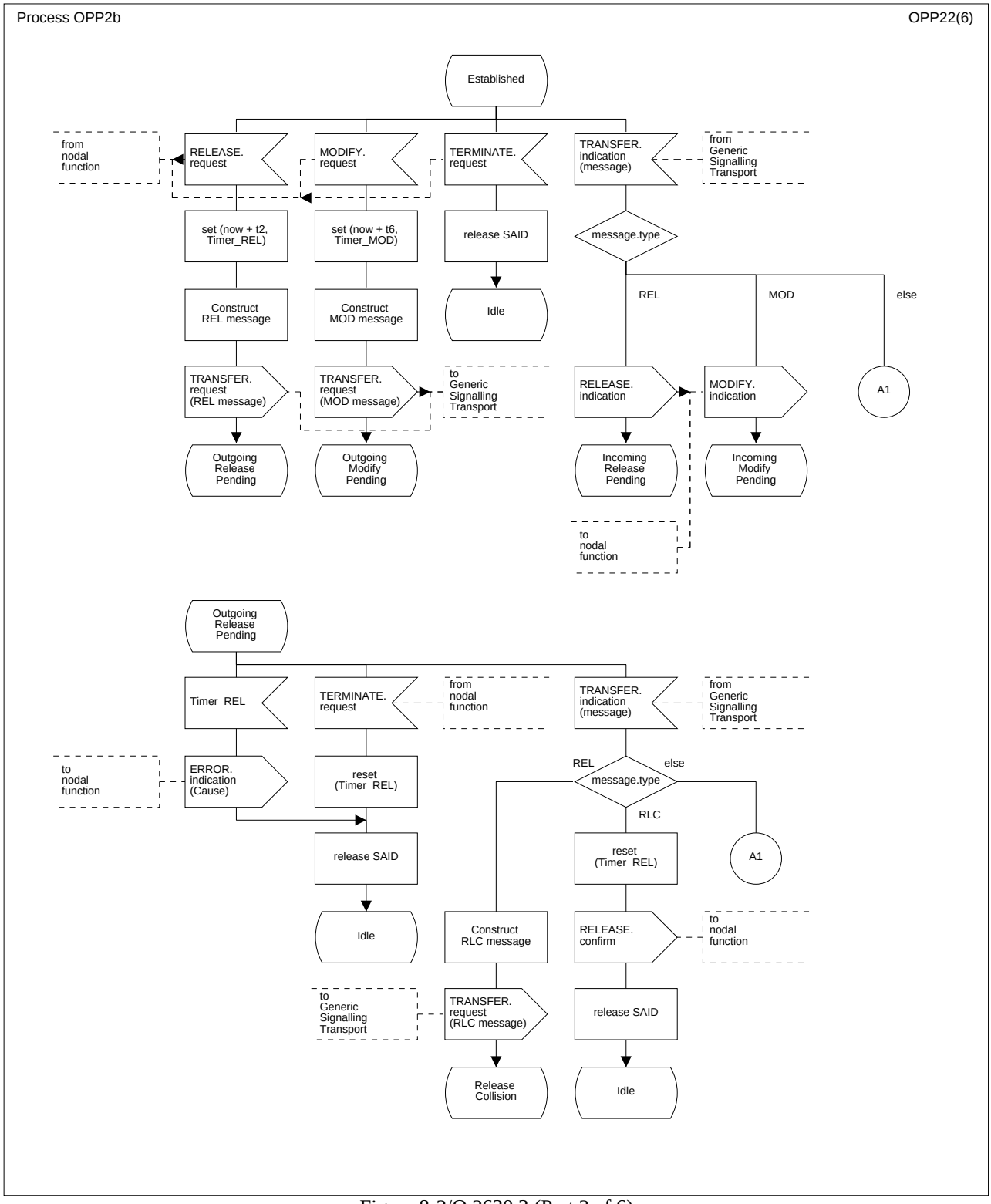


Figure 8-2/Q.2630.3 (Part 2 of 6)

SDL Diagram for the Outgoing Protocol Procedure

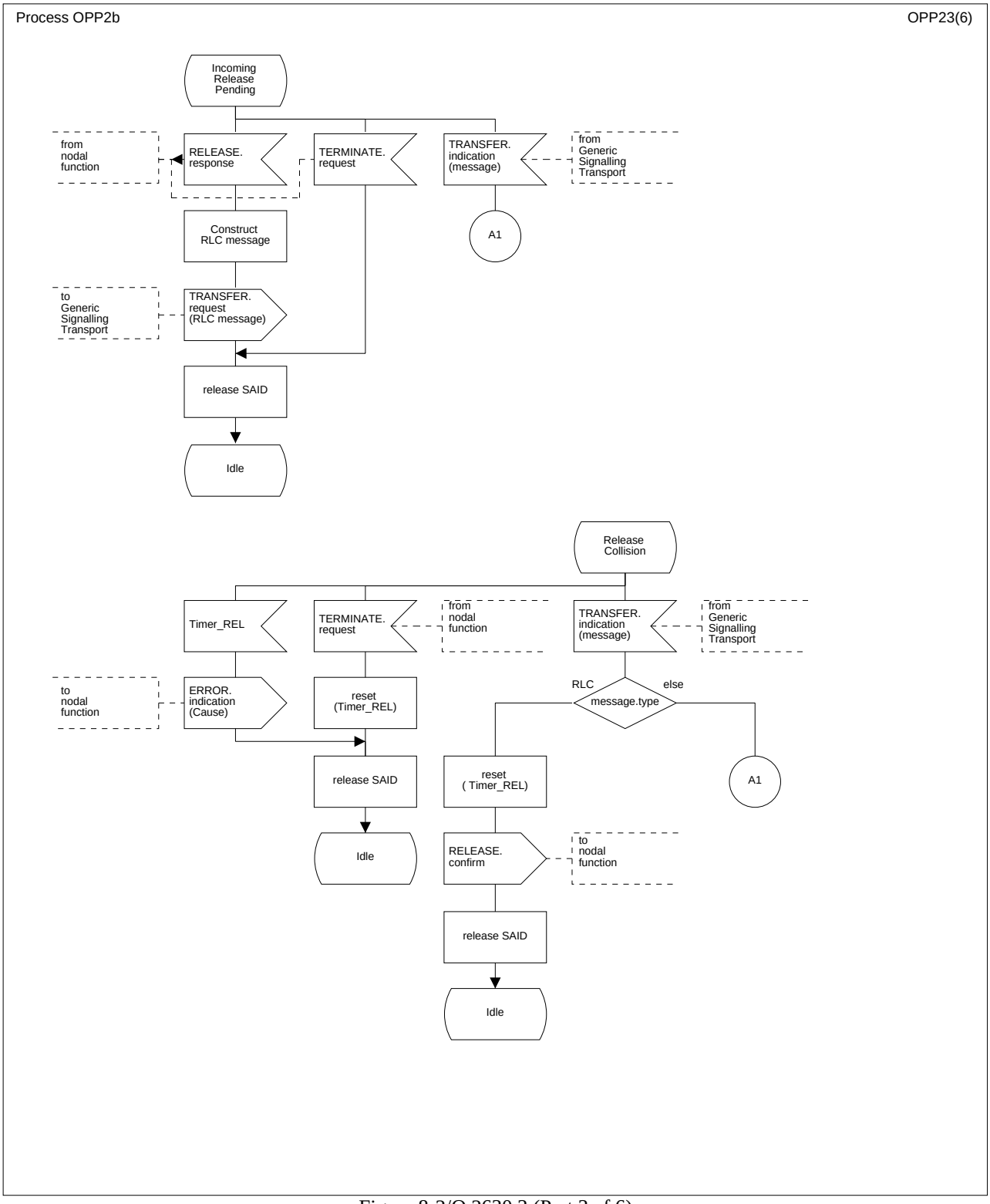


Figure 8-2/Q.2630.3 (Part 3 of 6)
SDL Diagram for the Outgoing Protocol Procedure

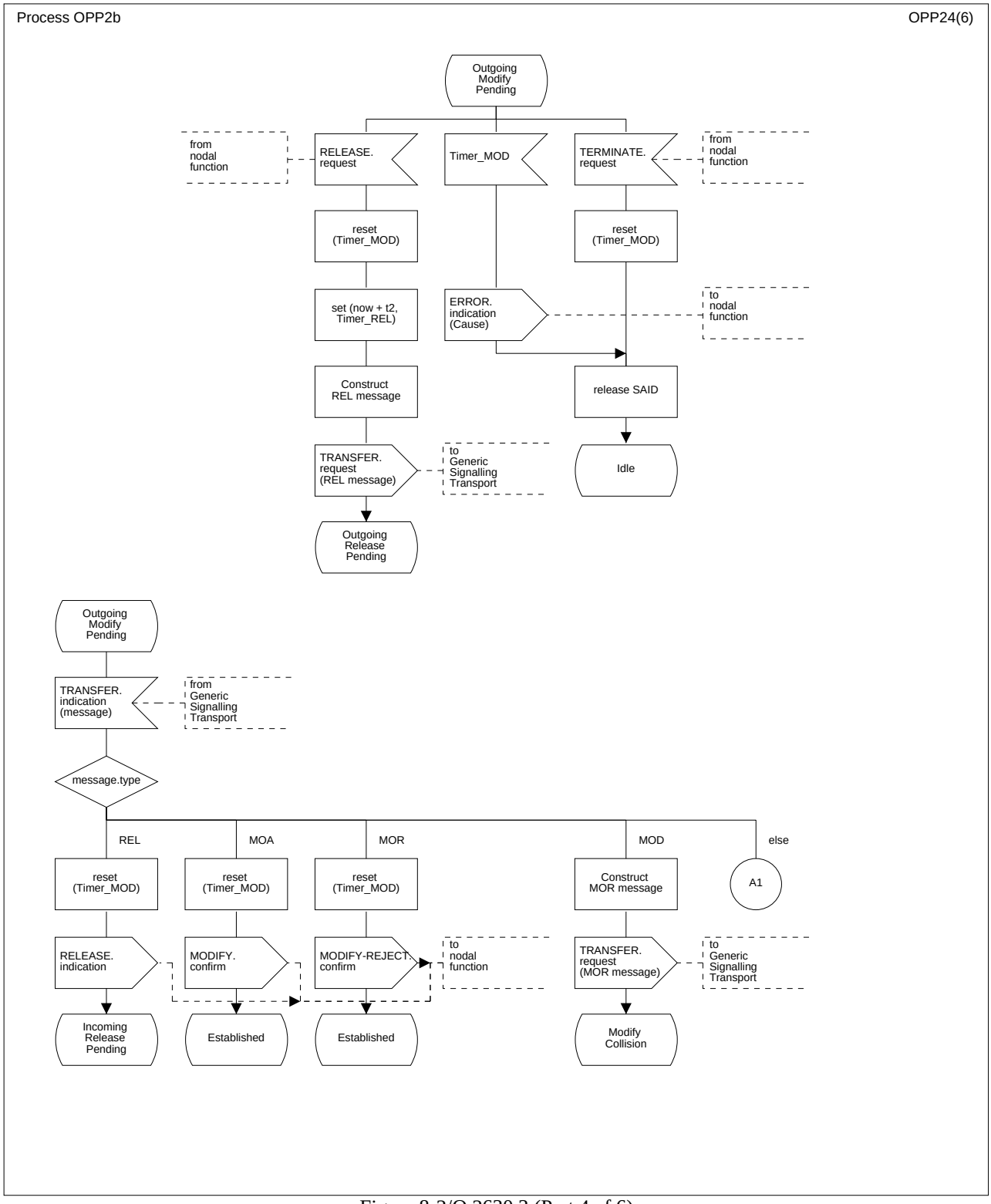


Figure 8-2/Q.2630.3 (Part 4 of 6)
SDL Diagram for the Outgoing Protocol Procedure

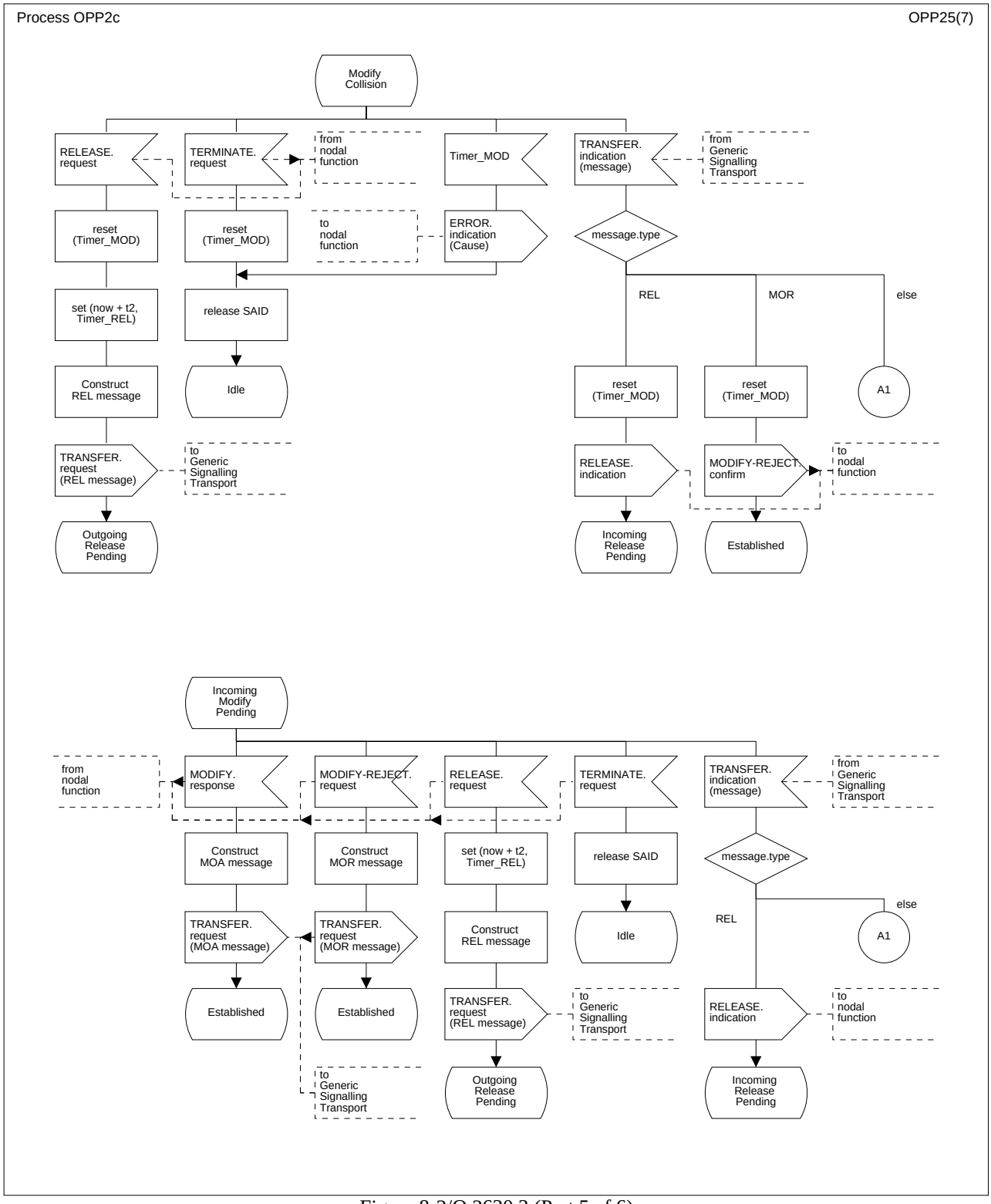


Figure 8-2/Q.2630.3 (Part 5 of 6)

SDL Diagram for the Outgoing Protocol Procedure

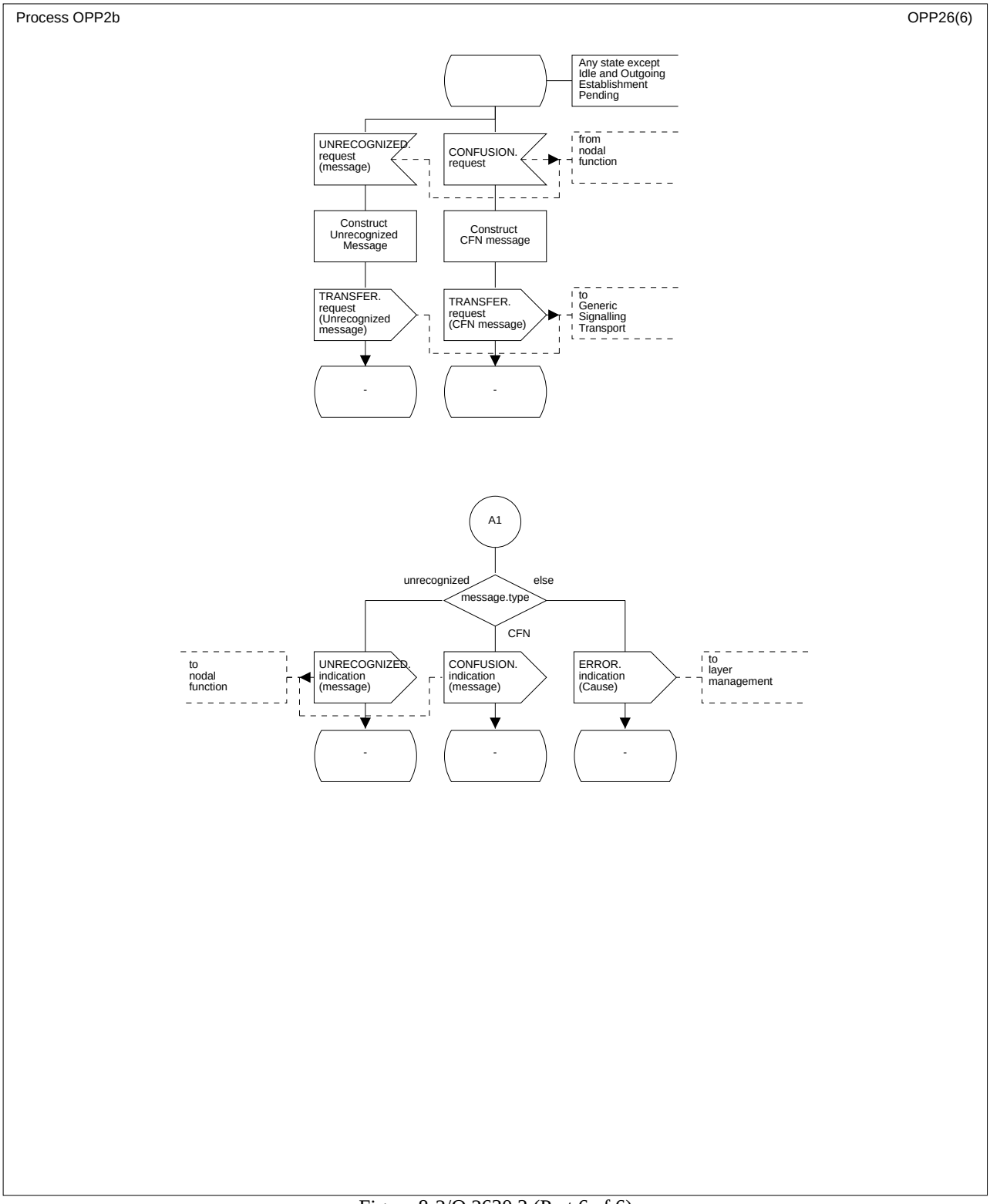


Figure 8-2/Q.2630.3 (Part 6 of 6)
SDL Diagram for the Outgoing Protocol Procedure

8.3.3 Incoming protocol procedures

8.3.3.1 Successful connection setup

Upon receiving an ERQ message (establish request) in state "Idle" with the DSAID set to "unknown", a Signalling Association Identifier (SAID) is allocated for the new incoming protocol entity instance.

The incoming protocol entity instance informs the nodal function of the request for a new connection and state "Incoming establishment pending" is entered.

After receiving an acknowledgement from the nodal function that the connection establishment is accepted, an ECF message (establish confirm) is sent to the preceding AAL type 2 node and state "Established" is entered.

8.3.3.2 Unsuccessful connection setup

If a Signalling Association Identifier (SAID) allocation for the incoming protocol entity instance fails, an RLC message (release confirm) is returned containing the cause "Resource unavailable, unspecified".

If a request to terminate the connection establishment from the nodal function is received, the SAID allocated to this particular incoming protocol entity instance is released and made available for new traffic and state "Idle" is entered.

If the nodal function informs the incoming protocol entity instance that the connection establishment is not accepted, an RLC message is issued towards the preceding AAL type 2 node with the cause and optionally the Automatic Congestion Control parameter provided by the nodal function. The SAID allocated to this particular incoming protocol entity instance is released and made available for new traffic and state "Idle" is entered.

8.3.3.3 Normal connection release

Refer to § 8.3.2.3.

8.3.3.4 Release request collision

Refer to § 8.3.2.4.

8.3.3.5 Abnormal connection release procedures

Refer to § 8.3.2.5.

8.3.3.6 Successful modification

Refer to § 8.3.2.6.

8.3.3.7 Unsuccessful modification

Refer to § 8.3.2.7.

8.3.3.8 Connection release during modification

Refer to § 8.3.2.8.

8.3.3.9 Modification request collision

Refer to § 8.3.2.9.

8.3.3.10 Unrecognized information procedures

Refer to § 8.3.2.10.

8.3.3.11 State transition model

8.3.3.11.1 State transition

The state transition diagram for the incoming protocol procedure is shown in Figure 8-3/Q.2630.3.

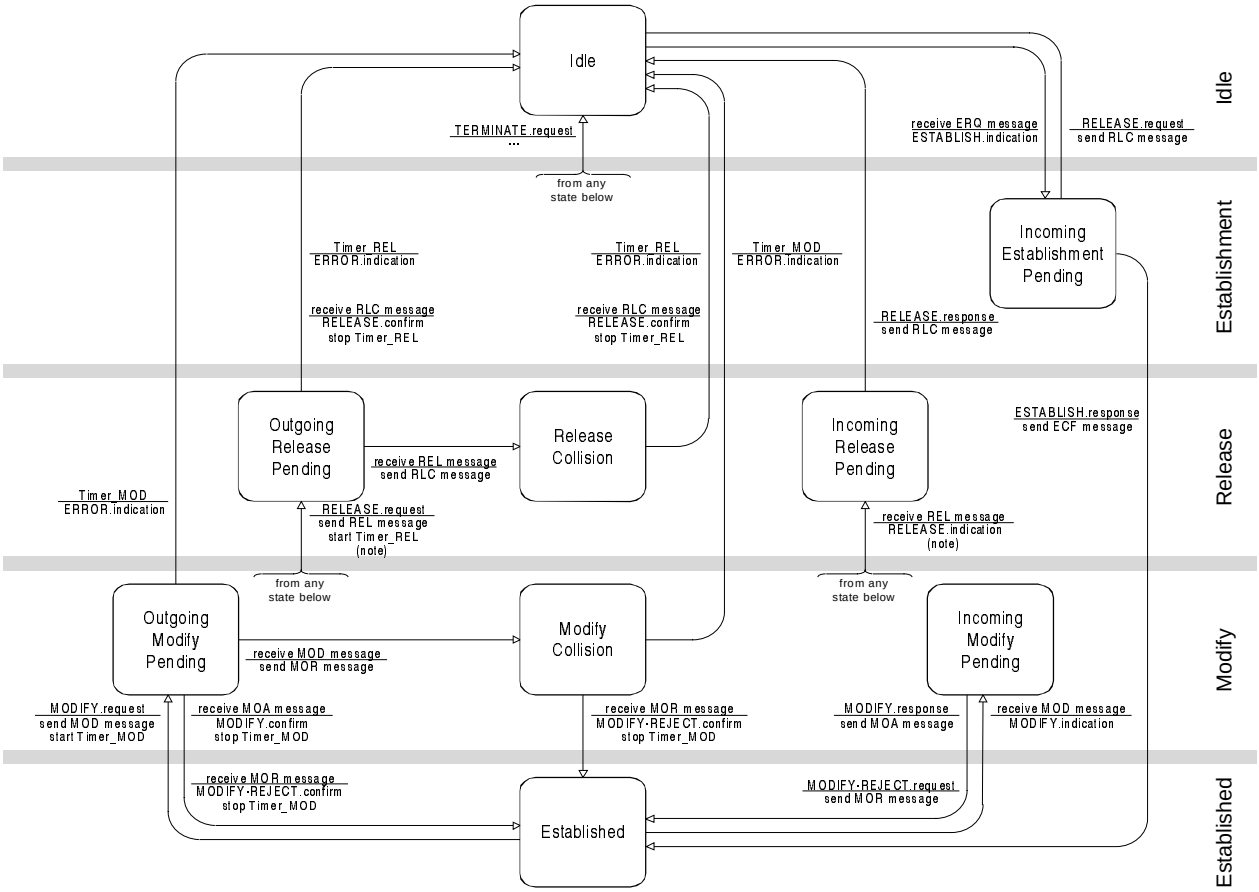


FIGURE 8-3/Q.2630.3
State transition diagram for the incoming protocol procedure

8.3.2.11.2 SDL diagrams for the incoming protocol procedures

The SDL diagram for the incoming protocol procedure is shown in Figure 8-4/Q.2630.3 (Parts 1 to 6).

The SDL diagrams contained in Figure 8-4/Q.2630.3 (parts 1 to 6) are an introduction to the procedures described in detail in § 8.3.3 of this Recommendation.

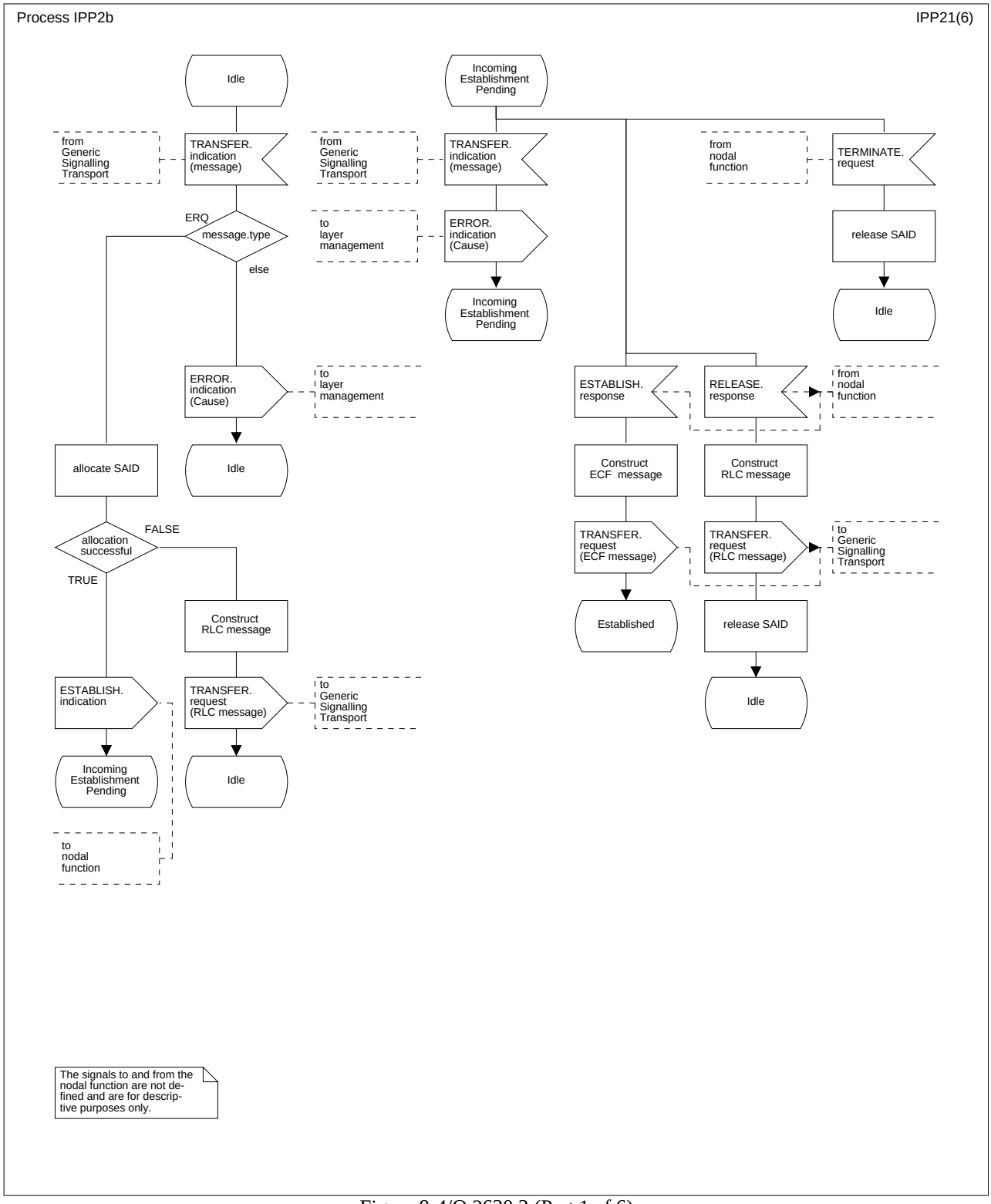


Figure 8-4/Q.2630.3 (Part 1 of 6)

SDL Diagram for the Incoming Protocol Procedure

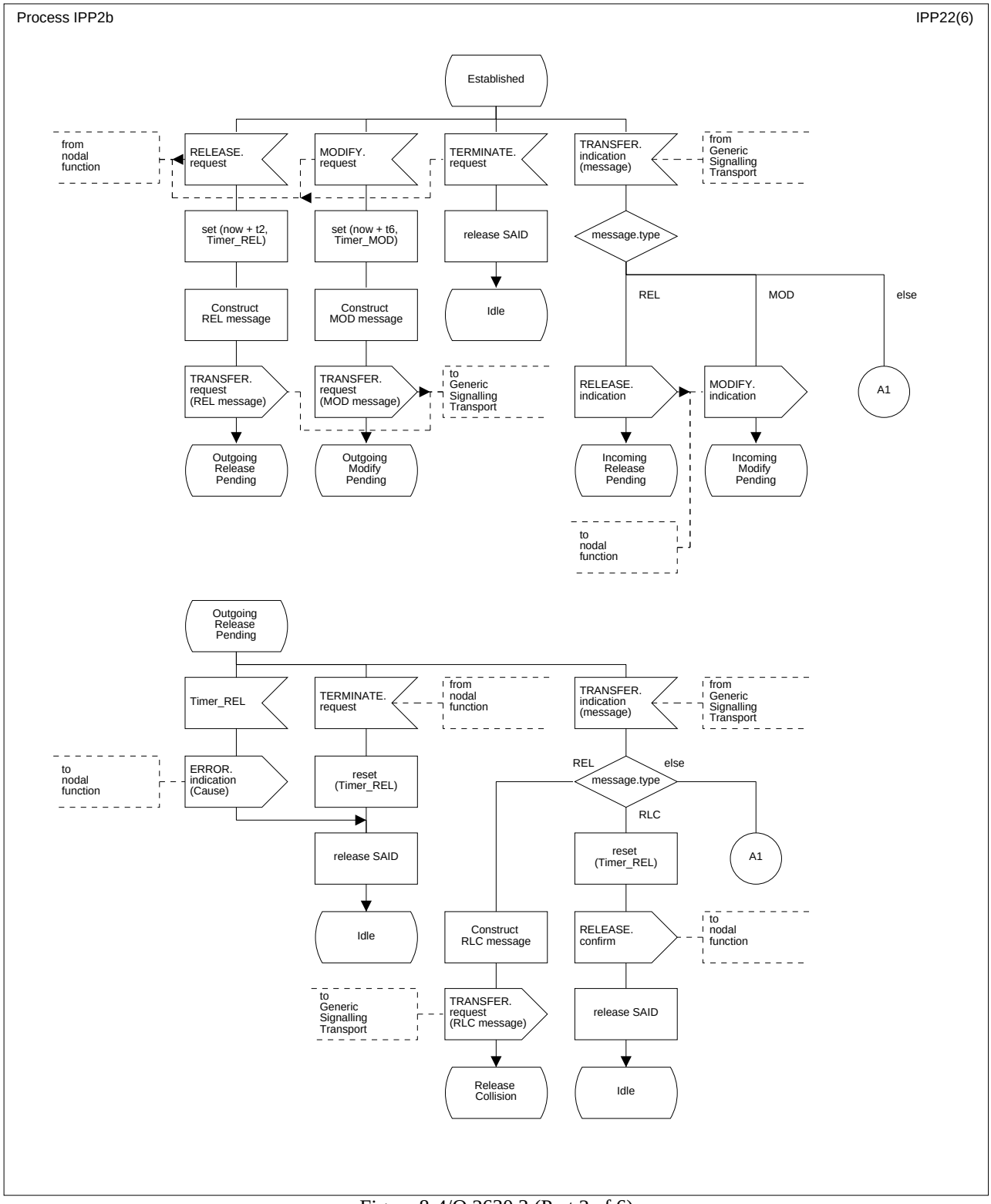


Figure 8-4/Q.2630.3 (Part 2 of 6)

SDL Diagram for the Incoming Protocol Procedure

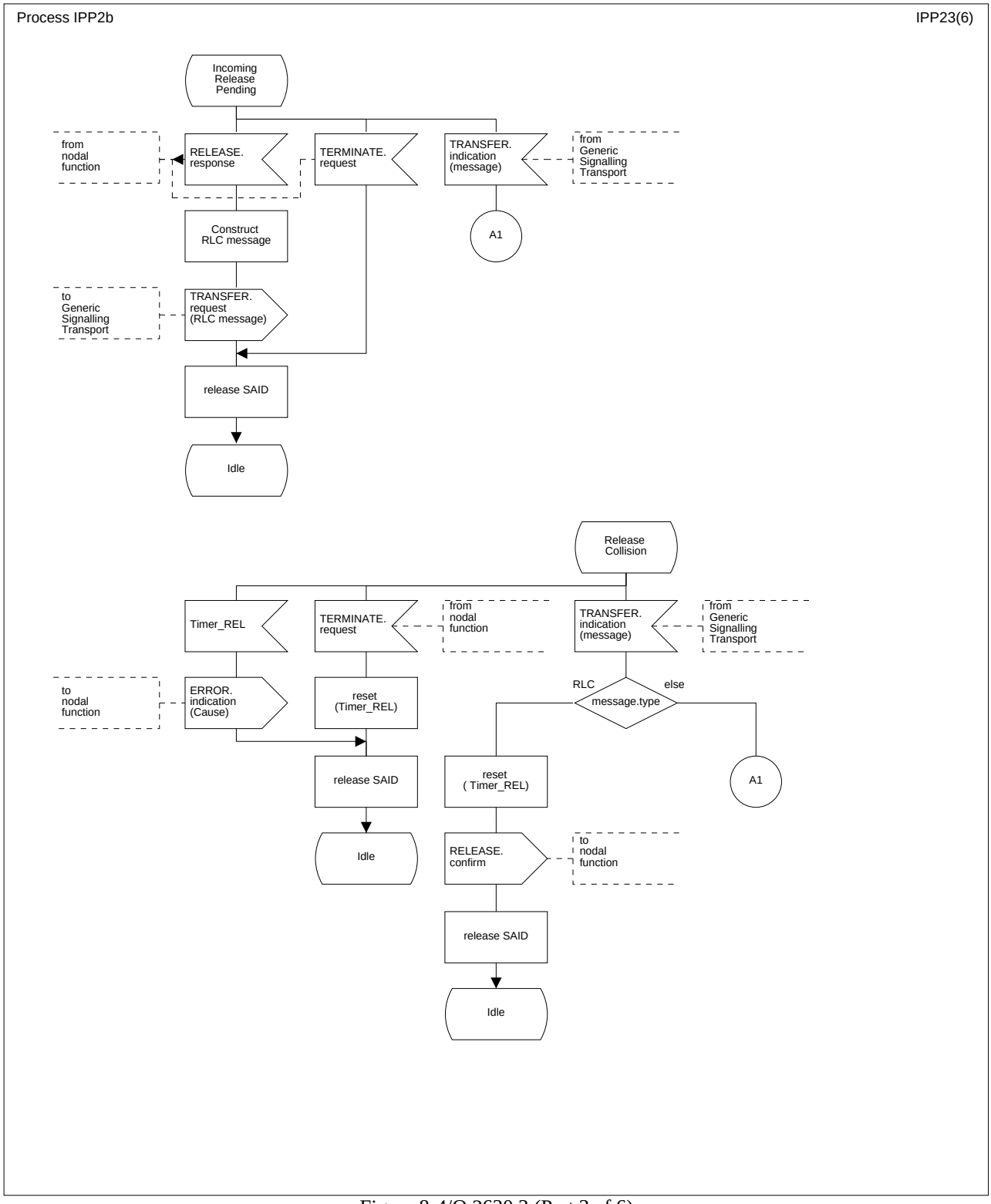


Figure 8-4/Q.2630.3 (Part 3 of 6)

SDL Diagram for the Incoming Protocol Procedure

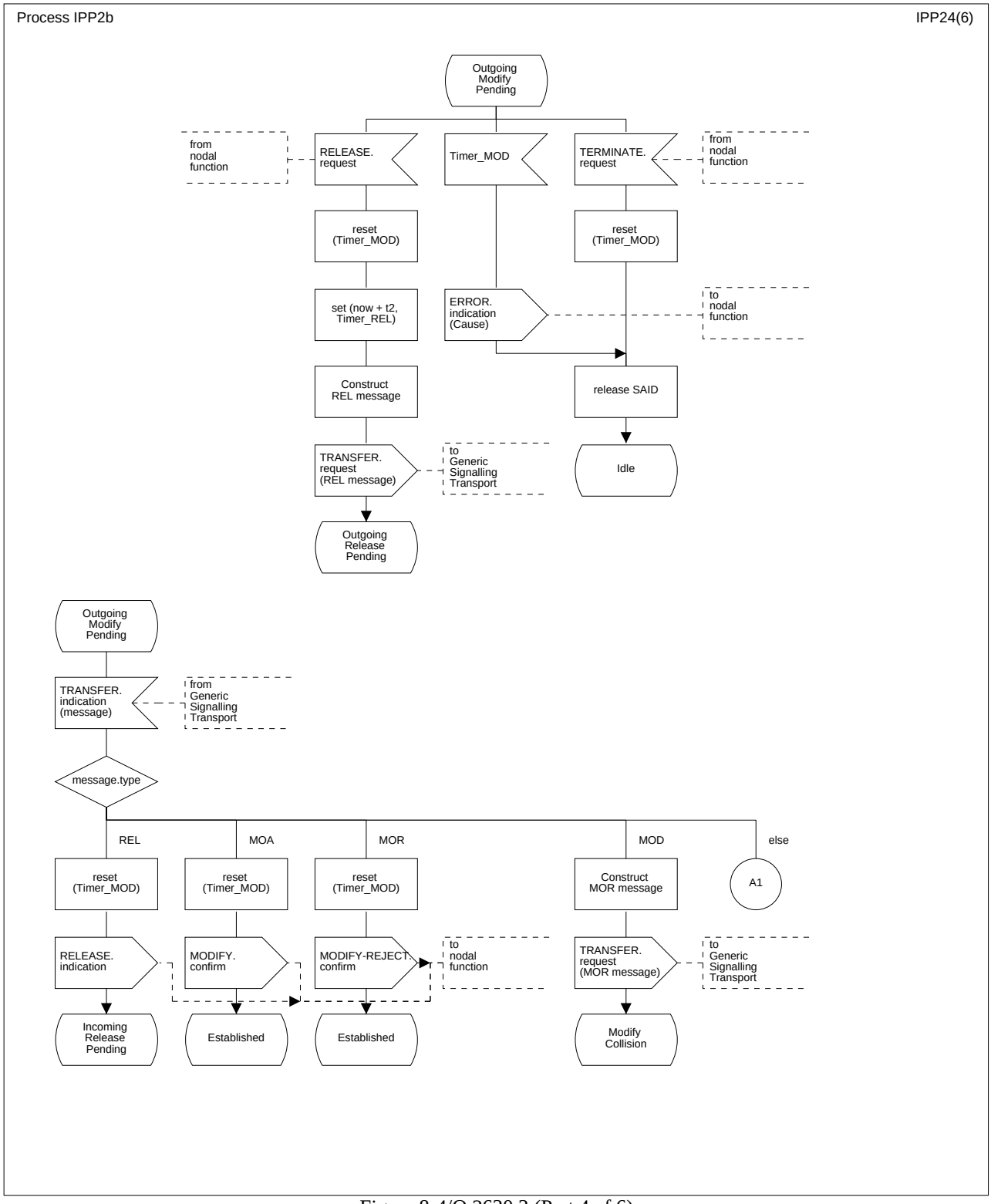


Figure 8-4/Q.2630.3 (Part 4 of 6)

SDL Diagram for the Incoming Protocol Procedure

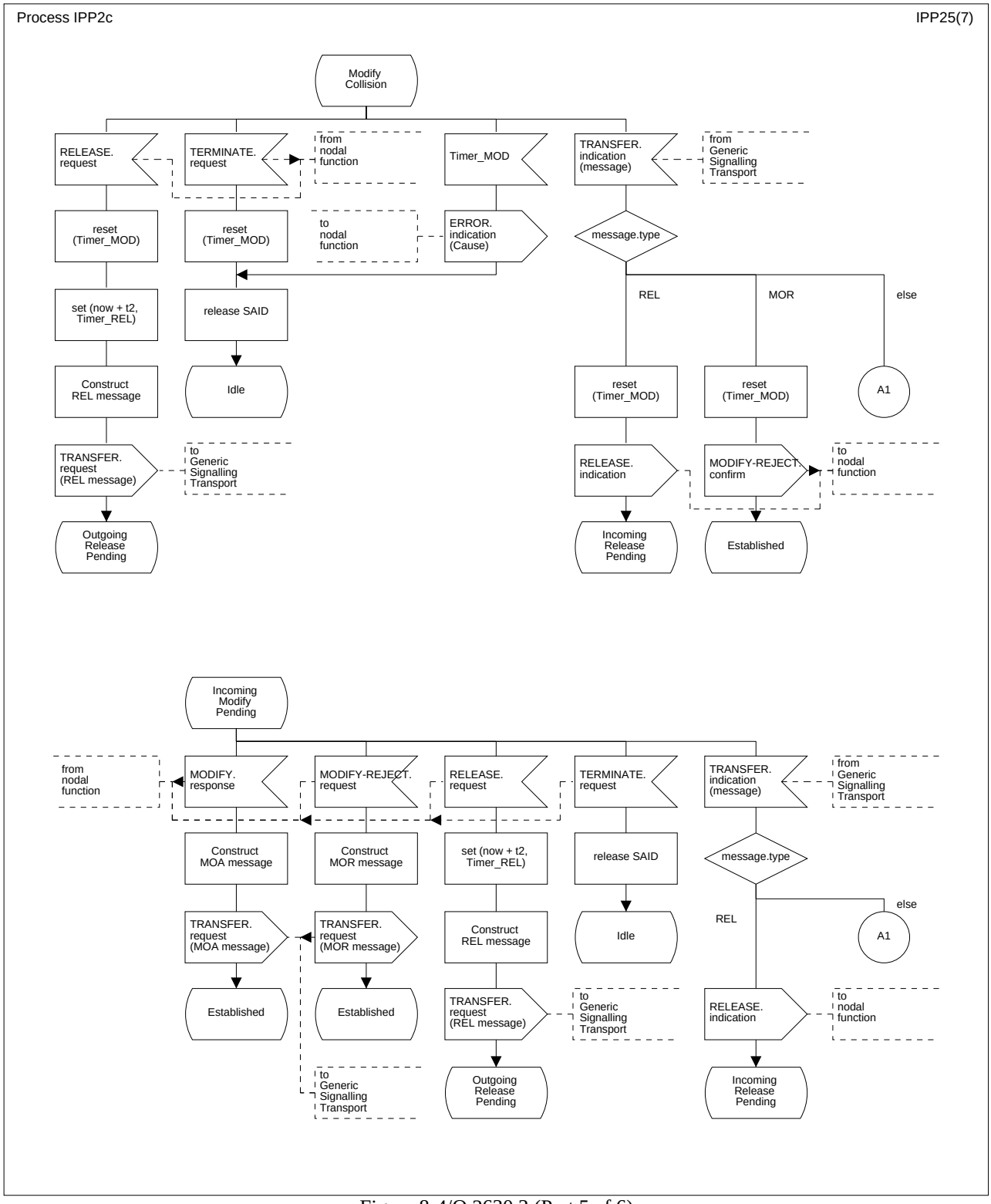


Figure 8-4/Q.2630.3 (Part 5 of 6)

SDL Diagram for the Incoming Protocol Procedure

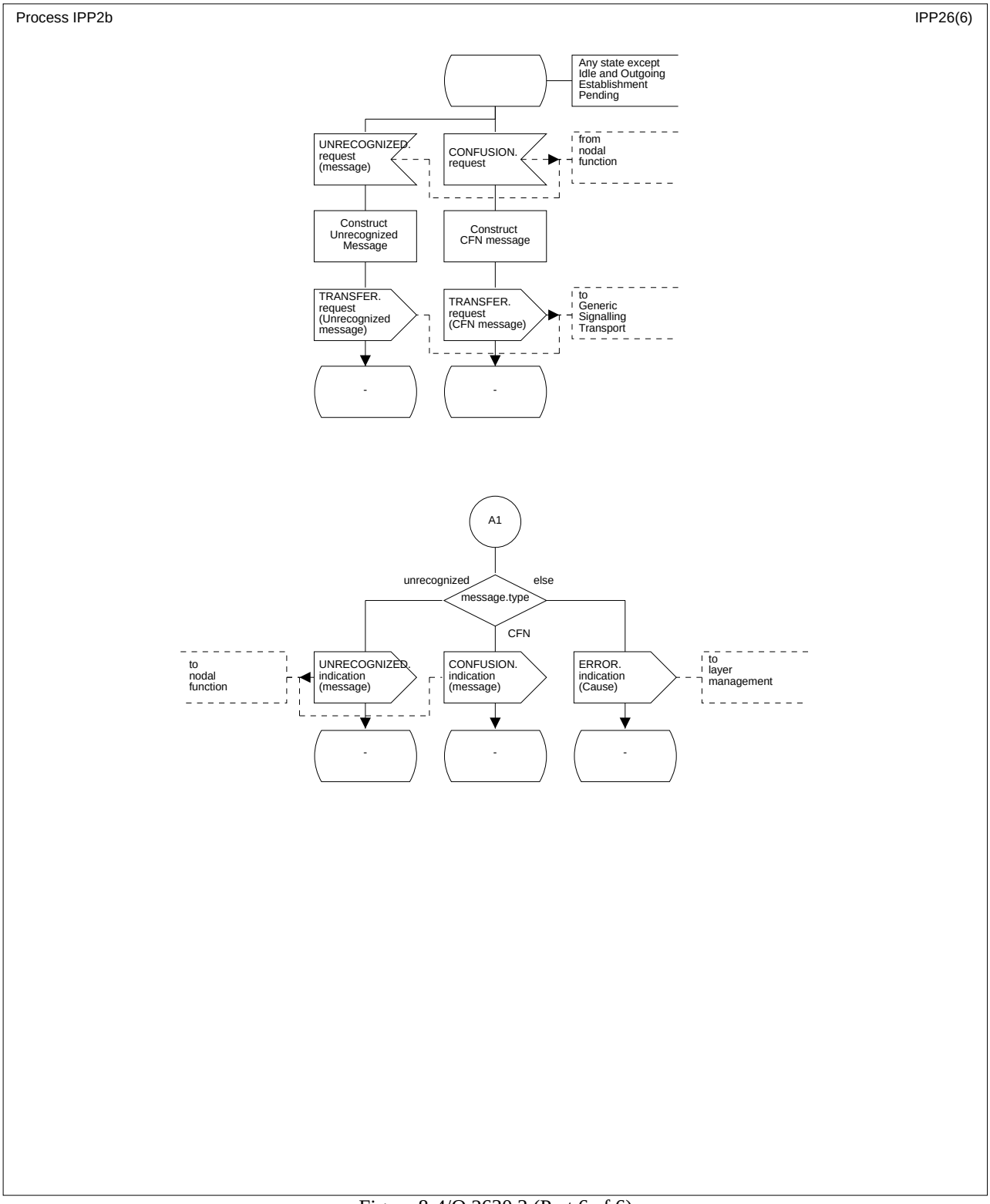


Figure 8-4/Q.2630.3 (Part 6 of 6)
SDL Diagram for the Incoming Protocol Procedure

8.3.4 Maintenance protocol procedures

8.3.4.1 Reset

8.3.4.1.1 Sending reset

When a request for reset is received from the nodal function, a maintenance protocol entity instance is created and an SAID allocated to it.

If the request indicates all AAL type 2 paths associated with a signalling transport association are to be reset, a RES message (Reset Request) containing the Connection Element Identifier parameter - with both the Path Identifier and the Channel Identifier coded with a “Null” value - is sent to the adjacent AAL type 2 node.

If the request contains the identity of an AAL type 2 path with the channel identifier coded with a “Null” value, a RES message containing the connection element identifier parameter - with the path identifier set to indicate the path and the channel identifier coded with the “Null” value - is sent to the adjacent AAL type 2 node.

If the request contains the identity of a path and a channel, a RES message containing the connection element identifier parameter - with the path identifier set to indicate the path and the channel identifier set to indicate the channel - is sent to the adjacent AAL type 2 node.

When the RES message is sent, Timer_RES is started and state “Outgoing reset pending” is entered.

If an RSC message (reset confirm) is received in state “Outgoing reset pending”, a reset confirmation is passed to the nodal function and Timer_RES is stopped. The SAID allocated to the maintenance protocol entity instance is released and made available for new traffic. The maintenance protocol entity instance enters state “Idle”.

8.3.4.1.2 Receiving reset

When a RES message (reset request) is received, a maintenance protocol entity instance will be invoked.

If the Path Identifier field in the CEID parameter included in the RES message is coded with the “Null” value, an indication that all AAL type 2 paths associated with the signalling transport association must be reset is passed to the nodal function.

If the path identifier field in the CEID parameter included in the RES message is coded with a “non-Null” value but the channel identifier field with a “Null” value, an indication that all channels within the AAL type 2 path must be reset is passed to the nodal function.

If the RES message contains the CEID parameter with both a “non-Null” path identifier field and a “non-Null” channel identifier field, an indication that the channel within the identified path must be reset is passed to the nodal function.

After notifying the nodal function, state “Incoming reset pending” is entered.

When a Reset response is received from the nodal function, a RSC message (reset confirm) is sent to the peer protocol entity instance. The maintenance protocol entity instance enters state “Idle”.

8.3.4.1.3 Exceptional reset procedures

If the SAID allocation fails, the nodal function is informed with a cause “Switching equipment congestion” and the maintenance protocol entity instance enters state “Idle”.

When Timer_RES expires in state “Outgoing reset pending”, the RES message is sent again, the nodal function is informed with a cause “Recovery on timer expiry”, state “Outgoing reset continuing” is entered, and Timer_RES is started again.

When Timer_RES expires in state “Outgoing reset continuing”, the RES message is sent again and Timer_RES is started again; the nodal function is not informed.

When an RSC message (reset confirm) is received in state “Outgoing reset continuing”, a reset confirmation is passed to the nodal function and Timer_RES is stopped. The SAID allocated to the maintenance protocol entity instance is released and made available for new traffic. The maintenance protocol entity instance enters state “Idle”.

When a request to terminate the repetition of the reset procedure is received, Timer_RES is stopped. The SAID allocated to the maintenance protocol entity instance is released and made available for new traffic. The maintenance protocol entity instance enters state “Idle”.

8.3.4.1.4 State transition model

The state transition diagram for the reset procedure is shown in Figure 8-5/Q.2630.3.

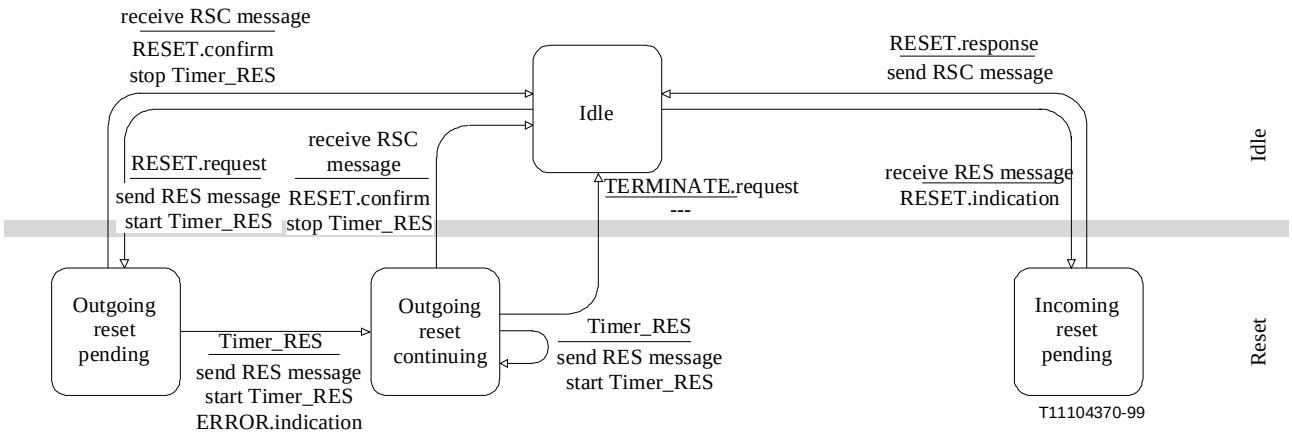


FIGURE 8-5/Q.2630.3
State transition diagram for the maintenance control procedure (reset)

8.3.4.2 Blocking and unblocking of AAL type 2 paths

8.3.4.2.1 Sending blocking/unblocking

When a request for blocking is received from the nodal function, a new maintenance protocol entity instance is created, a new SAID is allocated and a BLO message (block request) is sent to the peer AAL type 2 signalling entity. The BLO message contains a connection element identifier with the path identifier coded to indicate the AAL type 2 path to be blocked (as instructed from the nodal function) and the channel identifier coded with the "Null" value. Timer_BLO is started and state "Outgoing block pending" is entered.

When a BLC message (block confirm) is received from the peer AAL type 2 signalling entity in state "Outgoing block pending", a confirmation of blocking is sent to the nodal function and Timer_BLO is stopped. The SAID allocated to the maintenance procedure entity instance is released and made available for new traffic and state "Idle" is entered.

When a request for unblocking is received from the nodal function, a new maintenance protocol entity instance is created, a new SAID is allocated and an UBL message (unblock request) is sent to the peer AAL type 2 signalling entity. The UBL message contains a connection element identifier with the path identifier coded to indicate the AAL type 2 path to be unblocked (as instructed from the nodal function) and the channel identifier coded with the "Null" value. Timer_UBL is started and state "Outgoing unblock pending" is entered.

When an UBC message (unblock confirm) is received from the peer AAL type 2 signalling entity in state "Outgoing unblock pending", a confirmation of unblocking is sent to the nodal function and Timer_UBL is stopped. The SAID allocated to the maintenance protocol entity instance is released and made available for new traffic and state "Idle" is entered.

8.3.4.2.2 Receiving blocking/unblocking

When a BLO message (block request) is received from the peer AAL type 2 signalling entity, a new maintenance protocol entity instance is created, an indication of the blocking is sent to the nodal function and state "Incoming block pending" is entered.

When a response to the blocking is received from the nodal function in state "Incoming block pending", a BLC message (block confirm) is sent to the peer AAL type 2 signalling entity and state "Idle" is entered.

When an UBL message (unblock request) is received from the peer AAL type 2 signalling entity, a new maintenance protocol entity instance is created, an indication of the unblocking is sent to the nodal function and state "Incoming unblock pending" is entered.

When a response to the unblocking is received from the nodal function in state "Incoming unblock pending", an UBC message (unblock confirm) is sent to the peer AAL type 2 signalling entity and state "Idle" is entered.

8.3.4.2.3 Exceptional blocking and unblocking procedures

If the SAID allocation fails, the nodal function is informed with a cause "Switching equipment congestion" and the maintenance protocol entity instance enters state "Idle".

If Timer_BLO expires, the nodal function is informed with a cause "Recovery on timer expiry", the SAID is released, and state "Idle" is entered.

If Timer_UBL expires, the nodal function is informed with a cause "Recovery on timer expiry", the SAID is released, and state "Idle" is entered.

8.3.4.2.4 State transition

The state transition diagram for the path blocking procedure is shown in Figure 8-6/Q.2630.3.

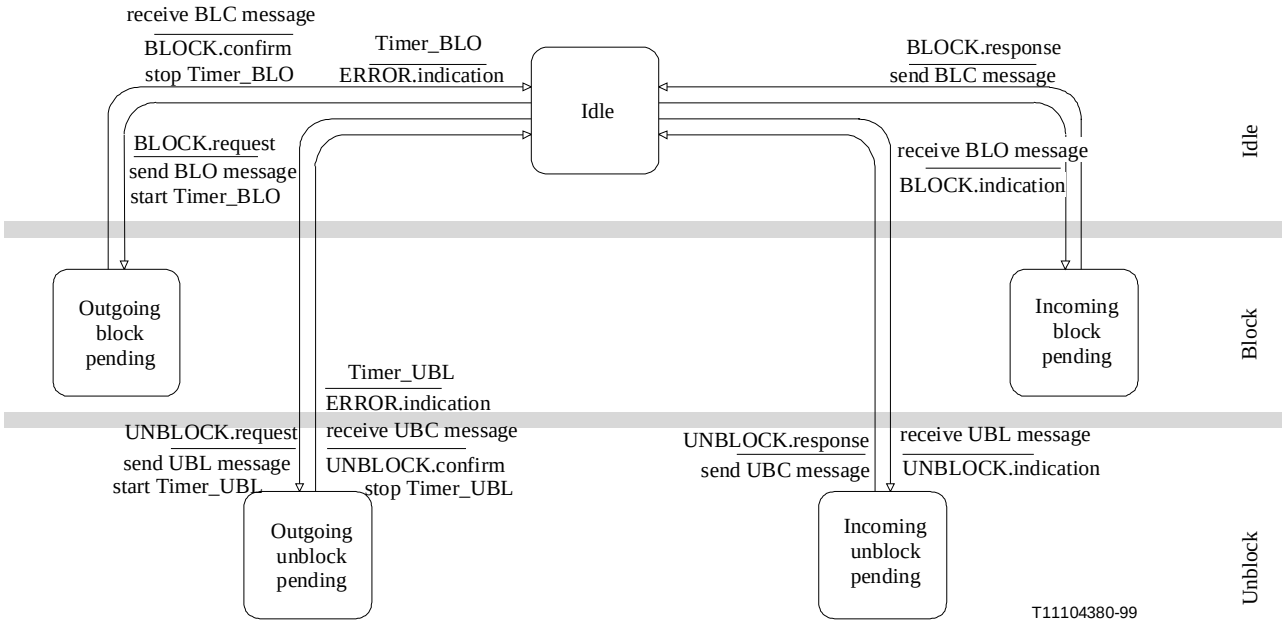


FIGURE 8-6/Q.2630.3
State transitions of the maintenance control procedure (blocking and unblocking)

8.3.4.3 Unrecognized information procedures

When an unrecognized message, parameter, or subfield value is received, the message, the parameter, or the subfield value respectively is conveyed to the nodal function for the appropriate action.

If a request to send a notification of receipt of unrecognized information is received from the nodal function, the BLC message (block confirm), UBC message (unblock confirm), or RSC message (reset confirm) shall contain the cause received from the nodal function.

When a cause parameter is received in a BLC message (block confirm), UBC message (unblock confirm), or RSC message (reset confirm), the cause parameter is conveyed to the nodal function for the appropriate action.

8.3.4.4 SDL diagrams for the maintenance control procedures

The SDL diagram for the maintenance control procedure is shown in Figure 8-7/Q.2630.3 (parts 1 to 4).

The SDL diagrams contained in Figure 8-7/Q.2630.3 (parts 1 to 4) are an introduction to the procedures described in detail in § 8.3.4 of this Recommendation.

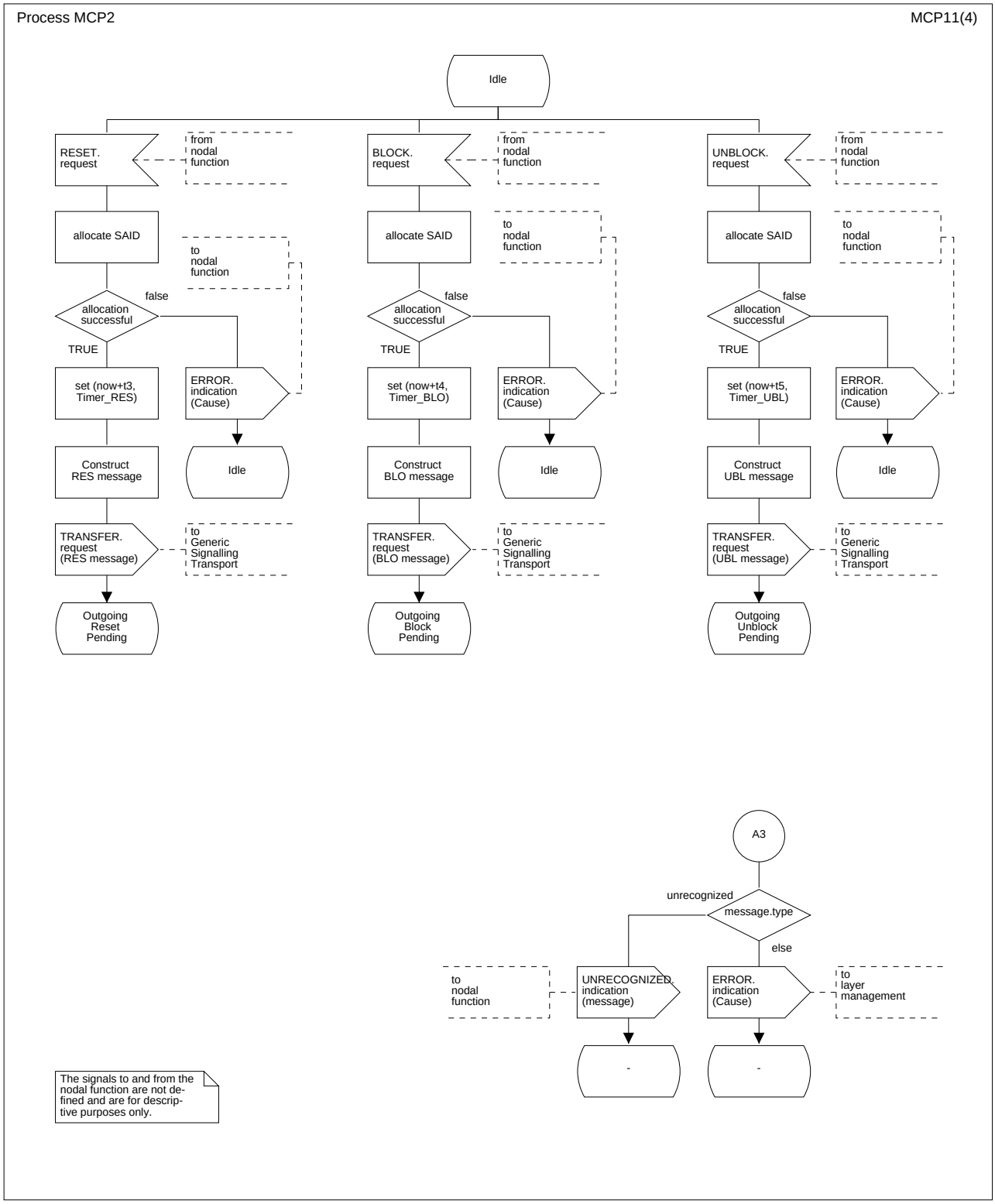


Figure 8-7/Q.2630.3 (Part 1 of 4)

SDL diagram for the maintenance control procedure

Process MCP2 MCP12(4)

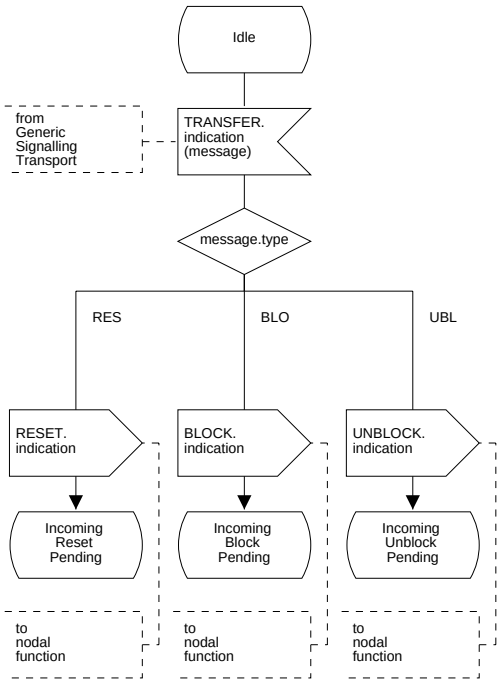


Figure 8-7/Q.2630.3 (Part 2 of 4)
SDL diagram for the maintenance control procedure

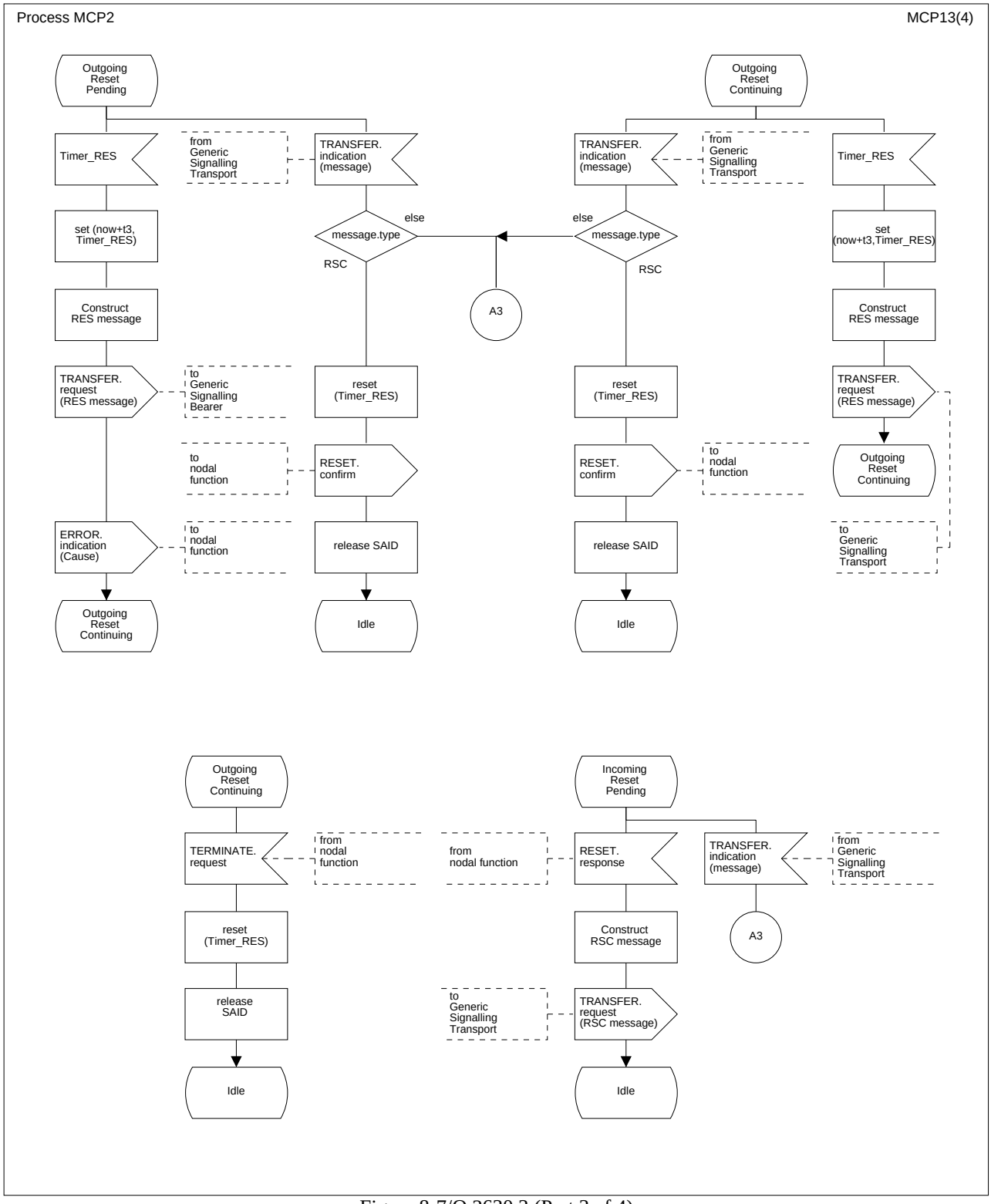


Figure 8-7/Q.2630.3 (Part 3 of 4)

SDL diagram for the maintenance control procedure

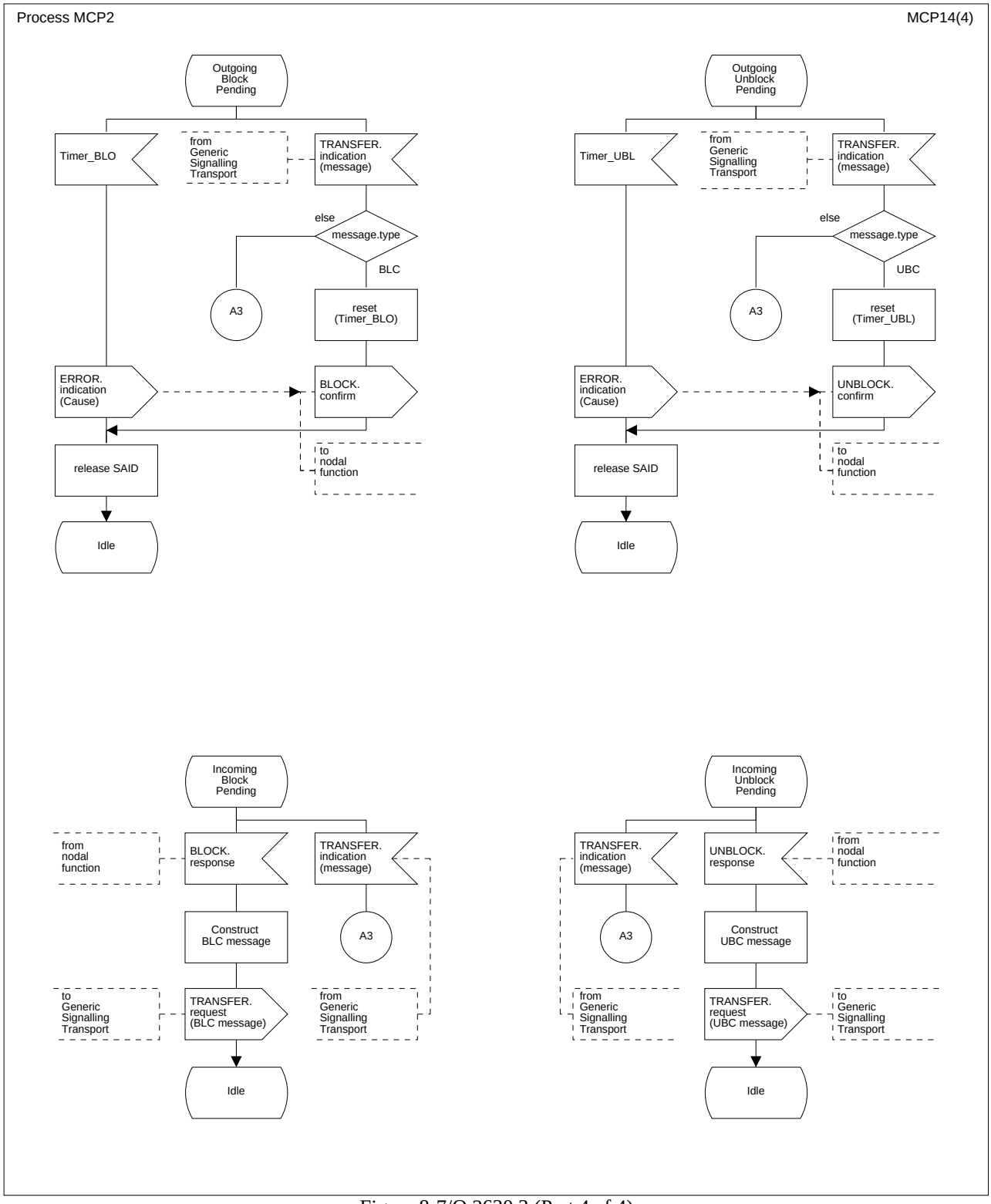


Figure 8-7/Q.2630.3 (Part 4 of 4)
SDL diagram for the maintenance control procedure

8.4 List of timers

The timers used in the procedures described in § 8.3 are listed in Table 8-1/Q.2630.3 together with a timeout value range, their cause for setting the timer, resetting the timer, and the action at expiry of the timer.

Table 8-1/Q.2630.3
List of Timers

Timer	**Time-out value**	**Cause for initiation**	**Normal termination**	**At expiry**
Timer_ERQ	5-30 s (t1)	When an ERQ message is sent	At the receipt of ECF message	Release all resources and the connection, send RES message.
Timer_REL	2-60 s (t2)	When an REL message is sent	At the receipt of RLC message	Release resources, send RES message.
Timer_RES	2-60 s (t3)	When an RES message is sent	At the receipt of RSC message	Repeat RES message, restart Timer_RES, at first expiry: inform the nodal function.
Timer_BLO	2-60 s (t4)	When a BLO message is sent	At the receipt of BLC message	Alert maintenance system, inform the nodal function.
Timer_UBL	2-60 s (t5)	When an UBL message is sent	At the receipt of UBC message	Alert maintenance system, inform the nodal function.
Timer_MOD	5-30 s (t6)	When a MOD message is sent	At the receipt of MOA message	Release all resources and the connection, send RES message.
NOTE - In the diagnostic field associated with a cause field indicating “Recovery on timer expiry”, the timer number is included. Timer_ERQ is coded as the IA5 character “1”; Timer_MOD is coded as the IA5 character “6”.				

ANNEX A
Support for non-switched scenario

(This Annex forms an integral part of this Recommendation)

A.1 Introduction

The AAL type 2 signalling protocol described in this Recommendation can be deployed in support of a non-switched scenario as depicted in Figure A-1/Q.2630.3.

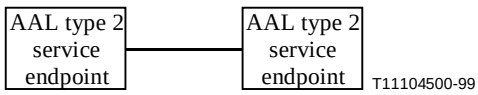


FIGURE A-1/Q.2630.3
Non-switched scenario

In this scenario, AAL type 2 paths are typically provisioned — with each originating AAL type 2 service endpoint having one signalling transport association with each neighboring AAL type 2 service endpoint. There is no AAL type 2 switch used in this scenario.

This annex describes the subset of the signalling requirements needed to support the non-switched scenario. Because most signalling procedures are link-by-link, there are few differences from the switched scenario. Since the non-switched scenario is a subset of the switched scenario, there are no additional requirements to support non-switched.

Subclauses below correspond with similarly numbered subclauses in the body of ITU-T Recommendation Q.2630.1[15].

A.2 References

§ 2/Q.2630.1[15] applies.

A.3 Definitions

§ 3/Q.2630.1[15] applies.

A.4 Abbreviations

§ 4/Q.2630.1[15] applies.

A.5 General framework of the AAL type 2 signalling protocol

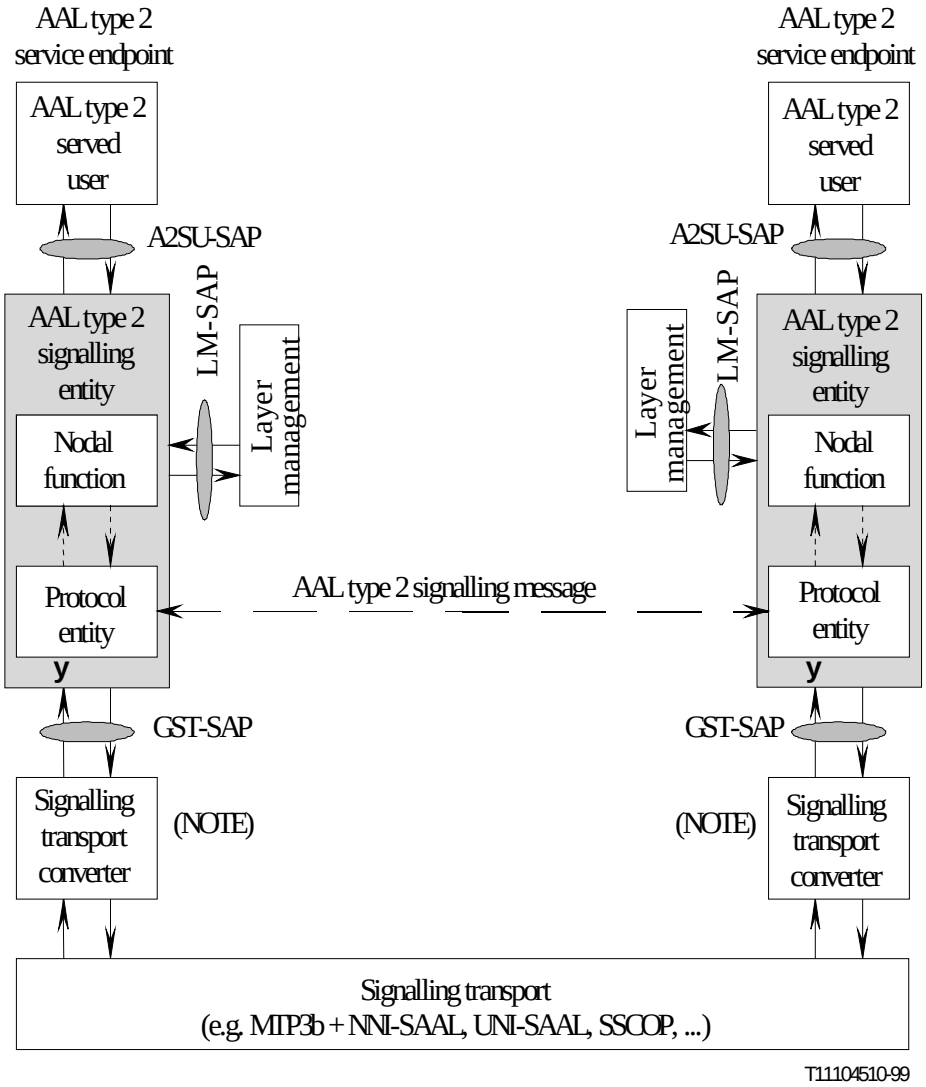
The AAL type 2 signalling protocol provides the signalling capability to establish, release and maintain AAL type 2 point-to-point connections across a single ATM VCC that carries AAL type 2 links. These services are accessible via the AAL type 2 User Service Access Point (A2SU-SAP).

Two peer AAL type 2 signalling entities rely on the generic signalling transport service to provide assured data transfer between them and service availability indications. These services are accessible via the Generic Signalling Transport Service Access Point (GST-SAP).

NOTE — Primitives over the A2SU-SAP, GST-SAP, and LM-SAP are used for descriptive purpose only. They do not imply a specific implementation.

Both peer AAL type 2 signalling entities provide the same set of services.

The AAL type 2 signalling entity is subdivided into protocol entities and nodal functions as shown in Figure A-5.1/Q.2630.3. At each AAL type 2 service endpoint, the AAL type 2 signalling entity communicates with the AAL type 2 served user.



NOTE — A signalling transport converter instance is associated with each AAL type 2 signalling transport.

FIGURE A-5.1/Q.2630.3
AAL type 2 signalling protocol reference architecture for the non-switched scenario

Protocol Entities define the interactions between two adjacent AAL type 2 nodes. AAL type 2 messages are exchanged between peer protocol entities using the generic signalling transport service.

The AAL type 2 signalling is independent of the signalling transport, although an assured data transport is required and a message size limit applies. To adapt the signalling transport services to a specific signalling transport service, a signalling bearer converter may be needed. The specification of signalling bearer converters is beyond the scope of this Recommendation (see ITU-T Recommendations Q.2150.0[12], Q.2150.1[22], and Q.2150.2[23]).

The protocol entity is divided into several procedures as shown in Figure A-5.2/Q.2630.3.

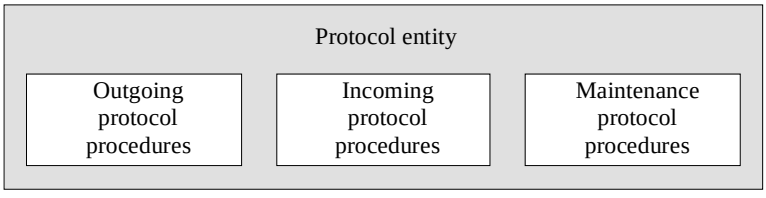


FIGURE A-5.2/Q.2630.3
Internal structure of the AAL type 2 signalling protocol entity

The outgoing protocol procedures provide the mechanism to initiate an AAL type 2 connection request. The incoming protocol procedures are applied when a request for an AAL type 2 connection is received from a peer entity. Both of

these procedures provide for the orderly release of an AAL type 2 connection. The maintenance protocol procedures provide the mechanisms to align the status of the AAL type 2 resources within the two adjacent AAL type 2 nodes and procedures to block and unblock an AAL type 2 path.

The unrecognized information procedures in the nodal function as well as in the protocol entities provide the forward compatibility mechanism which enables extension of the protocol in the future.

The nodal function keeps track of the AAL type 2 path resources.

A.5.1 Interface between the AAL type 2 signalling entity and the AAL type 2 served user

§ 5.1/Q.2630.1[15] applies, except for the following:

In the ESTABLISH.request primitive, AAL type 2 Service Endpoint Address (DA2EA) is not included.

A.5.2 Service provided by the generic signalling transport service

§ 5.2/Q.2630.1[15] applies except for the following:

CONGESTION.indication primitive does not apply.

A.5.3 Interface between the AAL type 2 signalling entities and layer management

§ 5.3/Q.2630.1[15] applies.

A.6 Forward and backward compatibility

§ 6/Q.2630.1[15] applies.

A.7 Format and coding of AAL type 2 signalling protocol

§ 7/Q.2630.1[15] applies.

A.7.1 Coding conventions for the AAL type 2 signalling protocol

§ 7.1/Q.2630.1[15] and its subclauses apply.

A.7.2 Format and coding of the AAL type 2 signalling protocol messages

A.7.2.1 AAL type 2 signalling protocol messages

§ 7.2.1/Q.2630.1[15] applies.

A.7.2.2 Parameters of the AAL type 2 signalling protocol messages

§ 7.2.2/Q.2630.1[15] applies as modified below:

The parameters of the AAL type 2 signalling protocol messages are shown in Table A-7-6/Q.2630.3. The indications of “mandatory” and “optional” are for information only. The authoritative definition is given in § A.8. If any difference between the indications in this clause and the definitions in § A.8 exists, the definitions in § A.8 take precedence.

Multiple presence of the same parameter in a single message is not permitted.

TABLE A-7-6/Q.2630.3 (part 1 of 2)
Parameters of the AAL type 2 signalling protocol messages

AAL type 2 parameter	**AAL type 2 message**						
	ERQ	**ECF**	**REL**	**RLC**			
Cause	—	—	M	[4])			
Connection Element ID	M	—	—	—			
Destination Signalling Association Identifier [1])	[2])	M	M	M			
Link Characteristics	O	—	—	—			
Originating Signalling Association Identifier	M	M	—	—			
Served User Generated Reference	O	—	—	—			
Served User Transport	O	—	—	—			
Service Specific Information (Audio)	[3])	—	—	—			
Service Specific Information (Multirate)	[3])	—	—	—			
Service Specific Information (SAR-assured)	[3])	—	—	—			
Service Specific Information (SAR-unassured)	[3])	—	—	—			
Test Connection Indicator	O	—	—	—			

M Mandatory parameter
O Optional parameter
— Parameter not present

NOTES
1 This row designates the Destination Signalling Association Identifier field in the message header.
2 The Destination Signalling Association Identifier field contains the value “unknown”.
3 At most one of these parameters is present in an instance of the message.
4 The “Cause” parameter is present in the Release Confirm message if
a) the RLC is used to reject a connection establishment, or
b) the cause reports unrecognized unknown information received in the REL message.

Table A-7-6/Q.2630.3 (Part 2 of 2)
Parameters of the AAL Type 2 Signalling Protocol messages

AAL type 2 parameter	**AAL type 2 message**						
	RES	**RSC**	**BLO**	**BLC**	**UBL**	**UBC**	**CFN**
Cause	—	[4])	—	[4])	—	[4])	M
Connection Element ID	M	—	M [3])	—	M [3])	—	—
Destination Signalling Association Identifier [1])	[2])	M	[2])	M	[2])	M	M
Originating Signalling Association Identifier	M	—	M	—	M	—	—

M Mandatory parameter
O Optional parameter
— Parameter not present

NOTES
1 This row designates the Destination Signalling Association Identifier field in the message header.
2 The Destination Signalling Association Identifier field contains the value “unknown”.
3 The Channel Identifier field is set to “Null”.
4 The “Cause” parameter is present only if the cause reports unrecognized information received.

The identifiers of the AAL type 2 message parameters are defined in Table A-7-7/Q.2630.3.

Table A-7-7/Q.2630.3
Identifiers of the AAL Type 2 message parameters

AAL type 2 Parameter	Ref.	Acronym	Identifier
Cause	7.3.1	CAU	0 0 0 0 0 0 0 1
Connection Element ID	7.3.2	CEID	0 0 0 0 0 0 1 0
Link Characteristics	7.3.5	ALC	0 0 0 0 0 1 0 1
Originating Signalling Association Identifier	7.3.6	OSAID	0 0 0 0 0 1 1 0
Served User Generated Reference	7.3.7	SUGR	0 0 0 0 0 1 1 1
Served User Transport	7.3.8	SUT	0 0 0 0 1 0 0 0
Service Specific Information (Audio)	7.3.9	SSIA	0 0 0 0 1 0 0 1
Service Specific Information (Multirate)	7.3.10	SSIM	0 0 0 0 1 0 1 0
Service Specific Information (SAR-assured)	7.3.11	SSISA	0 0 0 0 1 0 1 1
Service Specific Information (SAR-unassured)	7.3.12	SSISU	0 0 0 0 1 1 0 0
Test Connection Indicator	7.3.13	TCI	0 0 0 0 1 1 0 1

A.7.3 Parameter specification of the AAL type 2 signalling protocol messages

Applicable parameters are specified in § 7.3/Q.2630.1[15] except:

- For § 7.3.3 “Destination E.164 service endpoint address” and § 7.3.4 “Destination NSAP service endpoint address” which are not applicable.

A.7.4 Field specification of the AAL type 2 signalling protocol parameters

Applicable fields are specified in § 7.4/Q.2630.1[15] except:

a) In § 7.4.1.2/Q.2630.1[15] add the following sentence: “Optionally, it is possible to increase the CPS-SDU size to 64 octets”.

b) § 7.4.13/Q.2630.1[15], § 7.4.14/Q.2630.1[15], and § 7.4.15/Q.2630.1[15] are not applicable.

c) In § 7.4.16/Q.2630.1[15], cause “Unallocated (unassigned) number” is not applicable.

A.8 Procedure of the AAL type 2 signalling protocol

Before an ATM VCC (AAL type 2 path) is put into service between a pair of adjacent AAL type 2 nodes, certain actions need to be performed. An identifier called the AAL type 2 path identifier is assigned to the ATM VCC. This identifier is used to refer to the ATM VCC in the AAL type 2 signalling protocol messages. The AAL type 2 path identifier shall uniquely identify the ATM VCC between the two adjacent AAL type 2 nodes.

On any ATM VCC used for AAL type 2 connections, all CID values from “8” to “255” are available for assignment.

Any time a new ATM VCC is put into service, the ownership of the ATM VCC shall be determined before AAL type 2 connections are established in it. In case of switched ATM VCC, the owner of the VCC shall be the AAL type 2 node that initiated the establishment of the VCC. In case of PVC and soft PVC, it is the responsibility of the management system to determine the owner of the VCC.

The nodal function is informed by layer management of a newly established AAL type 2 path by the use of the ADD-PATH.indication primitive containing the adjacent AAL type 2 node identifier, the AAL type 2 path identifier, and the ownership. The nodal function is informed by layer management of the removal of an AAL type 2 path by use of the REMOVE-PATH.indication primitive containing the adjacent AAL type 2 node identifier and the AAL type 2 path identifier.

In order to minimize the likelihood of CID collision, the following CID allocation mechanism shall be used:

- if the AAL type 2 node owns the AAL type 2 path that carries the new connection, it allocates CID values from CID value 8 upwards; and
- if the AAL type 2 node does not own the AAL type 2 path that carries the new connection, it allocates CID values from CID value 255 downwards.

NOTE — Causes in the procedures defined in § 8/Q.2630.1[15] specify which ITU-T standardized code should be used in cause parameters of AAL type 2 signalling protocol messages. Implementation dependent non-standardized causes may be used for AAL type 2 signalling entity internal processing and for A2SU-SAP and LM-SAP cause primitive parameters.

The service endpoint address, the served user generated reference, the served user transport parameter, the link characteristics, the SSCS information, and the test connection indicator shall not be modified by the nodal function. The served user generated reference and the served user transport are parameters with significance to the served user only, therefore, they shall not be examined by the nodal function.

A.8.1 Compatibility

§ 8.1 applies with the following modifications:

a) In § 8.1.1/Q.2630.1[15] "General requirements on receipt of unrecognized signalling information", bullet item d) and the note below it are not applicable.

b) In § 8.1.2.1/Q.2630.1[15] "Unrecognized messages", the bullet item "transfer the message transparently" is not applicable.

c) In § 8.1.2.2/Q.2630.1[15] "Unrecognized parameters", the bullet item "transfer the parameter transparently" appears twice and is not applicable in either location.

A.8.2 Nodal functions

A.8.2.1 Nodal functions for AAL type 2 nodes with served user interaction

§ 8.2.1/Q.2630.1[15] applies with the modification below.

a) § 8.2.1.1.1.1/Q.2630.1[15] "Actions at the originating AAL type 2 service endpoint" is replaced by the following paragraphs:

When the nodal function receives an ESTABLISH.request primitive from the AAL type 2 served user, it determines the availability of a route with enough AAL type 2 path resources and selects an AAL type 2 path to the succeeding AAL type 2 service endpoint.

Selection of an AAL type 2 path typically is based on:
- the test connection indicator;
- link information (link characteristics); and
- other information (such as SSCS information).

AAL type 2 node internal resources are allocated for the new connection from the originating AAL type 2 served user to the outgoing AAL type 2 path.

On the selected outgoing AAL type 2 path, the CID and other resources (e.g. indicated by link characteristic or SSCS information) are allocated for the outgoing AAL type 2 link.

An outgoing protocol entity instance is invoked and the following parameters are passed to it: the AAL type 2 Path Identifier, and a CID value. The nodal function shall pass the following parameters to the outgoing protocol entity instance only if they were conveyed by the originating AAL type 2 served user: the link characteristics, the SSCS information, the served user generated reference, the served user transport, and the test connection indicator.

NOTE — Through-connection at AAL type 2 service endpoints is not specified by this Recommendation. It may be controlled by the AAL type 2 served user.

After receiving an indication of the successful AAL type 2 connection setup from the outgoing protocol entity instance, an ESTABLISH.confirm primitive is sent to the AAL type 2 served user.

b) § 8.2.1.1.1.2/Q.2630.1[15] "Actions at the destination AAL type 2 service endpoint" is replaced by the following paragraphs:

Upon receiving an indication from an incoming protocol entity instance requesting a new connection, the nodal function checks the availability of the CID value and other resources, e.g. indicated by link characteristic or SSCS information in the incoming AAL type 2 path.

If the test connection indicator parameter is present, a “locally blocked” or “remotely blocked” AAL type 2 path shall be acceptable for the incoming connection.

If the CID and the other resources are available, they are allocated to the new connection.

AAL type 2 node internal resources are allocated for the new connection from the incoming AAL type 2 path to the destination AAL type 2 served user.

The nodal function acknowledges the successful AAL type 2 connection establishment towards the incoming protocol entity instance.

An ESTABLISH.indication primitive is sent to the AAL type 2 served user to inform it of the successfully established new connection. The nodal function shall pass the following parameters to the outgoing protocol entity instance only if they were conveyed by the incoming protocol entity instance: the SSCS information, the served user transport, the served user generated reference, and the test connection indicator.

NOTE — Through-connection at AAL type 2 service endpoints is not specified by this Recommendation. It may be controlled by the AAL type 2 served user.

c) § 8.2.1.1.2.1/Q.2630.1[15] “Actions at the originating AAL type 2 service endpoint” is replaced by the following paragraphs:

If the AAL type 2 path selection or the CID and other resources allocation described in § 8.2.1.1.1.1 fails, a RELEASE.confirm primitive is returned to the AAL type 2 served user with one of the following causes:

- “No route to destination”;
- “No circuit/channel available”;
- “Resource unavailable, unspecified”;
- “Network out of order”; or
- “Temporary failure”.

If AAL type 2 node internal resources are not available for the new connection, a RELEASE.confirm primitive is sent to the AAL type 2 served user with the cause “Switching equipment congestion”.

Upon receiving a negative acknowledgement for the connection setup request from the outgoing protocol entity instance, all the resources associated with this AAL type 2 link are released and made available for new traffic. The association to the outgoing protocol entity instance is released. Features that enable a further connection attempt, involving the selection of a different AAL type 2 path within the same route, may be implemented. If no further connection attempt is made, the AAL type 2 node internal resources are released and a RELEASE.confirm primitive is sent to the AAL type 2 served user with the cause received from the outgoing protocol entity instance.

Upon receiving an indication from the outgoing protocol entity instance that a timer has expired, the association to the outgoing protocol entity instance is released and a reset procedure is started (see § 8.2.1.2.1.1 case 3 a)). The AAL type 2 node internal resources are released. A RELEASE.confirm primitive is sent to the AAL type 2 served user with the cause received from the outgoing protocol entity instance, i.e. “Recovery on timer expiry”.

A.8.2.2 Nodal functions for AAL type 2 nodes without served user interaction

§ 8.2.2/Q.2630.1[15] is not applicable.

A.8.3 Protocol entity

§ 8.3/Q.2630.1[15] applies.

A.8.4 List of timers

§ 8.4/Q.2630.1[15] applies.

Annex B
Coding of the compatibility information

(This Annex forms an integral part of this Recommendation.)

B.1 Coding of the compatibility information for CS1 and CS2 networks using Link Characteristics for Connection Resource Allocation

B.1.1 Message compatibility

To ensure backward compatibility with AAL type 2 nodes conforming only to ITU-T Recommendation Q.2630.1[15] or Q.2630.2[16], the message compatibility field of the Modify Request (MOD), Modify Acknowledge (MOA), and Modify Reject (MOR) messages shall be set as indicated in Table B-1/Q.2630.3.

Table B-1/Q.2630.3
Coding of the message compatibility information

	8	7	6	5	4	3	2	1
	pass-on not possible				general action			
Message	res.	send notification indicator	instruction indicator		res.	send notification indicator	instruction indicator	
Modify Request (MOD) with Transfer Capability	**0**	**0** do not send notification	**1 0** discard message		**0**	**0** do not send notification	**1 0** discard message	
Modify Request (MOD) without Transfer Capability	**0**	**0** do not send notification	**1 0** discard message		**0**	**0** do not send notification	**0 0** pass on message	
Modify Acknowledge (MOA)	**0**	**0** do not send notification	**1 0** discard message		**0**	**0** do not send notification	**0 0** pass on message	
Modify Reject (MOR)	**0**	**0** do not send notification	**1 0** discard message		**0**	**0** do not send notification	**0 0** pass on message	

B.1.2 Parameter compatibility

To ensure backward compatibility with AAL type 2 nodes conforming only to ITU-T Recommendation Q.2630.1[15], the parameter compatibility field of the new or differently used parameters introduced in ITU-T Recommendation Q.2630.2[16] shall be set as indicated in Table B-2/Q.2630.3.

Table B-2/Q.2630.3
Coding of the parameter compatibility information

	8	7	6	5	4	3	2	1
	pass-on not possible				general action			
Parameter	res.	send notification indicator	instruction indicator		res.	send notification indicator	instruction indicator	
Connection Element Identifier (CEID) in RLC message	**0**	**0** do not send notification	**0 1** discard parameter		**0**	**0** do not send notification	**0 1** discard parameter	
Modify Support for Link Characteristics (MSLC) in ERQ and ECF message	**0**	**0** do not send notification	**0 1** discard parameter		**0**	**0** do not send notification	**0 1** discard parameter	
Modify Support for Service Specific Information (MSSSI) in ERQ and ECF message	**0**	**0** do not send notification	**0 1** discard parameter		**0**	**0** do not send notification	**0 0** pass on parameter	
Preferred Link Characteristics (PLC) in ERQ message	**0**	**0** do not send notification	**0 1** discard parameter		**0**	**0** do not send notification	**0 1** discard parameter	
Preferred Service Specific Information (Audio Extended) (PSSIAE) in ERQ message	**0**	**0** do not send notification	**0 1** discard parameter		**0**	**0** do not send notification	**0 0** pass on parameter	
Preferred Service Specific Information (Multirate Extended) (PSSIME) in ERQ message	**0**	**0** do not send notification	**0 1** discard parameter		**0**	**0** do not send notification	**0 0** pass on parameter	
Service Specific Information (Audio Extended) (SSIAE) in ERQ message	**0**	**0** do not send notification	**1 1** release connection		**0**	**0** do not send notification	**0 0** pass on parameter	
Service Specific Information (Multirate Extended) (SSIME) in ERQ message	**0**	**0** do not send notification	**1 1** release connection		**0**	**0** do not send notification	**0 0** pass on parameter	
Path Type (PT) in ERQ message	**0**	**1** send notification	**0 1** discard parameter		**0**	**1** send notification	**0 0** pass on parameter	
Served User Correlation ID (SUCI) in MOD & MOA message	**0**	**0** do not send notification	**0 1** discard parameter		**0**	**0** do not send notification	**0 0** pass on parameter	

B.2 Coding of the compatibility information for CS1 and CS2 networks using Service Specific Information for Connection Resource Allocation

B.2.1 Message compatibility

To ensure backward compatibility with AAL type 2 nodes conforming only to ITU-T Recommendation Q.2630.1[15] or Q.2630.2[16], the message compatibility field of the Modify Request (MOD), Modify Acknowledge (MOA), and Modify Reject (MOR) messages shall be set as indicated in Table B-3/Q.2630.3.

Table B-3/Q.2630.3
Coding of the message compatibility information

	8	7	6	5	4	3	2	1
	pass-on not possible				general action			
Message	res.	send notification indicator	instruction indicator		res.	send notification indicator	instruction indicator	
Modify Request (MOD)	**0**	**0** do not send notification	**1 0** discard message		**0**	**0** do not send notification	**1 0** discard message	
Modify Acknowledge (MOA)	**0**	**0** do not send notification	**1 0** discard message		**0**	**0** do not send notification	**0 0** pass on message	
Modify Reject (MOR)	**0**	**0** do not send notification	**1 0** discard message		**0**	**0** do not send notification	**0 0** pass on message	

B.2.2 Parameter compatibility

To ensure backward compatibility with AAL type 2 nodes conforming only to ITU-T Recommendation Q.2630.1[15], the parameter compatibility field of the new or differently used parameters introduced in ITU-T Recommendation Q.2630.2[16] shall be set as indicated in Table B-4/Q.2630.3.

Table B-4/Q.2630.3
Coding of the parameter compatibility information

	8	7	6	5	4	3	2	1
	pass-on not possible				general action			
Parameter	res.	send notification indicator	instruction indicator		res.	send notification indicator	instruction indicator	
Connection Element Identifier (CEID) in RLC message	**0**	**0** do not send notification	**0 1** discard parameter		**0**	**0** do not send notification	**0 1** discard parameter	
Modify Support for Service Specific Information (MSSSI) in ERQ and ECF message	**0**	**0** do not send notification	**0 1** discard parameter		**0**	**0** do not send notification	**0 1** discard parameter	
Preferred Service Specific Information (Audio Extended) (PSSIAE) in ERQ message	**0**	**0** do not send notification	**0 1** discard parameter		**0**	**0** do not send notification	**0 1** discard parameter	
Preferred Service Specific Information (Multirate Extended) (PSSIME) in ERQ message	**0**	**0** do not send notification	**0 1** discard parameter		**0**	**0** do not send notification	**0 1** discard parameter	
Service Specific Information (Audio Extended) (SSIAE) in ERQ message	**0**	**0** do not send notification	**1 1** release connection		**0**	**0** do not send notification	**1 1** release connection	
Service Specific Information (Multirate Extended) (SSIME) in ERQ message	**0**	**0** do not send notification	**1 1** release connection		**0**	**0** do not send notification	**1 1** release connection	
Path Type (PT) in ERQ message	**0**	**1** send notification	**0 1** discard parameter		**0**	**1** send notification	**0 0** pass on parameter	
Served User Correlation ID (SUCI) in MOD & MOA message	**0**	**0** do not send notification	**0 1** discard parameter		**0**	**0** do not send notification	**0 0** pass on parameter	

B.3 Coding of the compatibility information of the new parameters for CS1 and CS2 networks

To ensure backward compatibility with AAL type 2 nodes conforming only to ITU-T Recommendations Q.2630.1[15] or Q.2630.2[16], the parameter compatibility field of the new parameter shall be set as indicated in Table B-5/Q.2630.3.

Table B-5/Q.2630.3
Coding of the parameter compatibility information

	8	7	6	5	4	3	2	1
	pass-on not possible				general action			
Parameter	res.	send notification indicator	instruction indicator		res.	send notification indicator	instruction indicator	
Origination AAL type 2 Service Endpoint Address (OA2AE) in ERQ message	**0**	**0** do not send notification	**0 1** discard parameter		**0**	**0** do not send notification	**0 0** pass on parameter	
Connection Priority (CP) in ERQ message	**0**	**0** do not send notification	**0 1** discard parameter		**0**	**0** do not send notification	**0 0** pass on parameter	
Congestion Level (CL) in REL or RLC message	**0**	**0** do not send notification	**0 1** discard parameter		**0**	**0** do not send notification	**0 1** discard parameter	
Hop Counter (HC) in ERQ message	**0**	**0** do not send notification	**0 1** discard parameter		**0**	**0** do not send notification	**0 0** pass on parameter	
TAR Controlled Connection (TCC) in ERQ message	**0**	**0** do not send notification	**0 1** discard parameter		**0**	**0** do not send notification	**0 0** pass on parameter	
Transfer Capability Support (TCS) in ERQ and ECF message	**0**	**0** do not send notification	**0 1** discard parameter		**0**	**0** do not send notification	**0 1** discard parameter	
Fixed Bandwidth Transfer Capability (FBW) in ERQ and MOD message	**0**	**0** do not send notification	**0 1** discard parameter		**0**	**0** do not send notification	**0 0** pass on parameter	
Variable Bandwidth Stringent Transfer Capability (VBWS) in ERQ and MOD message	**0**	**0** do not send notification	**0 1** discard parameter		**0**	**0** do not send notification	**0 0** pass on parameter	
Variable Bandwidth Tolerant Transfer Capability (VBWT) in ERQ and MOD message	**0**	**0** do not send notification	**0 1** discard parameter		**0**	**0** do not send notification	**0 0** pass on parameter	
Preferred Fixed Bandwidth Transfer Capability (PFBW) in ERQ message	**0**	**0** do not send notification	**0 1** discard parameter		**0**	**0** do not send notification	**0 0** pass on parameter	
Preferred Variable Bandwidth Stringent Transfer Capability (PVBWS) in ERQ message	**0**	**0** do not send notification	**0 1** discard parameter		**0**	**0** do not send notification	**0 0** pass on parameter	
Preferred Variable Bandwidth Tolerant Transfer Capability (PVBWT) in ERQ message	**0**	**0** do not send notification	**0 1** discard parameter		**0**	**0** do not send notification	**0 0** pass on parameter	

Annex C
Interworking with CS1 and CS2 Nodes for Connection Resource Allocation

(This Annex forms an integral part of this Recommendation.)

Examples of interworking cases are illustrated in Appendix III.

C.1. Connection Resources indicated with Link Characteristic Parameters

C.1.1. Connection Establishment

C.1.1.1. Introduction

NOTE 1 — In order to ensure interworking the following three cases are considered:

a) If no connection resource modifications are required for the AAL type 2 connection, the originating AAL type 2 served user may include a Link Characteristics parameter in the ESTABLISH.request primitive that corresponds to the Transfer Capability parameter.

b) If connection resource modifications may be required for the AAL type 2 connection and interworking to CS1 nodes is not required, the originating AAL type 2 served user may include a Link Characteristics parameter and a Modify Support for Link Characteristics parameter in the ESTABLISH.request primitive; the Link Characteristics parameter corresponds to the Transfer Capability parameter.

c) If connection resource modifications may be required for the AAL type 2 connection and interworking to CS1 nodes may be required, the originating AAL type 2 served user may additionally include the following parameters in the ESTABLISH.request primitive:
- the Link Characteristics
- the Preferred Transfer Capability,
- the Preferred Link Characteristicsand
- the Modify Support for Link Characteristics.

Interworking with CS2 and CS1 nodes is designed such that:
- If the Modify Support for Link Characteristics parameter is received by the destination AAL type 2 service endpoint, no CS1 node is part of the AAL type 2 connection; resource allocation for the AAL type 2 connection is based on the Preferred Transfer Capability (for CS3 nodes) and Preferred Link Characteristics (for CS2 nodes) and the connection resources are modifiable.
- If the Modify Support for Link Characteristics parameter is not received by the destination AAL type 2 service endpoint, a CS1 node is part of the AAL type 2 connection; resource allocation for the AAL type 2 connection is based on the Transfer Capability (for CS3 nodes) and Link Characteristics (for CS1 and CS2 nodes) and the connection resources are not modifiable.
- In all cases, the originating AAL type 2 served user includes a Transfer Capability Support parameter in the ESTABLISH.request primitive as well. If this parameter is received by a destination CS3 service endpoint, it is sent back towards the originating AAL type 2 service endpoint. The complete AAL type 2 connection passes through CS3 nodes only and the originating and the destination AAL type 2 served users know that the full functionality of this Recommendation is available for this connection.

NOTE 2 — From the point of view of this recommendation it is regarded to be within the responsibility of the AAL type 2 served user to ensure consistency between Transfer Capability and Link Characteristics parameters.

C.1.1.2. Actions at the originating AAL type 2 service endpoint

In addition to the specifications in § 8.2, the following applies:

When the nodal function receives an ESTABLISH.request primitive from the AAL type 2 served user, the following restrictions on the optionality of the parameters of the primitive apply:
- The Transfer Capability Support parameter shall be present;
- The Link Characteristics parameter shall be present;
- The Modify Support for Link Characteristics parameter may be present;

- The Preferred Link Characteristics parameter may be present only if the Modify Support for Link Characteristics parameter is also present;
- The Preferred Transfer Capability parameter shall be present if the AAL type 2 Preferred Link Characteristics parameter is present; and
- If a Preferred Transfer Capability parameter is specified, it must refer to the same AAL type 2 transfer capability as the Transfer Capability parameter.
  NOTE — For example, if the Transfer Capability parameter indicates a Variable Bandwidth Stringent Transfer Capability, the Preferred Transfer Capability parameter, if present, may only indicate a Variable Bandwidth Stringent Transfer Capability.

Depending on the presence of Preferred Transfer Capability parameter the following applies:

- If the Preferred Transfer Capability parameter is not present, connection admission control and connection resource allocation are performed as defined in § 8.2.
- If the Preferred Transfer Capability parameter is present, the connection admission control and connection resource allocation shall be based on the most demanding of the Preferred Transfer Capability and the Transfer Capability.

  NOTE — The concept of "demanding" depends on the connection admission control algorithm and connection resource allocation mechanisms in use which are outside the scope of this Recommendation.

If the originating AAL type 2 service endpoint receives a notification that the succeeding node did not recognize the Path Type parameter, the connection establishment shall be allowed to continue (QoS requirements are met by the network default stringent QoS class), or the connection is released and a RELEASE.confirm primitive is returned to the AAL type 2 served user with the cause "Resource unavailable, unspecified" (QoS requirements are not met by network default stringent QoS class).

After receiving an indication of the successful AAL type 2 connection setup from the outgoing protocol entity instance the following applies depending on the presence of the Modify Support for Link Characteristics parameter and the Preferred Transfer Capability parameter:

- If the Modify Support for Link Characteristics parameter is not present, connection admission control and connection resource allocation shall reflect the Transfer Capability (TC).
- If the Modify Support for Link Characteristics parameter is present, connection admission control and connection resource allocation shall reflect the Preferred Transfer Capability (PTC) if present, otherwise the Transfer Capability (TC) shall be reflected.

C.1.1.3. Actions at AAL type 2 nodes without served user interaction

In addition to the specifications in § 8.2, the following applies:

Upon receiving notification from an incoming protocol entity instance requesting a new connection and the Transfer Capability parameter is not conveyed by the incoming protocol entity instance,

- the nodal function prepares a Transfer Capability parameter corresponding to the Link Characteristics parameter; and
- if a Preferred Link Characteristics parameter is also conveyed by the incoming protocol entity instance, the nodal function prepares a Preferred Transfer Capability parameter corresponding to the Preferred Link Characteristics parameter. The Preferred Transfer Capability parameter must refer to the same AAL type 2 transfer capability as the Transfer Capability parameter.

  NOTE — For example, if the Transfer Capability parameter indicates a Variable Bandwidth Stringent Transfer Capability, the Preferred Transfer Capability parameter, if present, may only indicate a Variable Bandwidth Stringent Transfer Capability.

NOTE — In Appendix II, guidelines to derive the Transfer Capability parameter from a Link Characteristics parameter are shown.

These parameters are treated as if they would have been conveyed by the incoming protocol entity instance.

If a Preferred Transfer Capability parameter is conveyed by the incoming protocol entity instance but not a Preferred Link Characteristics parameter, the Preferred Transfer Capability parameter is discarded; subsequent treatment of the

parameters is as if the Preferred Transfer Capability parameter would not have been conveyed by the incoming protocol entity instance.

Depending on the presence of Preferred Transfer Capability parameter the following applies:

- If the Preferred Transfer Capability parameter is not present, the connection admission control and connection resource allocation are performed as defined in § 8.2.
- If the Preferred Transfer Capability parameter is present, the connection admission control and connection resource allocation shall be based on the most demanding of the Preferred Transfer Capability and the Transfer Capability.

  NOTE — The concept of "demanding" depends on the connection admission control algorithm and connection resource allocation mechanisms in use which are outside the scope of this Recommendation.

If AAL type 2 node receives a notification the succeeding node did not recognize the Path Type parameter, the AAL type 2 node allows the connection to be established (QoS requirements are met by the network default stringent QoS class), or releases the connection with the cause "Resource unavailable, unspecified" (QoS requirements are not met by network default stringent QoS class).

After receiving an indication of the successful AAL type 2 connection setup from the outgoing protocol entity instance the following applies depending on the presence of the Modify Support for Link Characteristics parameter and the Preferred Transfer Capability parameter:

- If the Modify Support for Link Characteristics parameter is not present, connection admission control and connection resource allocation shall reflect the Transfer Capability (TC).
- If the Modify Support for Link Characteristics parameter is present, connection admission control and connection resource allocation shall reflect the Preferred Transfer Capability (PTC) if present, otherwise the Transfer Capability (TC) shall be reflected.

C.1.1.4. Actions at the destination AAL type 2 service endpoint

In addition to the specifications in § 8.2, the following applies:

Upon receiving notification from an incoming protocol entity instance requesting a new connection and the Transfer Capability parameter is not conveyed by the incoming protocol entity instance,

- the nodal function prepares a Transfer Capability parameter corresponding to the Link Characteristics parameter; and
- if a Preferred Link Characteristics parameter is also conveyed by the incoming protocol entity instance, the nodal function prepares a Preferred Transfer Capability parameter corresponding to the Preferred Link Characteristics parameter. The Preferred Transfer Capability parameter must refer to the same AAL type 2 transfer capability as the Transfer Capability parameter.

  NOTE — For example, if the Transfer Capability parameter indicates a Variable Bandwidth Stringent Transfer Capability, the Preferred Transfer Capability parameter, if present, may only indicate a Variable Bandwidth Stringent Transfer Capability.

NOTE — In Appendix II, guidelines to derive the Transfer Capability parameter from a Link Characteristics parameter are shown.

These parameters are treated as if they would have been conveyed by the incoming protocol entity instance.

If a Preferred Transfer Capability parameter is conveyed by the incoming protocol entity instance but not a Preferred Link Characteristics parameter, the Preferred Transfer Capability parameter is discarded; subsequent treatment of the parameters is as if the Preferred Transfer Capability parameter would not have been conveyed by the incoming protocol entity instance.

Depending on the presence of Preferred Transfer Capability parameter the following applies:

- If the Preferred Transfer Capability parameter is not present, AAL type 2 connection resources (internal and on the incoming AAL type 2 path) indicated by the Transfer Capability (TC) parameter are allocated as specified in § 8.2.

- If the Preferred Transfer Capability parameter is present, AAL type 2 connection resources (internal and on the incoming AAL type 2 path) indicated by the Preferred Transfer Capability (PTC) parameter are allocated.

If a Transfer Capability Support parameter was received from the incoming protocol instance, the parameter shall be passed to the incoming protocol entity instance when the nodal function acknowledges the successful AAL type 2 connection establishment.

If a Modify Support for Link Characteristics parameter was received from the incoming protocol instance, the parameter shall be passed to the incoming protocol entity instance when the nodal function acknowledges the successful AAL type 2 connection establishment.

C.1.2. Connection Resource Modification

C.1.2.1. Introduction

If, during connection establishment, a Transfer Capability Support parameter was received by an AAL type 2 service endpoint, connection resource modification as specified in § 8.2 applies.

If, during connection establishment, a Transfer Capability Support parameter was not received but a Modify Support for Link Characteristics parameter was received by an AAL type 2 service endpoint, connection resource modification follows the specifications in this subclause.

If, during connection establishment, neither a Transfer Capability Support parameter nor a Modify Support for Link Characteristics parameter was received by an AAL type 2 service endpoint, no connection resource modification is possible.

NOTE — From the point of view of this recommendation it is regarded to be within the responsibility of the AAL type 2 served user to ensure consistency between Transfer Capability and Link Characteristics parameters.

C.1.2.2. Actions at the AAL type 2 service endpoint originating the modification

In addition to the specifications in § 8.2, the following applies:

The AAL type 2 served user shall include a Link Characteristics parameter (corresponding to the Transfer Capability parameter) in the MODIFY.request primitive.

C.1.2.3. Actions at AAL type 2 nodes without served user interaction

Upon receiving notification from a protocol entity instance requesting a connection modification and the Transfer Capability parameter is not conveyed by the protocol entity instance, the nodal function prepares a Transfer Capability parameter corresponding to the Link Characteristics parameter. This parameter is treated as if it would have been conveyed by the protocol entity instance.

NOTE — In Appendix II, guidelines to derive the Transfer Capability parameter from a Link Characteristics parameter are shown.

C.1.2.4. Actions at the AAL type 2 service endpoint receiving the modification

Upon receiving notification from a protocol entity instance requesting a connection modification and the Transfer Capability parameter is not conveyed by the protocol entity instance, the nodal function prepares a Transfer Capability parameter corresponding to the Link Characteristics parameter. This parameter is treated as if it would have been conveyed by the protocol entity instance.

NOTE — In Appendix II, guidelines to derive the Transfer Capability parameter from a Link Characteristics parameter are shown.

C.2. Connection Resources indicated with Service Specific Information Parameters

C.2.1. Connection Establishment

C.2.1.1. Introduction

NOTE 1 — In order to ensure interworking the following three cases are considered:

a) If no connection resource modifications are required for the AAL type 2 connection, the originating AAL type 2 served user may include an SSCS Information parameter in the ESTABLISH.request primitive whose connection resource requirements corresponds to those of the Transfer Capability parameter.

b) If connection resource modifications may be required for the AAL type 2 connection and interworking with CS1 nodes is not required, the originating AAL type 2 served user may include an SSCS Information parameter and a Modify Support for SSCS Information parameter in the ESTABLISH.request primitive; the connection resource requirements of the SSCS Information parameter corresponds to those of the Transfer Capability parameter.

c) If connection resource modifications may be required for the AAL type 2 connection and interworking to CS1 nodes may be required, the originating AAL type 2 served user may additionally include the following parameters in the ESTABLISH.request primitive:

- the SSCS Information
- the Preferred Transfer Capability,
- the Preferred SSCS Informationand
- the Modify Support for SSCS Information.

Interworking with CS2 and CS1 nodes is designed such that:

- If the Modify Support for SSCS Information parameter is received by the destination AAL type 2 service endpoint, no CS1 node is part of the AAL type 2 connection; resource allocation for the AAL type 2 connection is based on the Preferred Transfer Capability (for CS3 nodes) and Preferred SSCS Information (for CS2 nodes) and the connection resources are modifiable.
- If the Modify Support for SSCS Information parameter is not received by the destination AAL type 2 service endpoint, a CS1 node is part of the AAL type 2 connection; resource allocation for the AAL type 2 connection is based on the Transfer Capability (for CS3 nodes) and SSCS Information (for CS1 and CS2 nodes) and the connection resources are not modifiable.
- In all cases, the originating AAL type 2 served user includes a Transfer Capability Support parameter in the ESTABLISH.request primitive as well. If this parameter is received by a destination CS3 service endpoint, it is sent back towards the originating AAL type 2 service endpoint. The complete AAL type 2 connection passes through CS3 nodes only and the originating and the destination AAL type 2 served users know that the full functionality of this Recommendation is available for this connection.

NOTE — From the point of view of this recommendation it is regarded to be within the responsibility of the AAL type 2 served user to ensure consistency between the resource requirements of the Transfer Capability and SSCS Information parameters..

C.2.1.2. Actions at the originating AAL type 2 service endpoint

In addition to the specifications in § 8.2, the following applies:

When the nodal function receives an ESTABLISH.request primitive from the AAL type 2 served user, the following restrictions on the optionality of the parameters of the primitive apply:

- The Transfer Capability Support parameter shall be present;
- The SSCS Information parameter shall be present;
- The Modify Support for SSCS Information parameter may be present;
- The Preferred SSCS Information parameter may only be present if the Modify Support for SSCS Information parameter is present;
- If a Preferred SSCS Information parameter is specified, it has to refer to the same SSCS Information type as the SSCS Information parameter.
  NOTE — For example, if the SSCS Information parameter indicates an Audio SSCS Information, the Preferred SSCS Information parameter, if present, may only indicate an Audio SSCS Information.
- If a Preferred SSCS Information parameter is specified, the SSCS Information "Audio Extended" and "Multirate Extended" shall not be used in the SSCS Information parameter.
- The Preferred Transfer Capability parameter shall be present if the Preferred SSCS Information parameter is present; and
- If a Preferred Transfer Capability parameter is specified, it has to refer to the same Transfer Capability as the Transfer Capability parameter.
  NOTE — For example, if the Transfer Capability parameter indicates a Variable Bandwidth Stringent Transfer Capability, the Preferred Transfer Capability parameter, if present, may only indicate a Variable Bandwidth Stringent Transfer Capability.

Depending on the presence of Preferred Transfer Capability parameter the following applies:

- If the Preferred Transfer Capability parameter is not present, connection admission control and connection resource allocation are performed as defined in § 8.2.

- If the Preferred Transfer Capability parameter is present, the connection admission control and connection resource allocation shall be based on the most demanding of the Preferred Transfer Capability and the Transfer Capability.

  NOTE — The concept of "demanding" depends on the Connection Admission Control algorithm and connection resource allocation mechanisms in use which are outside the scope of this Recommendation.

If the originating AAL type 2 service endpoint receives a notification that the succeeding node did not recognize the Path Type parameter, the connection establishment shall be allowed to continue (QoS requirements are met by the network default stringent QoS class), or the connection is released and a RELEASE.confirm primitive is returned to the AAL type 2 served user with the cause "Resource unavailable, unspecified" (QoS requirements are not met by network default stringent QoS class).

After receiving an indication of the successful AAL type 2 connection setup from the outgoing protocol entity instance the following applies depending on the presence of the Modify Support for SSCS Information parameter and the Preferred SSCS Information parameter:

- If the Modify Support for SSCS Information parameter is not present, connection admission control and connection resource allocation shall reflect the Transfer Capability (TC).

- If the Modify Support for SSCS Information parameter is present, connection admission control and connection resource allocation shall reflect the Preferred Transfer Capability (PTC) if present, otherwise the Transfer Capability (TC) shall be reflected.

C.2.1.3. Actions at AAL type 2 nodes without served user interaction

In addition to the specifications in § 8.2, the following applies:

Upon receiving notification from an incoming protocol entity instance requesting a new connection and the Transfer Capability parameter is not conveyed by the incoming protocol entity instance,

- the nodal function prepares a Transfer Capability parameter whose connection resource requirements correspond to those of the SSCS Information parameter; and

- if a Preferred SSCS Information parameter is also conveyed by the incoming protocol entity instance, the nodal function prepares a Preferred Transfer Capability parameter whose connection resource requirements correspond to those of the Preferred SSCS Information parameter. The Preferred Transfer Capability parameter must refer to the same AAL type 2 transfer capability as the Transfer Capability parameter.

  NOTE — For example, if the Transfer Capability parameter indicates a Variable Bandwidth Stringent Transfer Capability, the Preferred Transfer Capability parameter, if present, may only indicate a Variable Bandwidth Stringent Transfer Capability.

These parameters are treated as if they would have been conveyed by the incoming protocol entity instance.

If a Preferred Transfer Capability parameter is conveyed by the incoming protocol entity instance but not a Preferred SSCS Information parameter, the Preferred Transfer Capability parameter is discarded; the treatment of the parameters are as if the Preferred Transfer Capability parameter would not have been conveyed by the incoming protocol entity instance.

Depending on the presence of Preferred Transfer Capability parameter the following applies:

- If the Preferred Transfer Capability parameter is not present, connection admission control and connection resource allocation are performed as defined in § 8.2.
- If the Preferred Transfer Capability parameter is present, the connection admission control and connection resource allocation shall be based on the most demanding of the Preferred Transfer Capability and the Transfer Capability.

  NOTE — The concept of “demanding” depends on the Connection Admission Control algorithm and connection resource allocation mechanisms in use which are outside the scope of this Recommendation.

If AAL type 2 node receives a notification the succeeding node did not recognize the Path Type parameter, the AAL type 2 node allows the connection to be established (QoS requirements are met by the network default stringent QoS class), or releases the connection with the cause “Resource unavailable, unspecified” (QoS requirements are not met by network default stringent QoS class).

After receiving an indication of the successful AAL type 2 connection setup from the outgoing protocol entity instance the following applies depending on the presence of the Modify Support for SSCS Information parameter and the Preferred SSCS Information parameter:

- If the Modify Support for SSCS Information parameter is not present, connection admission control and connection resource allocation shall reflect the Transfer Capability (TC).
- If the Modify Support for SSCS Information parameter is present, connection admission control and connection resource allocation shall reflect the Preferred Transfer Capability (PTC) if present, otherwise the Transfer Capability (TC) shall be reflected.

C.2.1.4. Actions at the destination AAL type 2 service endpoint

In addition to the specifications in § 8.2, the following applies:

Upon receiving notification from an incoming protocol entity instance requesting a new connection and the Transfer Capability parameter is not conveyed by the incoming protocol entity instance,

- the nodal function prepares a Transfer Capability parameter whose connection resource requirements correspond to those of the SSCS Information parameter; and
- if a Preferred Link Characteristics parameter is also conveyed by the incoming protocol entity instance, the nodal function prepares a Preferred Transfer Capability parameter whose connection resource requirements correspond to those of the Preferred SSCS Information parameter. The Preferred Transfer Capability parameter must refer to the same AAL type 2 transfer capability as the Transfer Capability parameter.

  NOTE — For example, if the Transfer Capability parameter indicates a Variable Bandwidth Stringent Transfer Capability, the Preferred Transfer Capability parameter, if present, may only indicate a Variable Bandwidth Stringent Transfer Capability.

These parameters are treated as if they would have been conveyed by the incoming protocol entity instance.

If a Preferred Transfer Capability parameter is conveyed by the incoming protocol entity instance but not a Preferred SSCS Information parameter, the Preferred Transfer Capability parameter is discarded; subsequent treatment of the

parameters are as if the Preferred Transfer Capability parameter would not have been conveyed by the incoming protocol entity instance.

Depending on the presence of Preferred Transfer Capability parameter the following applies:

- If the Preferred Transfer Capability parameter is not present, AAL type 2 connection resources (internal and on the incoming AAL type 2 path) indicated by the Transfer Capability (TC) parameter are allocated as specified in § 8.2.
- If the Preferred Transfer Capability parameter is present, AAL type 2 connection resources (internal and on the incoming AAL type 2 path) indicated by the Preferred Transfer Capability (PTC) parameter are allocated.

If a Transfer Capability Support parameter was received from the incoming protocol instance, the parameter shall be passed to the incoming protocol entity instance when the nodal function acknowledges the successful AAL type 2 connection establishment.

If a Modify Support for SSCS Information parameter was received from the incoming protocol instance, the parameter shall be passed to the incoming protocol entity instance when the nodal function acknowledges the successful AAL type 2 connection establishment.

C.2.2. Connection Resource Modification

C.2.2.1. Introduction

If, during connection establishment, a Transfer Capability Support parameter was received by the destination AAL type 2 service endpoint and sent back to the originating AAL type 2 service endpoint, connection resource modification as specified in § 8.2 applies.

If, during connection establishment, a Transfer Capability Support parameter was not received but a Modify Support for SSCS Information parameter was received by an AAL type 2 service endpoint, connection resource modification follows the specifications in this subclause.

If, during connection establishment, neither a Transfer Capability Support parameter nor a Modify Support for SSCS Information parameter was received by an AAL type 2 service endpoint, no connection resource modification is possible.

NOTE — From the point of view of this recommendation it is regarded to be within the responsibility of the AAL type 2 served user to ensure consistency between and SSCS Information parameters.

C.2.2.2. Actions at the AAL type 2 service endpoint originating the modification

In addition to the specifications in § 8.2, the following applies:

The AAL type 2 served user shall include a SSCS Information parameter (whose connection resource requirements correspond to those of the Transfer Capability parameter) in the MODIFY.request primitive.

C.2.2.3. Actions at AAL type 2 nodes without served user interaction

Upon receiving notification from a protocol entity instance requesting a connection modification and the Transfer Capability parameter is not conveyed by the protocol entity instance, the nodal function prepares a Transfer Capability parameter corresponding to the SSCS Information parameter. This parameter is treated as if it would have been conveyed by the protocol entity instance.

C.2.2.4. Actions at the AAL type 2 service endpoint receiving the modification

Upon receiving notification from a protocol entity instance requesting a connection modification and the Transfer Capability parameter is not conveyed by the protocol entity instance, the nodal function prepares a Transfer Capability parameter corresponding to the SSCS Information parameter. This parameter is treated as if it would have been conveyed by the protocol entity instance.

C.3. Service Specific Information indicated with SSCS Information Parameters

This clause only applies to the signalling for the service specific convergence sublayer.

NOTE — From the point of view of this recommendation it is regarded to be within the responsibility of the AAL type 2 served user to ensure consistency between the resource requirements of the Transfer Capability and SSCS Information parameters.

C.3.1. Connection Establishment

C.3.1.1. Introduction

NOTE — In order to ensure interworking the following three cases are considered:

a) If no Service Specific Information modifications are required for the AAL type 2 connection, the originating AAL type 2 served user may include an SSCS Information parameter in the ESTABLISH.request primitive.

b) If Service Specific Information modifications are required for the AAL type 2 connection and interworking to CS1 nodes is not required, the originating AAL type 2 served user may include an SSCS Information parameter and a Modify Support for SSI parameter in the ESTABLISH.request primitive.

c) If Service Specific Information modifications are required for the AAL type 2 connection and interworking to CS1 nodes may be required, the originating AAL type 2 served user may additionally include the following parameters in the ESTABLISH.request primitive:
- the SSCS Information parameter,
- the Preferred SSCS Information parameter, and
- the Modify Support for SSCS Information.

Interworking with CS2 and CS1 nodes is designed such that:
- If the Modify Support for SSCS Information parameter is received by the destination AAL type 2 service endpoint and this endpoint is a CS2 node, the Service Specific Information for the AAL type 2 connection is based on the Preferred SSCS Information (if present) and the Service Specific Information is modifiable.
- Otherwise, the Service Specific Information for the AAL type 2 connection is based on the SSCS Information and the Service Specific Information is not modifiable.
  NOTE — If the destination AAL type 2 service endpoint is a CS1 node, the Service Specific Information (Audio Extended) and Service Specific Information (Multirate Extended) are unknown to the AAL type 2 service endpoint.
- In all cases, the originating AAL type 2 served user includes a Transfer Capability Support parameter in the ESTABLISH.request primitive as well. If this parameter is received by a destination CS3 service endpoint, it is sent back towards the originating AAL type 2 service endpoint. The complete AAL type 2 connection passes through CS3 nodes only and the originating and the destination AAL type 2 served users know that the full functionality of this Recommendation is available.

C.3.1.2. Actions at the originating AAL type 2 service endpoint

In addition to the specifications in § 8.2, the following applies:

When the nodal function receives an ESTABLISH.request primitive from the AAL type 2 served user, the following restrictions on the optionality of the parameters of the primitive apply:
- The Transfer Capability Support parameter shall be present;
- The SSCS Information parameter shall be present;
- The Modify Support for SSCS Information parameter may be present;
- The Preferred SSCS Information parameter shall only be present if the Modify Support for SSCS Information parameter is present;
- If a Preferred SSCS Information parameter is specified, it has to refer to the same SSCS Information type as the SSCS Information parameter.
- NOTE — For example, if the SSCS Information parameter indicates an Audio SSCS Information, the Preferred SSCS Information parameter, if present, may only indicate an Audio SSCS Information.

After receiving an indication of the successful AAL type 2 connection setup from the outgoing protocol entity instance the following applies depending on the presence of the Modify Support for SSCS Information parameter and the Preferred SSCS Information parameter:

- If the Modify Support for SSCS Information parameter is not present, the Service Specific Information used for the connection is based on the SSCS Information parameter (SSCS) in the ESTABLISH.request primitive.
- If the Modify Support for SSCS Information parameter is present, the Service Specific Information used for the connection is based on the Preferred SSCS Information parameter (PSSCS) in the ESTABLISH.request primitive if present, otherwise the SSCS Information parameter (SSCS) shall be reflected.

C.3.1.3. Actions at AAL type 2 nodes without served user interaction

NOTE — No changes to the procedures in § 8.2 are required.

C.3.1.4. Actions at the destination AAL type 2 service endpoint

In addition to the specifications in § 8.2, the following applies:

The Service Specific Information used for the connection depends on the presence of the Preferred SSCS Information parameter and the Preferred SSCS Information parameter in the indication from the incoming protocol entity instance as follows:

- If the Preferred SSCS Information parameter is not present, the Service Specific Information used for the connection is based on the SSCS Information parameter indicated by the incoming protocol entity.
- If the Preferred SSCS Information parameter is present, the Service Specific Information used for the connection is based on the Preferred SSCS Information parameter indicated by the incoming protocol entity if present, otherwise the SSCS Information parameter (SSCS) shall be reflected.

If a Modify Support for SSCS Information parameter was received from the incoming protocol instance, the parameter shall be passed to the incoming protocol entity instance when the nodal function acknowledges the successful AAL type 2 connection establishment.

C.3.2. Service Specific Information Modification

If, during connection establishment, a Transfer Capability Support parameter was received by the destination AAL type 2 service endpoint and sent back to the originating AAL type 2 service endpoint, Service Specific Information modification as specified in § 8.2 applies.

If, during connection establishment, a Transfer Capability Support parameter was not received but a Modify Support for SSCS Information parameter was received by an AAL type 2 service endpoint, Service Specific Information modification also follows the specifications in § 8.2.

If, during connection establishment, neither a Transfer Capability Support parameter nor a Modify Support for SSCS Information parameter was received by an AAL type 2 service endpoint, no Service Specific Information modification is possible.

NOTE — From the point of view of this recommendation it is regarded to be within the responsibility of the AAL type 2 served user to ensure consistency between Transfer Capability and SSCS Information parameters.

Annex D
SDL Definition of the AAL type 2 Signalling Protocol

(This Annex forms an integral part of this Recommendation.)

The SDL definitions may contain more detail than the prose definition in clause 8 of the main body of this Recommendation. Nevertheless, should there exist any technical difference between this Annex and clause 8, then the definitions in clause 8 take precedence.

Editor's Note: This Annex will be incorporated into the document at a later time.

APPENDIX I
Example message sequences

(This Appendix does not form an integral part of this Recommendation)

I.1 Successful establishment and release

Figure I-1 illustrates the message sequences for a successful AAL type 2 connection establishment and its release.

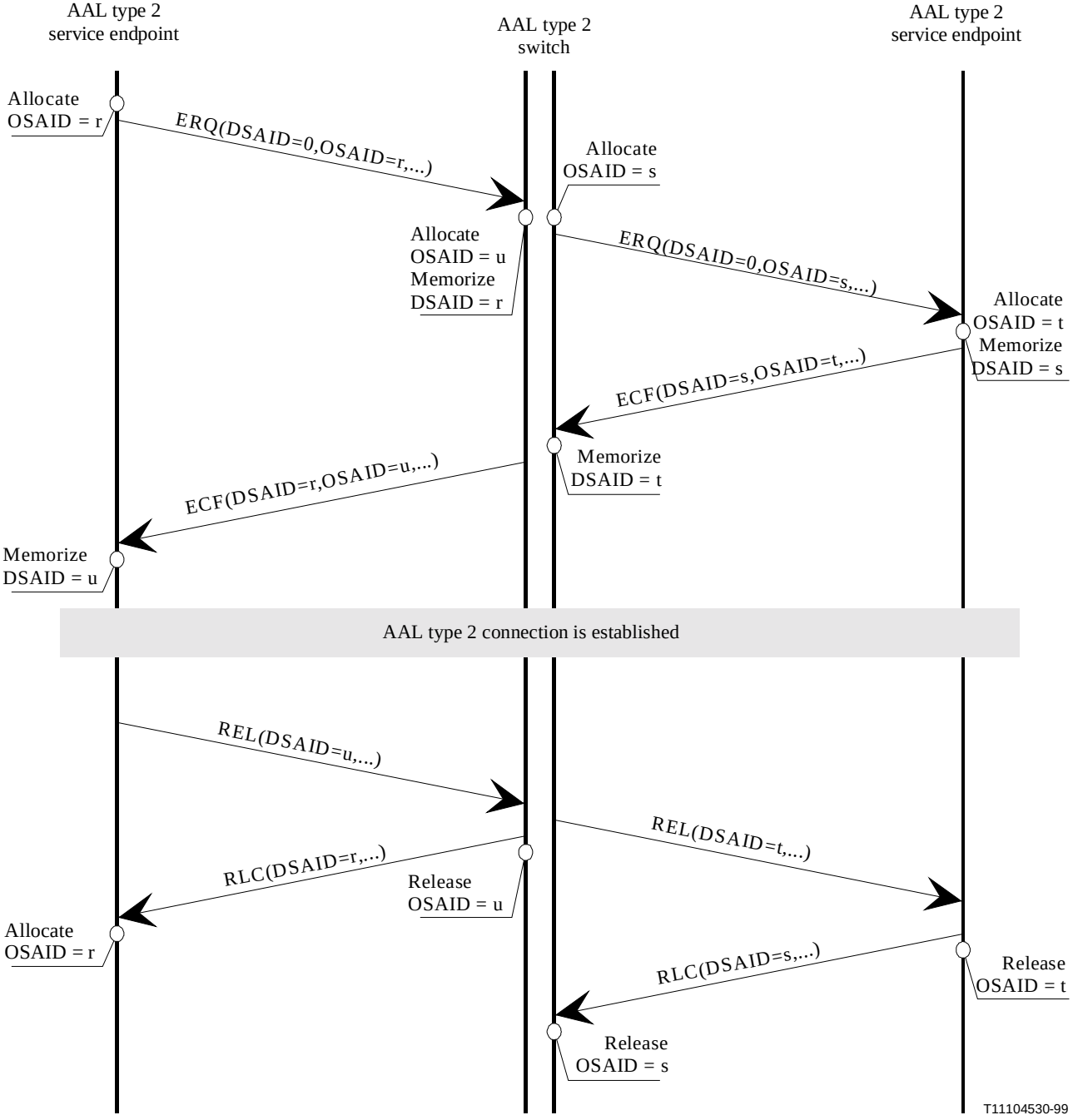


FIGURE I-1/Q.2630.3

Example of successful AAL type 2 connection establishment and release message sequences

Signalling Association Identifiers (SAID) are treated in the following way:

1) Whenever a new link associated signalling relationship is created, a new protocol entity instance is created and an OSAID is allocated to it; this ID is then transported in the first message in the OSAID parameter. The

DSAID in this message contains the value “unknown”, i.e. all octets are set to “0”. (In the Figures, this is indicated by “DSAID=0”.)

2) Upon receipt of a message that has a DSAID field set to “unknown”, a new protocol entity instance is created and an OSAID is allocated to it.

3) In the first message returned to the originator of the association, the OSAID of the sending protocol entity instance is transported in the OSAID parameter. The DSAID field carries the previously received OSAID of the originator of the association.

4) In all subsequent messages, the DSAID field carries the previously received OSAID of the destination entity.

5) If the first message returned to the originator of the association is also the last one for this link associated signalling relationship (see Figure I.2/Q.2630.3 or I.3/Q.2630.3), no OSAID parameter is carried in the message. The DSAID field carries the previously received OSAID of the originator of the association.

I.2 Unsuccessful establishment

Figure I.2 illustrates the message sequences for an unsuccessful AAL type 2 connection establishment.

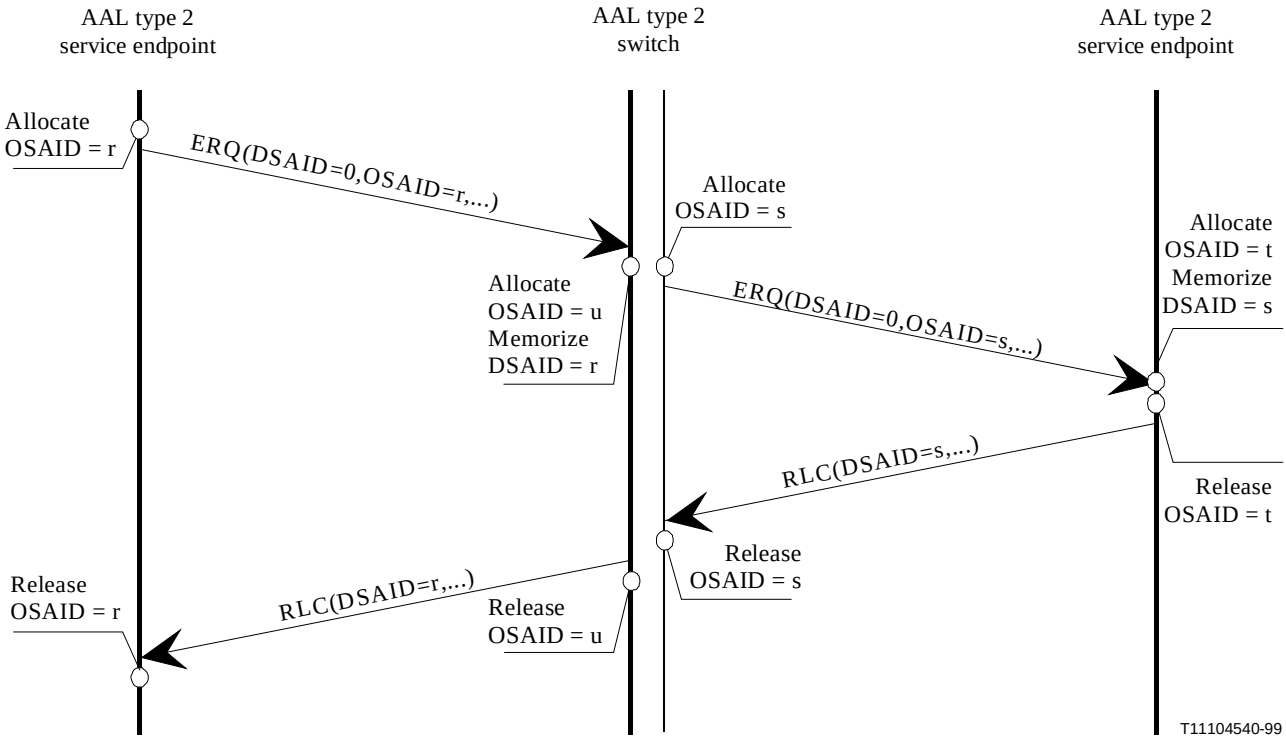


FIGURE I-2/Q.2630.3
Example of a message sequence for an unsuccessful AAL type 2 connection establishment

I.3 Management message sequences

Figure I-3 illustrates the message sequences for a management operation. Management operations include:

- reset procedures;
- blocking procedures;
- unblocking procedures.

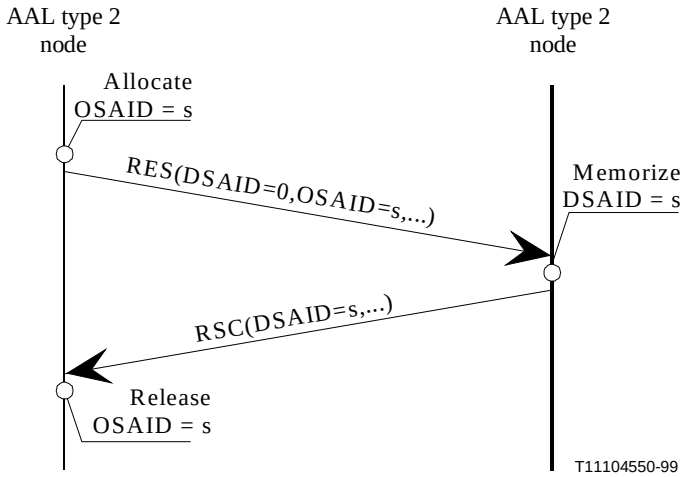


FIGURE I-3/Q.2630.3

Example of a message sequence for a management operation

NOTE — Message sequences for blocking or unblocking are the same as for reset except that instead of “RES” and “RSC”:

- for blocking, the messages “BLO” and “BLC” are used respectively; and
- for unblocking, the messages “UBL” and “UBC” are used respectively.

I.4 Release crossover/release collision

Figure I-4 illustrates the message sequences for release collision on an AAL type 2 connection release.

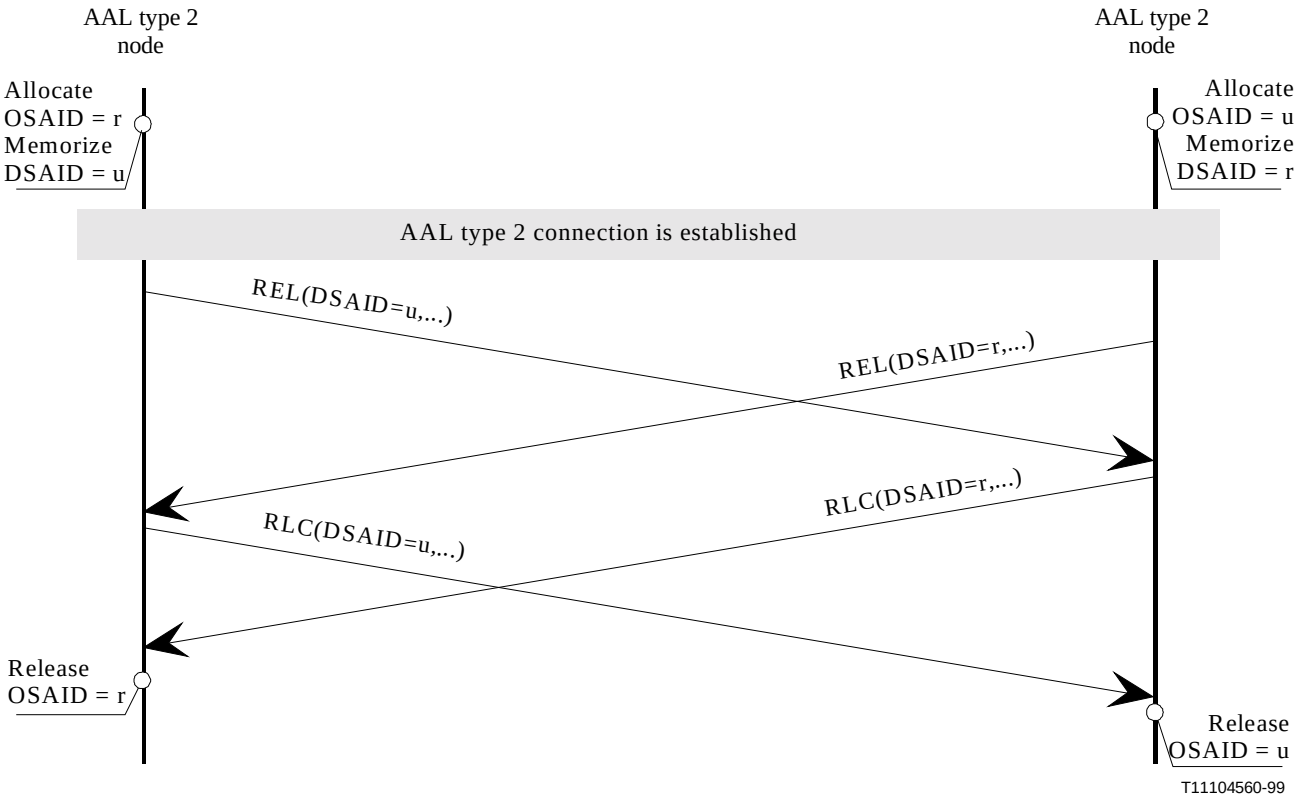


FIGURE I-4/Q.2630.3
Example of a message sequence for a release collision on an AAL type 2 connection

I.5 Resource contention

Figure I-5 illustrates the message sequences for a resource contention on an AAL type 2 connection establishment.

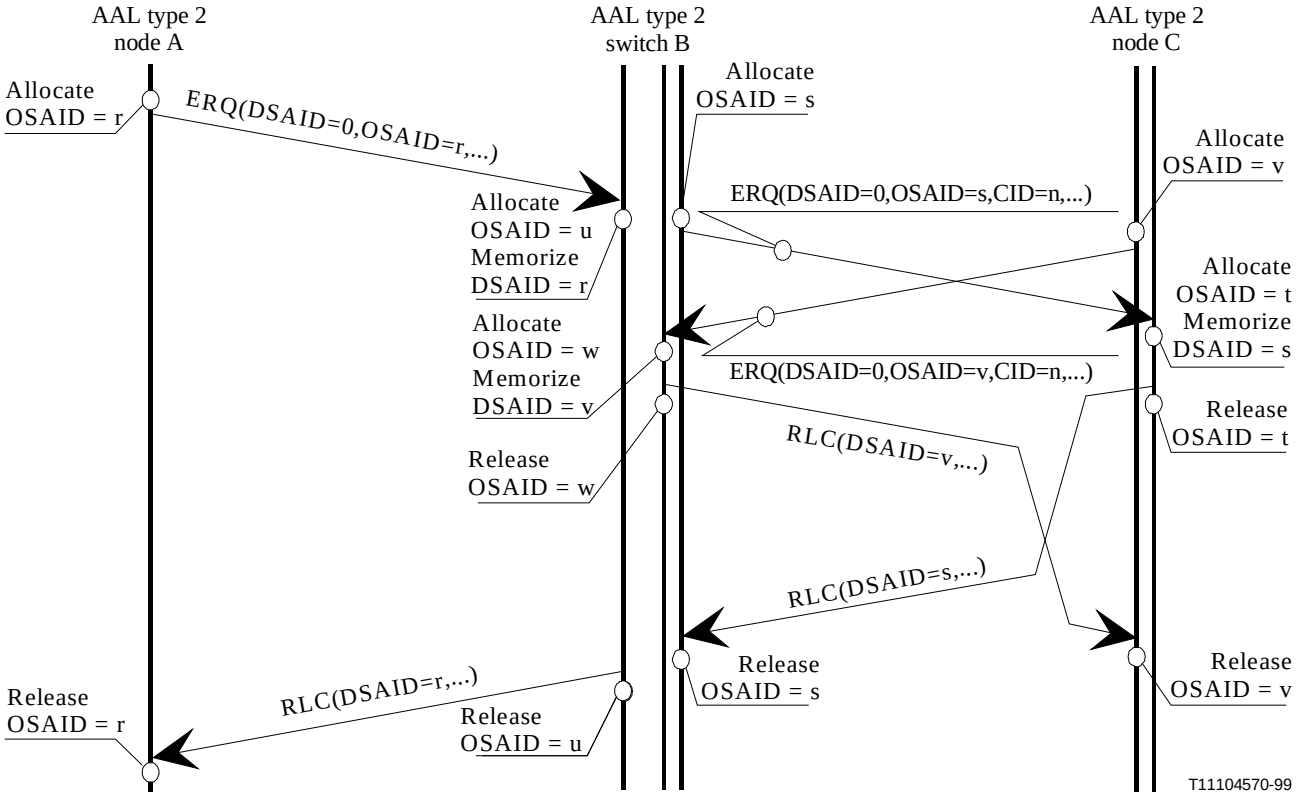


FIGURE I-5/Q.2630.3

Example of a message sequence for a resource contention on two AAL type 2 connections

NOTE — The resource contention is shown for a CID value “n” that is attempting to be assigned to two new AAL type 2 connections.

I.6. Successful modification

Figure I-6/Q.2630.3 illustrates the message sequences for a successful resource modification of an established AAL type 2 connection.

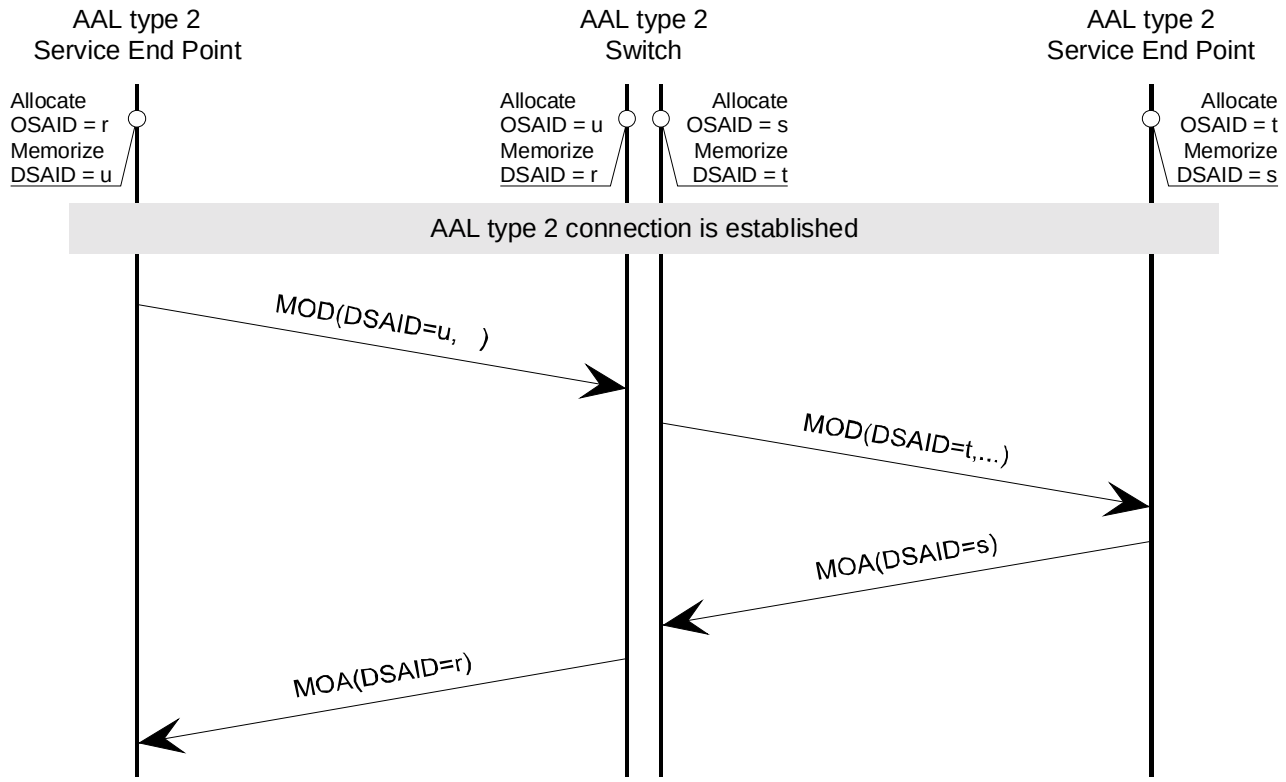


Figure I-5/Q.2630.3

Example of a message sequence for a successful resource modification of an established AAL type 2 connection

I.7. Unsuccessful modification

Figure I-7/Q.2630.3 illustrates the message sequences for an unsuccessful resource modification of an established AAL type 2 connection.

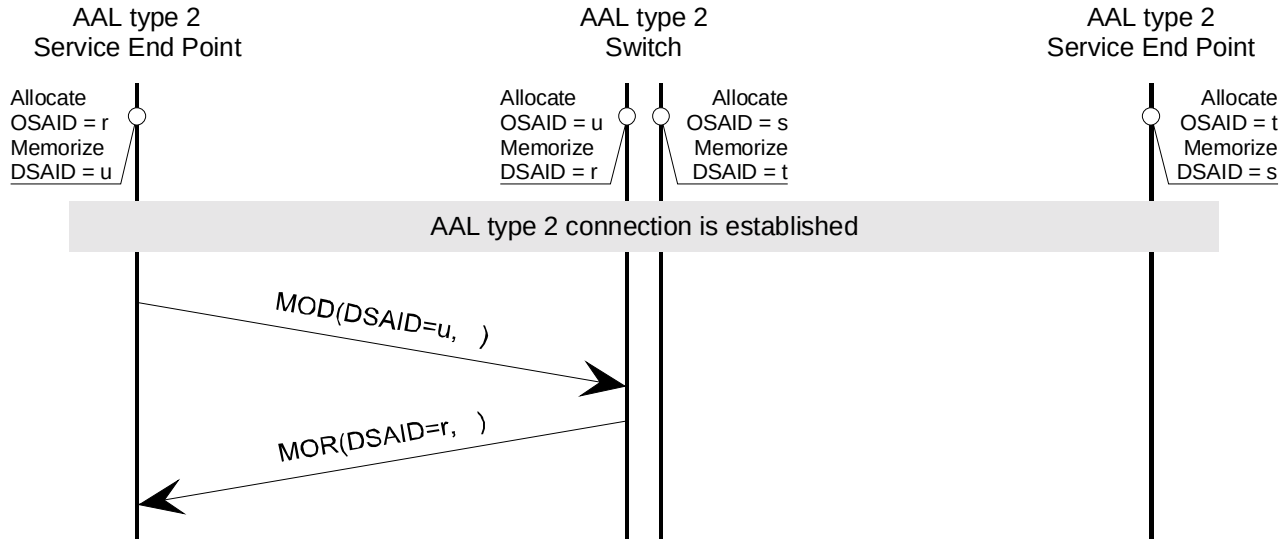


Figure I-6/Q.2630.3

Example of a message sequence for an unsuccessful resource modification of an established AAL type 2 connection

I.8. Modification Collision

Figure I-8/Q.2630.3 illustrates the message sequences for a resource modification collision of an established AAL type 2 connection.

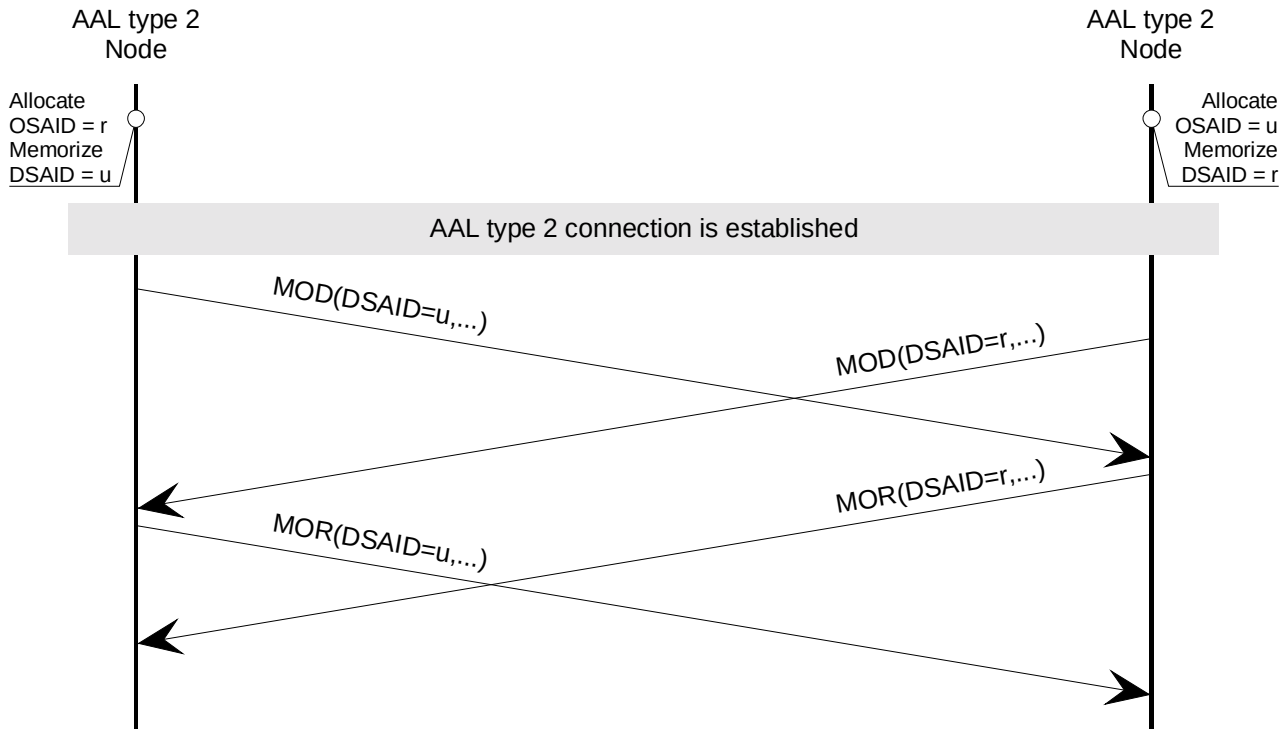


Figure I-7/Q.2630.3

Example of a message sequence for a resource modification collision of an established AAL type 2 connection

APPENDIX II
Conversion of CS1 or CS2 (Preferred) Link Characteristics to (Preferred) Transfer Capability parameters

(This Appendix does not form an integral part of this Recommendation)

The purpose of this Appendix is to give guidance to implementers how to capture the problem of interworking of CS1 and CS2 Link Characteristics parameters into CS3 Transfer Capability parameters.

NOTE – In this Appendix the terms "Transfer Capability" and "Preferred Transfer Capability" and the abbreviations "TC" and "PTC" do not distinguish between the different types of Transfer Capabilities, i.e. Fixed Bandwidth, Variable Bandwidth Stringent, Variable Bandwidth Tolerant.

II.1 Guidelines and Definitions

Appendix II provides rules for conversions from LC-type to TC-type parameters. In some cases explicit expressions are defined that allow computing the outgoing parameter values based on incoming parameter values. These expressions should be understood as formal in the sense that

they do not request by themselves the existence of certain parameters neither incoming nor outgoing,

they do not overrule constraints of any type that are defined within this protocol specification.

For the purpose of this section the following shorthand notation shall be used (Tables II-1/Q.2630.3 to II-4/Q.2630.3)

Table II-1/Q.2630.3
LC parameter fields

A = maximum CPS-SDU bit rate in the forward direction
B = average CPS-SDU bit rate in the forward direction
C = maximum CPS-SDU bit rate in the backward direction
D = average CPS-SDU bit rate in the backward direction
E = maximum CPS-SDU size in the forward direction
F = average CPS-SDU size in the forward direction
G = maximum CPS-SDU size in the backward direction
H = average CPS-SDU size in the backward direction

Table II-2/Q.2630.3
TC parameter fields

U = peak CPS bit rate in the forward direction
V = sustainable CPS bit rate in the forward direction
W = peak CPS bit rate in the backward direction
X = sustainable CPS bit rate in the backward direction
Y = maximum allowed CPS packet size in the forward direction
Z = maximum allowed CPS packet size in the backward direction
STT = source traffic type

Table II-3/Q.2630.3
PLC parameter fields

a = maximum CPS-SDU bit rate in the forward direction
b = average CPS-SDU bit rate in the forward direction
c = maximum CPS-SDU bit rate in the backward direction
d = average CPS-SDU bit rate in the backward direction
e = maximum CPS-SDU size in the forward direction
f = average CPS-SDU size in the forward direction
g = maximum CPS-SDU size in the backward direction
h = average CPS-SDU size in the backward direction

Table II-4/Q.2630.3
PTC parameter fields

u = peak CPS bit rate in the forward direction
v = sustainable CPS bit rate in the forward direction
w = peak CPS bit rate in the backward direction
x = sustainable CPS bit rate in the backward direction
y = maximum allowed CPS packet size in the forward direction
z = maximum allowed CPS packet size in the backward direction
stt = source traffic type

CPHL shall denote the length of the CPS packet header (see ITU-T recommendation I.363.2[1]) in octet.

For any real number x, [x] is defined as the smallest integer greater or equal to x.

MAX (x1, ..., xn) determines the maximum, MIN (x1, ..., xn) the minimum of the values x1, ..., xn.

Bit rates are measured in bit per second (“bit/s”), sizes, e.g. of data structures, in octet.

II.2 Bit Rates

The conversion from LC-type to TC-type bit rates requires to estimate the rate that will be caused by the CPS packet header overhead of length CPHL. This estimate is given in Table II-5/Q.2630.3. The values are "normalized" to multiples of 64 bit/s.

Table II-5/Q.2630.3
CPS packet header overhead rates

Definition	**Meaning**
HBA := [(CPHL*A) / (64*F)] * 64	Estimate of the CPHL bit rate for the Peak CPS bit rate in the forward direction for given LC
HBa := [(CPHL*a) / (64*f)] * 64	Estimate of the CPHL bit rate for the Peak CPS bit rate in the forward direction for given PLC
HBB := [(CPHL*B) / (64*F)] * 64	Estimate of the CPHL bit rate for the Sustainable CPS bit rate in the forward direction for given LC
HBb := [(CPHL*b) / (64*f)] * 64	Estimate of the CPHL bit rate for the Sustainable CPS bit rate in the forward direction for given PLC
HBC := [(CPHL*C) / (64*H)] * 64	Estimate of the CPHL bit rate for the Peak CPS bit rate in the backward direction for given LC
HBc := [(CPHL*c) / (64*h)] * 64	Estimate of the CPHL bit rate for the Peak CPS bit rate in the backward direction for given PLC
HBD := [(CPHL*D) /(64*H)] * 64	Estimate of the CPHL bit rate for the Sustainable CPS bit rate in the backward direction for given LC
HBd := [(CPHL*d) / (64*h)] * 64	Estimate of the CPHL bit rate for the Sustainable CPS bit rate in the backward direction for given PLC
NOTE 1– If a denominator turns out to be zero in any of the expressions above, the result of the expression shall be set equal to zero. NOTE 2 – If a factor does not exist in any of the expressions above the result of the expression shall be set equal to zero. NOTE 3 – The definitions in this table are formal. Whether or not a certain expression is required, is determined by the protocol specification.	

Table II-6/Q.2630.3 defines the interworking of LC bit rates (AAL type 2) to TC CPS bit rates

Table II-6/Q.2630.3
TC CPS bit rates determined from LC

TC parameter field	**Value**
U	A + HBA
V	B + HBB
W	C + HBC
X	D + HBD
NOTE 1 – Whether or not a certain field is required is determined by the protocol specification. NOTE 2 – Whether or not a certain value is meaningful and valid is determined by the protocol specification.	

Table II-7/Q.2630.3 defines the interworking of PLC bit rates (AAL type 2) to PTC CPS bit rates

Table II-7/Q.2630.3
PTC bit rates determined from PLC

PTC parameter field	Value
u	a + HBa
v	b + HBb
w	c + HBc
x	d + HBd
NOTE 1 – Whether or not a certain field is required is determined by the protocol specification. NOTE 2 – Whether or not a certain value is meaningful and valid is determined by the protocol specification.	

II.3 Maximum allowed packet sizes

Table II-8/Q.2630.3 defines the derivation of TC and PTC maximum allowed packet sizes from LC and PLC CPS-SDU sizes.

Table II-8/Q.2630.3
Determination of maximum allowed packet sizes

TC/PTC SDU size subfields	Value
Y	CPHL + E
Z	CPHL + G
y	CPHL + e
z	CPHL + g
NOTE 1 – Whether or not a certain field is required is determined by the protocol specification. NOTE 2 – Whether or not a certain value is meaningful and valid is determined by the protocol specification.	

II.4 Token bucket sizes

The CS3 node receiving LC without TC in an initial ERQ shall set the token bucket sizes to the allowed maximum values. The allowed maximum value is the minimum out of the maximum defined by the protocol and the maximum defined within the network.

NOTE – If modification is possible, an appropriate adjustment of the token bucket sizes controlled by the Served User may be initiated from a CS3 service endpoint with a subsequent MOD message.

Token bucket sizes shall not be affected by received MOD messages with LC but without TC parameter.

II.5 Determination of the TC class

I.378[19] defines three AAL Type 2 transfer capability classes: Fixed Bandwidth, Variable Bandwidth Stringent, and Variable Bandwidth Tolerant Transfer Capability.

A CS3 node receiving LC without TC in an initial ERQ has to determine the AAL Type 2 Transfer Capability class to be used by CS3 nodes.

If all subsequent conditions

A = B
C = D
E = F
G = H
MSLC not set

are satisfied, the Fixed Bandwidth Transfer Capability shall be selected. If at least one of the conditions C1), ..., C5) is not fulfilled the Variable Bandwidth Stringent or Variable Bandwidth Tolerant Transfer Capability shall be applied. If

not otherwise indicated by administrative settings in the CS3 node (possibly in dependence from a received Path Type parameter), Variable Bandwidth Stringent Transfer Capability shall be selected.

II.6 Source Traffic Type

A CS3 node, which receives LC (and possibly PLC) without TC (and PTC) in an initial ERQ and which selects the Variable Bandwidth Stringent Transfer Capability, shall set the Source Traffic Type parameters in TC (and possibly PTC) as follows:

STT = STT unknown
stt = STT unknown

NOTE 1 – If the received signalling information or network configuration knowledge indicate that other valid source traffic type values are more suitable, then the STT and stt parameters may be set to values other than “unknown”.

NOTE 2 – If modification is possible, an appropriate adjustment of the source traffic type controlled by the Served User may be initiated from a CS3 service endpoint with a subsequent MOD message.

Source traffic types shall not be affected by received MOD messages with LC but without TC parameter.

APPENDIX III
Interworking Examples

(This Appendix does not form an integral part of this Recommendation)

This Appendix illustrates the mechanism for connection resource allocation in a network where the CS1 and CS2 nodes allocate connection resources based on link characteristics. The mechanisms where CS1 and CS2 nodes allocate connection resources based on SSCS information are similar.

This Appendix assumes the behavior of CS3 nodes according to Annex C.

III.1. Symbols and Abbreviations

The diagrams are showing the exchange of ERQ / ECF messages (originating at left) and the exchange of MOD / MOA messages (also originating at left). Only parameters relevant to connection resource reservation and allocation are shown.

a) The 1st column shows the name of the relevant parameters. On the Establish Confirm (ECF) message, the term Alloc'n is not a parameter of the message but an indication which parameter is used to make the actual resource allocation.

   On the Modify Request (MOD) message, LC_{old} indicates the actually allocated resources in CS2 and CS1 nodes, LC_{new} the new LC that the modification attempts to allocate. Similarly, TC_{old} indicates the actually allocated resources in CS3 nodes, TC_{new} the new TC that the modification attempts to allocate.

b) The 2nd column shows the name of the message.

c) The 3rd column indicates the parameters of the primitive from (⇘) or to (⇖) the originating served user.

d) The 4th to the 13th columns show the AAL type 2 nodes where in the top cell the capability set of the node is indicated. The indications in the other cells are explained below.

e) The 14th column indicates the parameters of the primitive to (⇗) or from (⇙) the destination served user.

In columns 4 to 13, the indications in a row of a parameter or an actually allocated resource have the following meaning:

" ": Parameter not present or actual resource allocation not done with this parameter.

——": Parameter passed because it is not relevant or due to the compatibility instructions.

"==": Parameter passed according to specifications in ITU-T Recommendations Q.2630.1[15] or Q.2630.2[16].

"≡≡": Parameter passed according to instructions in § 8.2.

"✓": Parameter processed.

"A": This parameter is used to perform the allocation of resources.

"R": These parameters are used to reserve resources according to the „most demanding" requirements.

"★": Parameter inserted by the AAL type 2 node.

"×": Parameter discarded by the AAL type 2 node due to compatibility instructions.

"⊠": Parameter discarded by the AAL type 2 node due interworking specifications instructions (see Annex C).

III.2. Connection Establishment

III.2.1. All CS3 nodes

This subclause illustrates AAL type 2 connection establishment where the originating and the destination AAL type 2 service endpoints as well as all AAL type 2 switches reside in a part of the network consisting of CS3.

The parameters transported in the Establish Request (ERQ) and Establish Confirm (ECF) messages and the effects on the connection resource allocation mechanisms are illustrated in Figure III.1/Q.2630.3.

			CS3a	CS3b	CS3c	CS3d	CS3e	CS3f	CS3g	CS3h	CS3i	
LC	ERQ	⇩	≡	≡	≡	≡	≡	≡	≡	≡	≡	⇩
PLC		⇩	≡	≡	≡	≡	≡	≡	≡	≡	≡	⇩
TC		⇩	R	R	R	R	R	R	R	R		⇩
PTC		⇩	R	R	R	R	R	R	R	R	A	⇩
MSLC		⇩	≡	≡	≡	≡	≡	≡	≡	≡	≡	⇩
TCS		⇩	≡	≡	≡	≡	≡	≡	≡	≡	≡	⇩
LC	ECF											
PLC												
TC												
PTC			A	A	A	A	A	A	A	A		
MSLC		⇧	≡	≡	≡	≡	≡	≡	≡	≡	≡	
TCS		⇧	≡	≡	≡	≡	≡	≡	≡	≡	≡	

Figure III.1/Q.2630.3
All CS3 nodes in the AAL type 2 connection

In the ESTABLISH.request primitive, the nodal function receives from the AAL type 2 served user the following parameters relevant to interworking and connection resource allocation:

- the Transfer Capability,
- the Preferred Transfer Capability,
- the Transfer Capability Support,
- the Link Characteristics,
- the Preferred Link Characteristics, and
- the Modify Support for Link Characteristics.

Nodes CS3a, CS3b, CS3c, CS3d, CS3e, CS3f, CS3g, and CS3h reserve connection resources reflecting the more “demanding” of the parameters Transfer Capability (TC) and Preferred Transfer Capability (PTC).

Node CS3i allocates connection resources reflecting the Preferred Transfer Capability (PTC) parameter; this decision is based on the presence of the Preferred Transfer Capability (PTC) parameter. The parameters Transfer Capability (TC), Preferred Transfer Capability (PTC), Link Characteristics (LC), Preferred Link Characteristics (PLC), Modify Support for Link Characteristics (MSLC), and Transfer Capability Support (TCS) are passed to the AAL type 2 served user, which interprets the last parameter to indicate that the AAL type 2 connection passes only through CS3 nodes and that, therefore, the full functionality of this Recommendation is available.

The parameters Modify Support for Link Characteristics (MSLC) and Transfer Capability Support (TCS) are inserted into the Establish Confirm (ECF) message.

Nodes CS3h, CS3g, CS3f, CS3e, CS3d, CS3c, CS3b, and CS3a allocate connection resources reflecting the Preferred Transfer Capability (PTC) parameter that was passed previously in the Establish Request (ERQ) message or received from the AAL type 2 served user; this decision is based on the presence of the Modify Support for Link Characteristics (MSLC) parameter in the Establish Confirm (ECF) message.

Node CS3a includes the Modify Support for Link Characteristics (MSLC) and Transfer Capability Support (TCS) parameters in the ESTABLISH.confirm primitive to the AAL type 2 served user, which interprets the latter parameter to indicate that the AAL type 2 connection passes only through CS3 nodes and that, therefore, the full functionality of this Recommendation is available.

III.2.2. From CS3 via CS2/CS1 nodes to CS3

This subclause illustrates AAL type 2 connection establishment where the originating and the destination AAL type 2 service endpoints reside in a part of the network consisting of CS3 nodes and where the AAL type 2 connection passes through a part of the network consisting of CS2 and/or CS1 nodes.

III.2.2.1. No CS1 nodes in the AAL type 2 connection

The parameters transported in the Establish Request (ERQ) and Establish Confirm (ECF) messages and the effects on the connection resource allocation mechanisms are illustrated in Figure III.2/Q.2630.3.

			CS3a	CS3b	CS2c	CS2d	CS2e	CS2f	CS2g	CS3h	CS3i	
LC	ERQ	⇩	≡	≡	R	R	R	R	R	≡	≡	⇩
PLC		⇩	≡	≡	R	R	R	R	R	≡	≡	⇩
TC		⇩	R	R	—	—	—	—	—	R		⇩
PTC		⇩	R	R	—	—	—	—	—	R	A	⇩
MSLC		⇩	≡	≡	=	=	=	=	=	≡	≡	⇩
TCS		⇩	≡	≡	×							
LC	ECF				A	A	A	A	A			
PLC												
TC			A	A						A		
PTC												
MSLC		⇦	≡	≡	=	=	=	=	=	≡	★	
TCS												

Figure III.2/Q.2630.3
No CS1 nodes in the AAL type 2 connection in the "From CS3 via CS2/CS1 nodes to CS3" scenario

In the ESTABLISH.request primitive, the nodal function receives from the AAL type 2 served user the following parameters relevant to interworking and connection resource allocation:

- the Transfer Capability,
- the Preferred Transfer Capability,
- the Transfer Capability Support,
- the Link Characteristics,
- the Preferred Link Characteristics, and
- the Modify Support for Link Characteristics.

Nodes CS3a and CS3b reserve connection resources reflecting the more "demanding" of the parameters Transfer Capability (TC) and Preferred Transfer Capability (PTC).

At node CS2c, the Transfer Capability Support (TCS) parameter is discarded (compatibility instructions); the AAL type 2 served users at both AAL type 2 service endpoints realize that the connection does not pass through CS3 nodes entirely.

Nodes CS2c, CS2d, CS2e, CS2f, and CS2g reserve connection resources reflecting the more "demanding" of the parameters Link Characteristics (LC) and Preferred Link Characteristics (PLC).

Node CS3h reserves connection resources reflecting the more "demanding" of the parameters Transfer Capability (TC) and Preferred Transfer Capability (PTC).

Node CS3i allocates connection resources reflecting the Preferred Transfer Capability (PTC) parameter; this decision is based on the presence of the Preferred Transfer Capability (PTC) parameter. The parameters Transfer Capability (TC), Preferred Transfer Capability (PTC), Link Characteristics (LC), Preferred Link Characteristics (PLC), and Modify Support for Link Characteristics (MSLC) are passed to the AAL type 2 served user. The absence of the Transfer Capability Support (TCS) parameter indicates that the AAL type 2 connection does not pass through CS3 nodes entirely. The Modify Support for Link Characteristics (MSLC) parameter is inserted into the Establish Confirm (ECF) message.

Node CS3h allocates connection resources reflecting the Preferred Transfer Capability (PTC) parameter that was passed previously present in the Establish Request (ERQ) message; this decision is based on the presence of the Modify Support for Link Characteristics (MSLC) parameter in the Establish Confirm (ECF) message.

Nodes CS2g, CS2f, CS2e, CS2d, and CS2c allocate connection resources reflecting the Preferred Link Characteristics (PLC) parameter that was passed previously present in the Establish Request (ERQ) message; this decision is based on the presence of the Modify Support for Link Characteristics (MSLC) parameter in the Establish Confirm (ECF) message.

Nodes CS3b and CS3a allocate connection resources reflecting the Preferred Transfer Capability (PTC) that was passed previously present in the Establish Request (ERQ) message or received from the AAL type 2 served user; this decision is based on the presence of the Modify Support for Link Characteristics (MSLC) parameter in the Establish Confirm (ECF) message.

Node CS3a includes the Modify Support for Link Characteristics (MSLC) parameter in the ESTABLISH.confirm primitive to the AAL type 2 served user.

III.2.2.2. At least one CS1 nodes in the AAL type 2 connection

The parameters transported in the Establish Request (ERQ) and Establish Confirm (ECF) messages and the effects on the connection resource allocation mechanisms are illustrated in Figure III.3/Q.2630.3.

			CS3a	CS3b	CS2c	CS2d	CS1e	CS2f	CS2g	CS3h	CS3i	
LC PLC	ERQ	⇩ ⇩	≡≡ ≡≡	≡≡ ≡≡	R R	R R	A ×	A	A	≡≡	≡≡	
TC PTC	ERQ	⇩ ⇩	R R	R R	— —	— —	— —	— —	— —	A ☒	A	
MSLC TCS	ERQ	⇩ ⇩	≡≡ ≡≡	≡≡ ≡≡	== ×	==	×					
LC PLC	ECF				A	A						
TC PTC	ECF		A	A								
MSLC TCS	ECF											

Figure III.3/Q.2630.3

At least one CS1 nodes in the AAL type 2 connection in the "From CS3 via CS2/CS1 nodes to CS3" scenario

In the ESTABLISH.request primitive, the nodal function receives from the AAL type 2 served user the following parameters relevant to interworking and connection resource allocation:

- the Transfer Capability,
- the Preferred Transfer Capability,
- the Transfer Capability Support,
- the Link Characteristics,
- the Preferred Link Characteristics, and
- the Modify Support for Link Characteristics.

Nodes CS3a and CS3b reserve connection resources reflecting the more "demanding" of the parameters Transfer Capability (TC) and Preferred Transfer Capability (PTC).

At node CS2c, the Transfer Capability Support (TCS) parameter is discarded (compatibility instructions); the AAL type 2 served users at both AAL type 2 service endpoints realize that the connection does not pass through CS3 nodes entirely.

Nodes CS2c and CS2d reserve connection resources reflecting the more "demanding" of the parameters Link Characteristics (LC) and Preferred Link Characteristics (PLC).

At node CS1e, the parameters Preferred Link Characteristics (PLC) and Modify Support for Link Characteristics (MSLC) are discarded (compatibility instructions). Connection resources reflecting the Link Characteristics (LC) are allocated.

Nodes CS2f and CS2g allocate connection resources reflecting the Link Characteristics (LC); the Preferred Link Characteristics (PLC) parameter is no longer present in the Establish Request (ERQ) message.

At node CS3h it is detected that although no Preferred Link Characteristics (PLC) parameter is present, a Preferred Transfer Capability (PTC) parameter is; this parameter is discarded due to interworking definitions (see Annex C) before the Establish Request (ERQ) message is interpreted by the nodal function. Connection resources reflecting the Transfer Capability (TC) are allocated.

At node CS3i, connection resources reflecting the Transfer Capability (TC) are allocated. The parameters Transfer Capability (TC) and Link Characteristics (LC) are passed to the AAL type 2 served user. The absence of the Transfer Capability Support (TCS) parameter indicates that the AAL type 2 connection does not pass through CS3 nodes entirely. No parameters are inserted into the Establish Confirm (ECF) message.

At nodes CS3h, CS2g, CS2f, and CS1e, no action except passing the Establish Confirm (ECF) message is performed.

Nodes CS2d and CS2c allocate connection resources reflecting the Link Characteristics (LC) that was passed previously present in the Establish Request (ERQ) message; this decision is based on the absence of the Modify Support for Link Characteristics (MSLC) parameter in the Establish Confirm (ECF) message.

Nodes CS3b and CS3a allocate connection resources reflecting the Transfer Capability (TC) that was passed previously present in the Establish Request (ERQ) message or received from the AAL type 2 served user; this decision is based on the absence of the Modify Support for Link Characteristics (MSLC) parameter in the Establish Confirm (ECF) message.

Node CS3a includes no parameters in the ESTABLISH.confirm primitive to the AAL type 2 served user.

III.2.3. From a CS3 service endpoint to a CS2/CS1 service endpoint

This subclause illustrates AAL type 2 connection establishment where the originating AAL type 2 service endpoint resides in a part of the network consisting of CS3 nodes and where the destination AAL type 2 service endpoint resides in a part of the network consisting of CS2 and/or CS1 nodes.

III.2.3.1. No CS1 nodes in the AAL type 2 connection

The parameters transported in the Establish Request (ERQ) and Establish Confirm (ECF) messages and the effects on the connection resource allocation mechanisms are illustrated in Figure III.4/Q.2630.3.

			CS3a	CS3b	CS3c	CS3d	CS2e	CS2f	CS2g	CS2h	CS2i	
LC	ERQ	⇩	≡	≡	≡	≡	R	R	R	R		⇩
PLC		⇩	≡	≡	≡	≡	R	R	R	R	A	⇩
TC		⇩	R	R	R	R	—	—	—	—	×	
PTC		⇩	R	R	R	R	—	—	—	—	×	
MSLC		⇩	≡	≡	≡	≡	=	=	=	=	=	⇩
TCS		⇩	≡	≡	≡	≡	×					
LC	ECF											
PLC							A	A	A	A		
TC												
PTC			A	A	A	A						
MSLC		⇦	≡	≡	≡	≡	=	=	=	=	★	
TCS												

Figure III.4/Q.2630.3
No CS1 nodes in the AAL type 2 connection in the "From CS3 to CS2/CS1" scenario

In the ESTABLISH.request primitive, the nodal function receives from the AAL type 2 served user the following parameters relevant to interworking and connection resource allocation:

- the Transfer Capability,
- the Preferred Transfer Capability,
- the Transfer Capability Support,
- the Link Characteristics,
- the Preferred Link Characteristics, and
- the Modify Support for Link Characteristics.

Nodes CS3a, CS3b, CS3c, and CS3d reserve connection resources reflecting the more "demanding" of the parameters Transfer Capability (TC) and Preferred Transfer Capability (PTC).

At node CS2e, the Transfer Capability Support (TCS) parameter is discarded (compatibility instructions).

Nodes CS2e, CS2f, CS2g, and CS2h reserve connection resources reflecting the more “demanding” of the parameters Link Characteristics (LC) and Preferred Link Characteristics (PLC).

Node CS2i allocates connection resources reflecting the Preferred Link Characteristics (PLC) parameter; this decision is based on the presence of the Modify Support for Link Characteristics (MSLC) parameter. The parameters Transfer Capability (TC) and Preferred Transfer Capability (PTC) are discarded. The parameters Link Characteristics (LC), Preferred Link Characteristics (PLC), and Modify Support for Link Characteristics (MSLC) are passed to the AAL type 2 served user. The Modify Support for Link Characteristics (MSLC) parameter is inserted into the Establish Confirm (ECF) message.

Nodes CS2h, CS2g, CS2f, and CS2e allocate connection resources reflecting the Preferred Link Characteristics (PLC) parameter that was passed previously present in the Establish Request (ERQ) message; this decision is based on the presence of the Modify Support for Link Characteristics (MSLC) parameter in the Establish Confirm (ECF) message.

Nodes CS3d, CS3c, CS3b, and CS3a allocate connection resources reflecting the Preferred Transfer Capability (PTC) that was passed previously present in the Establish Request (ERQ) message or received from the AAL type 2 served user; this decision is based on the presence of the Modify Support for Link Characteristics (MSLC) parameter in the Establish Confirm (ECF) message.

Node CS3a includes the Modify Support for Link Characteristics (MSLC) parameter in the ESTABLISH.confirm primitive to the AAL type 2 served user. The absence of the Transfer Capability Support (TCS) parameter indicates that the AAL type 2 connection does not pass through CS3 nodes entirely.

III.2.3.2. At least one CS1 nodes in the AAL type 2 connection

The parameters transported in the Establish Request (ERQ) and Establish Confirm (ECF) messages and the effects on the connection resource allocation mechanisms are illustrated in Figure III.5/Q.2630.3.

			CS3a	CS3b	CS3c	CS3d	CS2e	CS2f	CS1g	CS2h	CS2i	
LC PLC	ERQ	⇩ ⇩	≡≡ ≡≡	≡≡ ≡≡	≡≡ ≡≡	≡≡ ≡≡	R R	R R	A ×	A	A	⇩
TC PTC		⇩ ⇩	R R	R R	R R	R R	— —	— —	— —	— —	× ×	
MSLC TCS		⇩ ⇩	≡≡ ≡≡	≡≡ ≡≡	≡≡ ≡≡	≡≡ ≡≡	— ×	—	×			
LC PLC	ECF						A	A				
TC PTC			A	A	A	A						
MSLC TCS												

Figure III.5/Q.2630.3

At least one CS1 nodes in the AAL type 2 connection in the “From CS3 to CS2/CS1” scenario

In the ESTABLISH.request primitive, the nodal function receives from the AAL type 2 served user the following parameters relevant to interworking and connection resource allocation:

- the Transfer Capability,
- the Preferred Transfer Capability,
- the Transfer Capability Support,
- the Link Characteristics,
- the Preferred Link Characteristics, and
- the Modify Support for Link Characteristics.

Nodes CS3a, CS3b, CS3c, and CS3d reserve connection resources reflecting the more “demanding” of the parameters Transfer Capability (TC) and Preferred Transfer Capability (PTC).

At node CS2e, the Transfer Capability Support (TCS) parameter is discarded (compatibility instructions).

Nodes CS2e and CS2f reserve connection resources reflecting the more “demanding” of the parameters Link Characteristics (LC) and Preferred Link Characteristics (PLC).

At node CS1g, the parameters Preferred Link Characteristics (PLC) and Modify Support for Link Characteristics (MSLC) are discarded (compatibility instructions). Connection resources reflecting the Link Characteristics (LC) are allocated.

Node CS2h allocates connection resources reflecting the Link Characteristics (LC); the Preferred Link Characteristics (PLC) parameter is no longer present in the Establish Request (ERQ) message.

At node CS2i, connection resources reflecting the Link Characteristics (LC) are allocated; the Preferred Link Characteristics (PLC) parameter is no longer present in the Establish Request (ERQ) message. The parameters Transfer Capability (TC) and Preferred Transfer Capability (PTC) are discarded. The Link Characteristics (LC) parameter is passed to the AAL type 2 served user. No parameters are inserted into the Establish Confirm (ECF) message.

At nodes CS2h and CS1g, no action except passing the Establish Confirm (ECF) message is performed.

Nodes CS2f and CS2e allocate connection resources reflecting the Link Characteristics (LC) that was passed previously present in the Establish Request (ERQ) message; this decision is based on the absence of the Modify Support for Link Characteristics (MSLC) parameter in the Establish Confirm (ECF) message.

Nodes CS3d, CS3c, CS3b, and CS3a allocate connection resources reflecting the Transfer Capability (TC) that was passed previously present in the Establish Request (ERQ) message or received from the AAL type 2 served user; this decision is based on the absence of the Modify Support for Link Characteristics (MSLC) parameter in the Establish Confirm (ECF) message.

Node CS3a includes no parameters in the ESTABLISH.confirm primitive to the AAL type 2 served user. The absence of the Transfer Capability Support (TCS) parameter indicates that the AAL type 2 connection does not pass through CS3 nodes entirely.

III.2.4. From a CS2/CS1 service endpoint to a CS3 service endpoint

This subclause illustrates AAL type 2 connection establishment where the originating AAL type 2 service endpoint resides in a part of the network consisting of CS2 and/or CS1 nodes and where the destination AAL type 2 service end-point resides in a part of the network consisting of CS3 and nodes.

III.2.4.1. No CS1 nodes in the AAL type 2 connection

The parameters transported in the Establish Request (ERQ) and Establish Confirm (ECF) messages and the effects on the connection resource allocation mechanisms are illustrated in Figure III.6/Q.2630.3.

			CS2a	CS2b	CS2c	CS2d	CS2e	CS3f	CS3g	CS3h	CS3i	
LC	ERQ	↓	R	R	R	R	R	≡	≡	≡	≡	↗
PLC		↓	R	R	R	R	R	≡	≡	≡	≡	↗
TC								★ R	R	R		↗
PTC								★ R	R	R	A	↗
MSLC		↓	==	==	==	==	==	≡	≡	≡	≡	↗
TCS												
LC	ECF		A	A	A	A	A					
PLC												
TC								A	A	A		
PTC												
MSLC		↑	==	==	==	==	==	≡	≡	≡	★	
TCS												

Figure III.6/Q.2630.3
No CS1 nodes in the AAL type 2 connection in the “From CS2/CS1 to CS3” scenario

In the ESTABLISH.request primitive, the nodal function receives from the AAL type 2 served user the following parameters relevant to interworking and connection resource allocation:

- the Link Characteristics,
- the Preferred Link Characteristics, and
- the Modify Support for Link Characteristics.

Nodes CS2a, CS2b, CS2c, CS2d, and CS2e reserve connection resources reflecting the more “demanding” of the parameters Link Characteristics (LC) and Preferred Link Characteristics (PLC).

At node CS3f, the Transfer Capability (TC) parameter is not present, hence, the nodal function prepares a Transfer Capability (TC) parameter corresponding to the Link Characteristics (LC) parameter. In addition, the Preferred Link Characteristics (PLC) parameter is present also, hence, the nodal function prepares a Preferred Transfer Capability (PTC) parameter corresponding to the Preferred Link Characteristics (PLC) as well. Node CS3f then reserves connection resources reflecting the more “demanding” of the parameters Transfer Capability (TC) and Preferred Transfer Capability (PTC).

Nodes CS3g and CS3h reserve connection resources reflecting the more “demanding” of the parameters Transfer Capability (TC) and Preferred Transfer Capability (PTC).

Node CS3i allocates connection resources reflecting the Preferred Transfer Capability (PTC) parameter; this decision is based on the presence of the Preferred Transfer Capability (PTC) parameter. The parameters Transfer Capability (TC), Preferred Transfer Capability (PTC), Link Characteristics (LC), Preferred Link Characteristics (PLC), and Modify Support for Link Characteristics (MSLC) are passed to the AAL type 2 served user. The absence of the Transfer Capability Support (TCS) parameter indicates that the AAL type 2 connection does not pass through CS3 nodes entirely. The Modify Support for Link Characteristics (MSLC) parameter is inserted into the Establish Confirm (ECF) message.

Nodes CS3h, CS3g, and CS3f allocate connection resources reflecting the Preferred Transfer Capability (PTC) parameter that was passed previously present in the Establish Request (ERQ) message; this decision is based on the presence of the Modify Support for Link Characteristics (MSLC) parameter in the Establish Confirm (ECF) message.

Nodes CS2e, CS2d, CS2c, CS2b, and CS2a allocate connection resources reflecting the Preferred Link Characteristics (PLC) parameter that was passed previously present in the Establish Request (ERQ) message or received from the AAL type 2 served user; this decision is based on the presence of the Modify Support for Link Characteristics (MSLC) parameter in the Establish Confirm (ECF) message.

Node CS2a includes the Modify Support for Link Characteristics (MSLC) parameter in the ESTABLISH.confirm primitive to the AAL type 2 served user.

III.2.4.2. At least one CS1 nodes in the AAL type 2 connection

The parameters transported in the Establish Request (ERQ) and Establish Confirm (ECF) messages and the effects on the connection resource allocation mechanisms are illustrated in Figure III.7/Q.2630.3.

			CS2a	CS2b	CS1c	CS2d	CS2e	CS3f	CS3g	CS3h	CS3i	
LC PLC	ERQ	↳ ↳	R R	R R	A ×	A	A	==	==	==	==	↱
TC PTC								★ A	A	A	A	↱
MSLC TCS		↳	==	==	×							
LC PLC	ECF		A	A								
TC PTC												
MSLC TCS												

Figure III.7/Q.2630.3

At least one CS1 nodes in the AAL type 2 connection in the “From CS2/CS1 to CS3” scenario

In the ESTABLISH.request primitive, the nodal function receives from the AAL type 2 served user the following parameters relevant to interworking and connection resource allocation:

- the Link Characteristics,
- the Preferred Link Characteristics, and
- the Modify Support for Link Characteristics.

Nodes CS2a and CS2b reserve connection resources reflecting the more "demanding" of the parameters Link Characteristics (LC) and Preferred Link Characteristics (PLC).

At node CS1c, the parameters Preferred Link Characteristics (PLC) and Modify Support for Link Characteristics (MSLC) are discarded (compatibility instructions). Connection resources reflecting the Link Characteristics (LC) are allocated.

Nodes CS2d and CS2e allocate connection resources reflecting the Link Characteristics (LC); the Preferred Link Characteristics (PLC) parameter is no longer present in the Establish Request (ERQ) message.

At node CS3f, the Transfer Capability (TC) parameter is not present, hence, the nodal function prepares a Transfer Capability (TC) parameter corresponding to the Link Characteristics (LC) parameter. The Preferred Link Characteristics (PLC) parameter is not present, hence, no Preferred Transfer Capability (PTC) parameter needs to be prepared. Node CS3f then allocates connection resources reflecting the Transfer Capability (TC) parameter.

Nodes CS3g and CS3h allocate connection resources reflecting the Transfer Capability (TC) parameter.

Node CS3i allocates connection resources reflecting the Transfer Capability (TC) parameter. The parameters Transfer Capability (TC) and Link Characteristics (LC) are passed to the AAL type 2 served user. The absence of the Transfer Capability Support (TCS) parameter indicates that the AAL type 2 connection does not pass through CS3 nodes entirely. No parameters are inserted into the Establish Confirm (ECF) message.

At nodes CS3h, CS3g, CS3f, CS2e, CS2d and CS1c, no action except passing the Establish Confirm (ECF) message is performed.

Nodes CS2b and CS2a allocate connection resources reflecting the Link Characteristics (LC) parameter that was passed previously present in the Establish Request (ERQ) message or received from the AAL type 2 served user; this decision is based on the absence of the Modify Support for Link Characteristics (MSLC) parameter in the Establish Confirm (ECF) message.

Node CS2a includes no parameters in the ESTABLISH.confirm primitive to the AAL type 2 served user.

III.3. Connection Resource Modification

III.3.1. All CS3 nodes

This subclause illustrates AAL type 2 connection resource modifications where the originating and the destination AAL type 2 service endpoints as well as all AAL type 2 switches reside in a part of the network consisting of CS3.

The availability of the full functionality specified in this Recommendation (capability set 3) was asserted by the receipt of the Transfer Capability Support (TCS) parameter by both service endpoints at connection establishment (see § III.2.1). There exists no need to transmit parameters used only for interworking.

The parameters transported in the Modify Request (MOD) and Modify Acknowledge (MOA) messages and the effects on the connection resource allocation mechanisms are illustrated in Figure III.8/Q.2630.3.

			CS3a	CS3b	CS3c	CS3d	CS3e	CS3f	CS3g	CS3h	CS3i	
LC_{old} LC_{new}	MOD											
TC_{old} TC_{new}	MOD	↳	R R	R R	R R	R R	R R	R R	R R	R R	A	↱
LC_{old} LC_{new}	MOA											
TC_{old} TC_{new}	MOA		A	A	A	A	A	A	A	A		

Figure III.8/Q.2630.3
AAL type 2 connection resource modification in the "All CS3" scenario

In the MODIFY.request primitive, the nodal function receives from the AAL type 2 served user the Transfer Capability (TC) parameter.

Nodes CS3a, CS3b, CS3c, CS3d, CS3e, CS3f, CS3g, and CS3h reserve connection resources reflecting the more "demanding" of the currently allocated connection resources (TC_{old}) and the Transfer Capability (TC_{new})parameter.

Node CS3i allocates connection resources reflecting the Transfer Capability (TC_{new}) parameter. The Transfer Capability (TC_{new}) parameter is passed to the AAL type 2 served user.

Nodes CS3h, CS3g, CS3f, CS3e, CS3d, CS3c, CS3b, and CS3a allocate connection resources reflecting the new Transfer Capability (TC_{new}) parameter that was passed previously present in the Modify Request (MOD) message or received from the AAL type 2 served user; this decision is based on the nature of the message, i.e., Modification Acknowledge (MOA) message rather than the Modification Reject (MOR) message.

Node CS3a includes no parameters in the MODIFY.confirm primitive to the AAL type 2 served user.

III.3.2. From CS3 via CS2 nodes to CS3

This subclause illustrates AAL type 2 connection resource modification where the modify originating and the modify destination AAL type 2 service endpoints reside in a part of the network consisting of CS3 nodes and where the AAL type 2 connection passes through a part of the network consisting of CS2 nodes.

NOTE — Connection Resource Modification is not possible if a CS1 node is part of the AAL type 2 connection.

The parameters transported in the Modify Request (MOD) and Modify Acknowledge (MOA) messages and the effects on the connection resource allocation mechanisms are illustrated in Figure III.9/Q.2630.3.

			CS3a	CS3b	CS2c	CS2d	CS2e	CS2f	CS2g	CS3h	CS3i	
LC_{old} LC_{new}	MOD	↳	≡≡	≡≡	R R	R R	R R	R R	R R	≡≡	≡≡	↱
TC_{old} TC_{new}	MOD	↳	R R	R R	—	—	—	—	—	R R	A	↱
LC_{old} LC_{new}	MOA				A	A	A	A	A			
TC_{old} TC_{new}	MOA		A	A						A		

Figure III.9/Q.2630.3
AAL type 2 connection resource modification in the "From CS3 via CS2 nodes to CS3" scenario

In the MODIFY.request primitive, the nodal function receives from the AAL type 2 served user the following parameters relevant to interworking and connection resource allocation:

- the Transfer Capability, and
- the Link Characteristics.

Nodes CS3a and CS3b reserve connection resources reflecting the more "demanding" of the currently allocated connection resources (TC_{old}) and the Transfer Capability (TC_{new}) parameter.

Nodes CS2c, CS2d, CS2e, CS2f and CS2g reserve connection resources reflecting the more "demanding" of the currently allocated connection resources (LC_{old}) and the Link Characteristics (LC_{new}) parameter.

Node CS3h reserves connection resources reflecting the more "demanding" of the currently allocated connection resources (TC_{old}) and the Transfer Capability (TC_{new}) parameter.

Node CS3i allocates connection resources reflecting the Transfer Capability (TC_{new}) parameter. The parameters Transfer Capability (TC_{new}) and Link Characteristics (LC_{new}) are passed to the AAL type 2 served user.

Node CS3h allocates connection resources reflecting the new Transfer Capability (TC_{new}) parameter that was passed previously present in the Modify Request (MOD) message; this decision is based on the nature of the message, i.e., Modification Acknowledge (MOA) message rather than the Modification Reject (MOR) message.

Nodes CS2g, CS2f, CS2e, CS2d and CS2c allocate connection resources reflecting the new Link Characteristics (LC_{new}) parameter that was passed previously present in the Modify Request (MOD) message; this decision is based on the nature of the message, i.e., Modification Acknowledge (MOA) message rather than the Modification Reject (MOR) message.

Nodes CS3b and CS3a allocate connection resources reflecting the new Transfer Capability (TC_{new}) parameter that was passed previously present in the Modify Request (MOD) message or received from the AAL type 2 served user; this decision is based on the nature of the message, i.e., Modification Acknowledge (MOA) message rather than the Modification Reject (MOR) message.

Node CS3a sends a MODIFY.confirm primitive to the AAL type 2 served user.

III.3.3. From a CS3 service endpoint to a CS2 service endpoint

This subclause illustrates AAL type 2 connection resource modification where the modify originating AAL type 2 service endpoint resides in a part of the network consisting of CS3 nodes and where the modify destination AAL type 2 service endpoint resides in a part of the network consisting of CS2 nodes.

NOTE — Connection Resource Modification is not possible if a CS1 node is part of the AAL type 2 connection.

The parameters transported in the Modify Request (MOD) and Modify Acknowledge (MOA) messages and the effects on the connection resource allocation mechanisms are illustrated in Figure III.10/Q.2630.3.

			CS3a	CS3b	CS3c	CS3d	CS2e	CS2f	CS2g	CS2h	CS2i	
LC_{old} LC_{new}	MOD	↳	≡≡	≡≡	≡≡	≡≡	R R	R R	R R	R R	A	↱
TC_{old} TC_{new}	MOD	↳	R R	R R	R R	R R	—	—	—	—	×	
LC_{old} LC_{new}	MOA						A	A	A	A		
TC_{old} TC_{new}	MOA		A	A	A	A						

Figure III.10/Q.2630.3
AAL type 2 connection resource modification in the "From CS3 to CS2" scenario

In the MODIFY.request primitive, the nodal function receives from the AAL type 2 served user the following parameters relevant to interworking and connection resource allocation:

- the Transfer Capability, and
- the Link Characteristics.

Nodes CS3a, CS3b, CS3c, and CS3d reserve connection resources reflecting the more "demanding" of the currently allocated connection resources (TC_{old}) and the Transfer Capability (TC_{new}) parameter.

Nodes CS2e, CS2f, CS2g and CS2h reserve connection resources reflecting the more "demanding" of the currently allocated connection resources (LC_{old}) and the Link Characteristics (LC_{new}) parameter.

Node CS2i allocates connection resources reflecting the Link Characteristics (LC_{new}) parameter. The Transfer Capability (TC) parameter is discarded The Transfer Capability (LC_{new}) parameter is passed to the AAL type 2 served user.

Nodes CS2h, CS2g, CS2f and CS2e allocate connection resources reflecting the new Link Characteristics (LC_{new}) parameter that was passed previously present in the Modify Request (MOD) message; this decision is based on the nature of the message, i.e., Modification Acknowledge (MOA) message rather than the Modification Reject (MOR) message.

Nodes CS3d, CS3c, CS3b, and CS3a allocate connection resources reflecting the new Transfer Capability (TC_{new}) parameter that was passed previously present in the Modify Request (MOD) message or received from the AAL type 2 served user; this decision is based on the nature of the message, i.e., Modification Acknowledge (MOA) message rather than the Modification Reject (MOR) message.

Node CS3a sends a MODIFY.confirm primitive to the AAL type 2 served user.

III.3.4. From a CS2 service endpoint to a CS3 service endpoint

This subclause illustrates AAL type 2 connection resource modification where the modify originating AAL type 2 service endpoint resides in a part of the network consisting of CS2 nodes and where the modify destination AAL type 2 service endpoint resides in a part of the network consisting of CS3 and nodes.

NOTE — Connection Resource Modification is not possible if a CS1 node is part of the AAL type 2 connection.

The parameters transported in the Modify Request (MOD) and Modify Acknowledge (MOA) messages and the effects on the connection resource allocation mechanisms are illustrated in Figure III.11/Q.2630.3.

			CS2a	CS2b	CS2c	CS2d	CS2e	CS3f	CS3g	CS3h	CS3i	
LC_{old} LC_{new}	MOD	↳	R R	R R	R R	R R	R R	≡≡	≡≡	≡≡	≡≡	⇗
TC_{old} TC_{new}								R ★ R	R R	R R	A	⇗
LC_{old} LC_{new}	MOA		A	A	A	A	A					
TC_{old} TC_{new}								A	A	A		

Figure III.11/Q.2630.3
AAL type 2 connection resource modification in the "From CS2 to CS3" scenario

In the MODIFY.request primitive, the nodal function receives from the AAL type 2 served user the Link Characteristics (LC_{new}) parameter.

Nodes CS2a, CS2b, CS2c, CS2d and CS2e reserve connection resources reflecting the more "demanding" of the currently allocated connection resources (LC_{old}) and the Link Characteristics (LC_{new}) parameter.

At node CS3f, the Transfer Capability (TC_{new}) parameter is not present, hence, the nodal function prepares a Transfer Capability (TC_{new}) parameter corresponding to the Link Characteristics (LC_{new}) parameter.

Nodes CS3f, CS3g and CS3h reserve connection resources reflecting the more "demanding" of the currently allocated connection resources (TC_{old}) and the Transfer Capability (TC_{new}) parameter.

Node CS3i allocates connection resources reflecting the Transfer Capability (TC_{new}) parameter. The parameters Transfer Capability (TC_{new}) and Link Characteristics (LC_{new}) are passed to the AAL type 2 served user.

Nodes CS3h, CS3g, and CS3f allocates connection resources reflecting the new Transfer Capability (TC_{new}) parameter that was passed previously present in the Modify Request (MOD) message; this decision is based on the nature of the message, i.e., Modification Acknowledge (MOA) message rather than the Modification Reject (MOR) message.

Nodes CS2e, CS2d, CS2c, CS2b and CS2a allocate connection resources reflecting the new Link Characteristics (LC_{new}) parameter that was passed previously present in the Modify Request (MOD) message or received from the AAL type 2 served user; this decision is based on the nature of the message, i.e., Modification Acknowledge (MOA) message rather than the Modification Reject (MOR) message.
Node CS2a sends a MODIFY.confirm primitive to the AAL type 2 served user.

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