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Supplement 8

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SERIES Q: SWITCHING AND SIGNALLING

**Technical report TRQ.2400:
Transport control signalling requirements –
Signalling requirements for AAL type 2 link
control capability set 1**

ITU-T Q-series Recommendations – Supplement 8

(Previously CCITT Recommendations)

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SUPPLEMENT 8 TO ITU-T Q-SERIES RECOMMENDATIONS

TECHNICAL REPORT TRQ.2400: TRANSPORT CONTROL SIGNALLING REQUIREMENTS – SIGNALLING REQUIREMENTS FOR AAL TYPE 2 LINK CONTROL CAPABILITY SET 1

Summary

This Supplement to the Q-series Recommendations contains a Technical report that specifies the general aspects of AAL type 2 signalling requirements for the development of AAL type 2 signalling capability set 1 (CS-1).

This Supplement identifies what can be viewed as the capabilities for AAL type 2 signalling. In addition, it describes the essential features and models useful for the development of functional entity actions in support of AAL type 2 signalling.

Source

Supplement 8 to ITU-T Q-series Recommendations was prepared by ITU-T Study Group 11 (1997-2000) and was approved under the WTSC Resolution No. 5 procedure on the 15th of March 1999.

FOREWORD

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NOTE

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Supplement 8 to Q-series Recommendations

TECHNICAL REPORT TRQ.2400: TRANSPORT CONTROL SIGNALLING REQUIREMENTS – SIGNALLING REQUIREMENTS FOR AAL TYPE 2 LINK CONTROL CAPABILITY SET 1

(Geneva, 1999)

1 Scope

This Supplement contains the signalling requirements for the AAL type 2 connection signalling for the capability set 1 (CS-1). They support the establishment, maintenance and clearing of AAL type 2 connections with a common protocol, operating over multiple signalling transport protocol stacks. The shaded area of Figure 1 shows the scope of this Supplement.

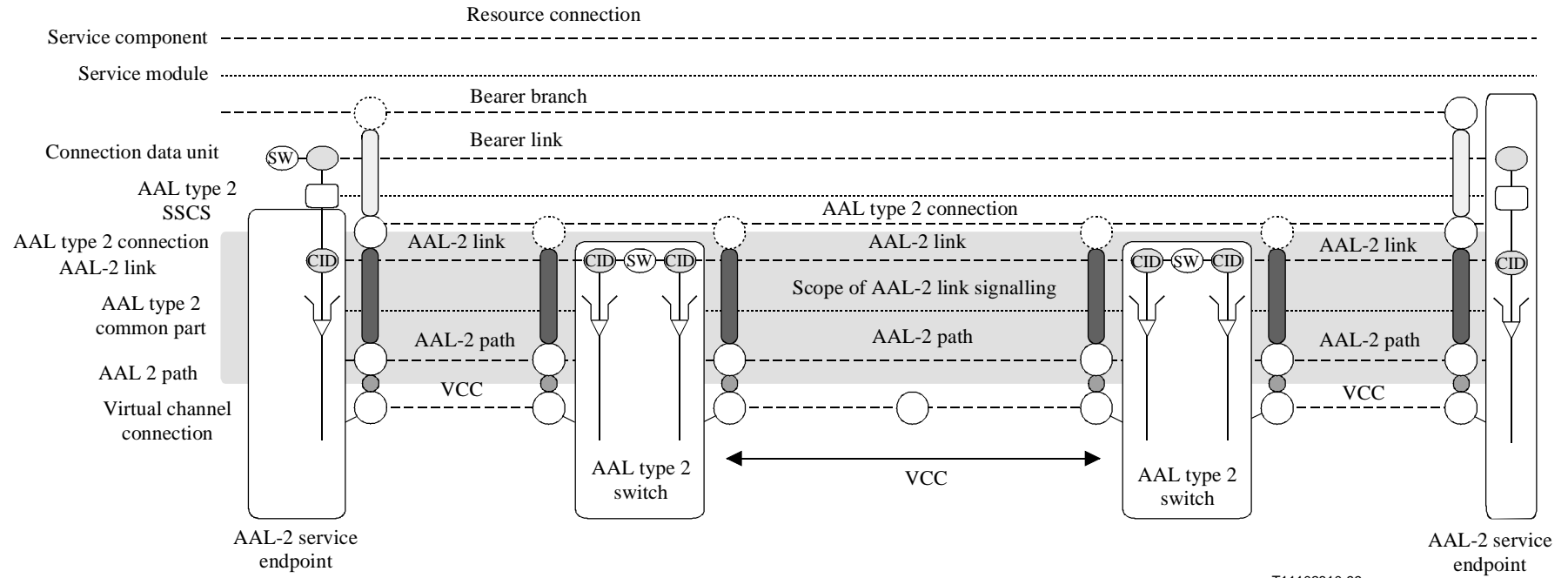


Figure 1 – Scope and definition of terms used in AAL type 2 connection signalling

2 References

- [1] ITU-T Recommendation I.363.2 (1997), *B-ISDN ATM Adaptation Layer specification: Type 2 AAL*.
- [2] ITU-T Recommendation I.366.1 (1998), *Segmentation and Reassembly Service Specific Convergence Sublayer for the AAL type 2*.
- [3] ITU-T Recommendation I.366.2 (1999), *AAL type 2 SSCS for trunking*.
- [4] ITU-T Recommendation X.200 (1994), *Information technology – Open Systems Interconnection – Basic reference model: The basic model*.
- [5] ITU-T Recommendation X.210 (1993) | ISO/IEC 10731:1994, *Information technology – Open Systems Interconnection – Basic reference model: Conventions for the definition of OSI services*.
- [6] ITU-T Recommendation X.213 (1995) | ISO/IEC 8348:1996, *Information technology – Open Systems Interconnection – Network service definition*.
- [7] ITU-T Recommendation E.164 (1997), *The international public telecommunication numbering plan*.

3 Definitions

This Supplement is based upon the concepts developed in Recommendations X.200 [4] and X.210 [5].

In addition, this Supplement defines the following terms:

- 3.1 AAL type 2 channel:** A concept used in 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.
- 3.2 AAL type 2 connection:** The logical concatenation of one or more AAL type 2 links between two AAL type 2 service endpoints.
- 3.3 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.
- 3.4 AAL type 2 link characteristics:** Describes the attributes of the AAL type 2 link.
- 3.5 AAL type 2 node:** An AAL type 2 service endpoint or an AAL type 2 switch.
- 3.6 AAL type 2 path:** An ATM VCC between two AAL type 2 nodes. This ATM VCC can either be an SVC or a PVC.
- 3.7 AAL type 2 path identifier:** The identifier of the AAL type 2 path.
- 3.8 AAL type 2 service endpoint:** A termination point of an AAL type 2 connection.
- 3.9 AAL type 2 served user:** The user of an AAL type 2 signalling protocol.
- 3.10 AAL type 2 signalling:** Control Plane functions for establishing, clearing and maintaining AAL type 2 connections.
- 3.11 AAL type 2 signalling transport:** A facility for carrying AAL type 2 signalling messages.
- 3.12 AAL type 2 signalling endpoint:** The termination point of an AAL type 2 signalling transport.

3.13 AAL type 2 signalling requirements CS-1: First release of sets of AAL type 2 signalling requirements.

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

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

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

4 Abbreviations

This Supplement uses the following abbreviations:

AAL	ATM Adaptation Layer
AESA	ATM End System Address
ATM	Asynchronous Transfer Mode
ATM VCC	ATM Virtual Channel Connection
CID	Channel Identifier
CPS	Common Part Sublayer
CPS-UII	CPS-User-to-User Indication
CS-1	Capability Set 1
EP	Endpoint
PDU	Protocol Data Unit
PVC	Permanent Virtual Channel
QoS	Quality of Service
SAP	Service Access Point
SDU	Service Data Unit
SSCOP	Service Specific Connection Oriented Protocol
SSCS	Service Specific Convergence Sublayer
SVC	Switched Virtual Channel
SW	Switch
VCC	Virtual Channel Connection
VPC	Virtual Path Connection

5 Requirements

The AAL type 2 signalling requirements for capability set 1 (CS-1) are provided in this clause.

5.1 General

The AAL type 2 signalling endpoint shall include mechanisms for the establishment and clearing of AAL type 2 links.

In support of general signalling requirements for the establishment of AAL type 2 links, the AAL type 2 signalling endpoint shall provide:

- the transparent transfer of the AAL type 2 served user generated reference to the AAL type 2 served user in the forward direction in the establishment phase;
NOTE – The AAL type 2 served user generated reference may include, for example, a reference to an access channel or radio link.
- the Service Specific Convergence Sublayer type and any relevant Service Specific Convergence Sublayer parameters; and
- the AAL type 2 link characteristics.

5.2 Addressing

The AAL type 2 signalling endpoint shall support addressing of AAL type 2 service endpoints, connected via a network of AAL type 2 switches. The AAL type 2 signalling shall support multiple address formats including E.164 [7] and X.213 [6]. The AAL type 2 signalling protocol shall carry an explicit indication of the address format being used.

5.3 Routing

The AAL type 2 signalling shall support hop-by-hop routing.

Routing typically is based on addressing information (in the switched case), link characteristics reflecting the resources required, e.g. bandwidth and other information. The information used for describing the link characteristics shall be defined in such a way as to allow efficient routing with minimal delay and processing burden. Routing algorithms are implementation specific.

5.4 Symmetry of connection control

The AAL type 2 signalling protocol and procedures shall reflect a peer-to-peer (rather than a master/slave) relationship among the AAL type 2 signalling endpoints. For example, both ends may request AAL type 2 connections with the same protocol procedures.

5.5 Scope of signalling

The AAL type 2 signalling endpoint shall support AAL type 2 link-by-link signalling.

5.6 Connection configuration

The AAL type 2 signalling endpoint shall support handling of single, point-to-point AAL type 2 connections.

5.7 Symmetry of information transfer capability

The AAL type 2 signalling endpoint shall support asymmetric AAL type 2 connections. That is, the end-to-end connections shall be bidirectional where the information transfer capability, for example, in each direction might be different. Unidirectional AAL type 2 user connections can, therefore, be provided, i.e. connections which provide zero bandwidth in one direction for the AAL type 2 user portion of the connection, consistent with AAL type 2 management requirements.

5.8 Essential features of the underlying signalling transport

The AAL type 2 signalling requirements provided in this Supplement are based upon a dependence that an underlying signalling transport supports:

- a) assured (error free) data transfer;
- b) in-sequence delivery of PDU's; and
- c) an indication of flow control.

5.9 Flow control

Upon receipt of a flow control primitive, the AAL type 2 signalling protocol shall reduce/allow increase of the connection establishment requests towards the identified signalling association.

5.10 Independence from underlying signalling transport

The AAL type 2 signalling protocol design shall be independent from the underlying signalling transport. As an example, it shall be possible to carry the AAL type 2 signalling messages over multiple signalling transport protocol stacks.

5.11 Independence from the AAL type 2 served user

The AAL type 2 signalling protocol and procedures shall be independent from the AAL type 2 served user.

5.12 Extent of control

The scope of AAL type 2 signalling responsibility is restricted to control of AAL type 2 connections. In particular, the appropriate ATM resources must be present before an AAL type 2 connection can be established.

5.13 Concatenation

The AAL type 2 signalling endpoint shall handle AAL type 2 connections over a network of AAL type 2 nodes, where each connection may be a concatenation of AAL type 2 links. An AAL type 2 link can exist on an ATM PVC or an ATM SVC.

5.14 Information transfer capability and QoS requirements

An AAL type 2 connection is characterized by its information transfer capability and its QoS class. A default information transfer capability and default QoS class shall be supported. The definition of AAL type 2 information transfer capability and QoS classes are beyond the scope of this Recommendation.

5.15 Contention resolution

The AAL type 2 signalling endpoint shall be able to resolve all contentions with respect to resource allocation and collisions when establishing AAL type 2 connections.

5.16 Error reporting

The AAL type 2 signalling endpoint shall include mechanisms for detecting and reporting signalling procedural errors or other failures detected by the AAL type 2 signalling endpoint to AAL type 2 management. Service failures may also be reported to the AAL type 2 served user.

5.17 Unrecoverable failures

The AAL type 2 signalling endpoint shall include mechanisms for returning the AAL type 2 protocol instance to a stable state after detection of unrecoverable failures.

5.18 Forward and backward compatibility

The AAL type 2 signalling endpoint shall include a forward compatibility mechanism and backward compatibility rules.

5.19 Separation from the ATM layer signalling

AAL type 2 transport control signalling is fully separated from ATM layer signalling. AAL type 2 signalling endpoints may exist in equipment that do not possess the functionality to serve as ATM signalling endpoints. The AAL type 2 transport control signalling protocol and procedures shall support this situation.

5.20 Scope of control of an AAL type 2 signalling endpoint

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

5.21 Parameters and values for AAL type 2 connections

Relevant parameters and their possible values are specified in Recommendation I.363.2 [1] and, for some applications, other I-series Recommendations, e.g. in Recommendations I.366.1 [2] and I.366.2 [3]. The value range of CID is 1 to 255. The value range of CPS-SDU size in the switched scenario is 1 to 45 octets (default in the non-switched scenario). In the non-switched scenario there is an option to increase the CPS-SDU size to 64 octets.

5.22 AAL type 2 link characteristics

AAL type 2 link characteristics may include information such as:

- maximum forward CPS-SDU bit rate;
- maximum backward CPS-SDU bit rate;
- average forward CPS-SDU bit rate;
- average backward CPS-SDU bit rate;
- maximum forward CPS-SDU size;
- maximum backward CPS-SDU size;
- average forward CPS-SDU size;
- average backward CPS-SDU size.

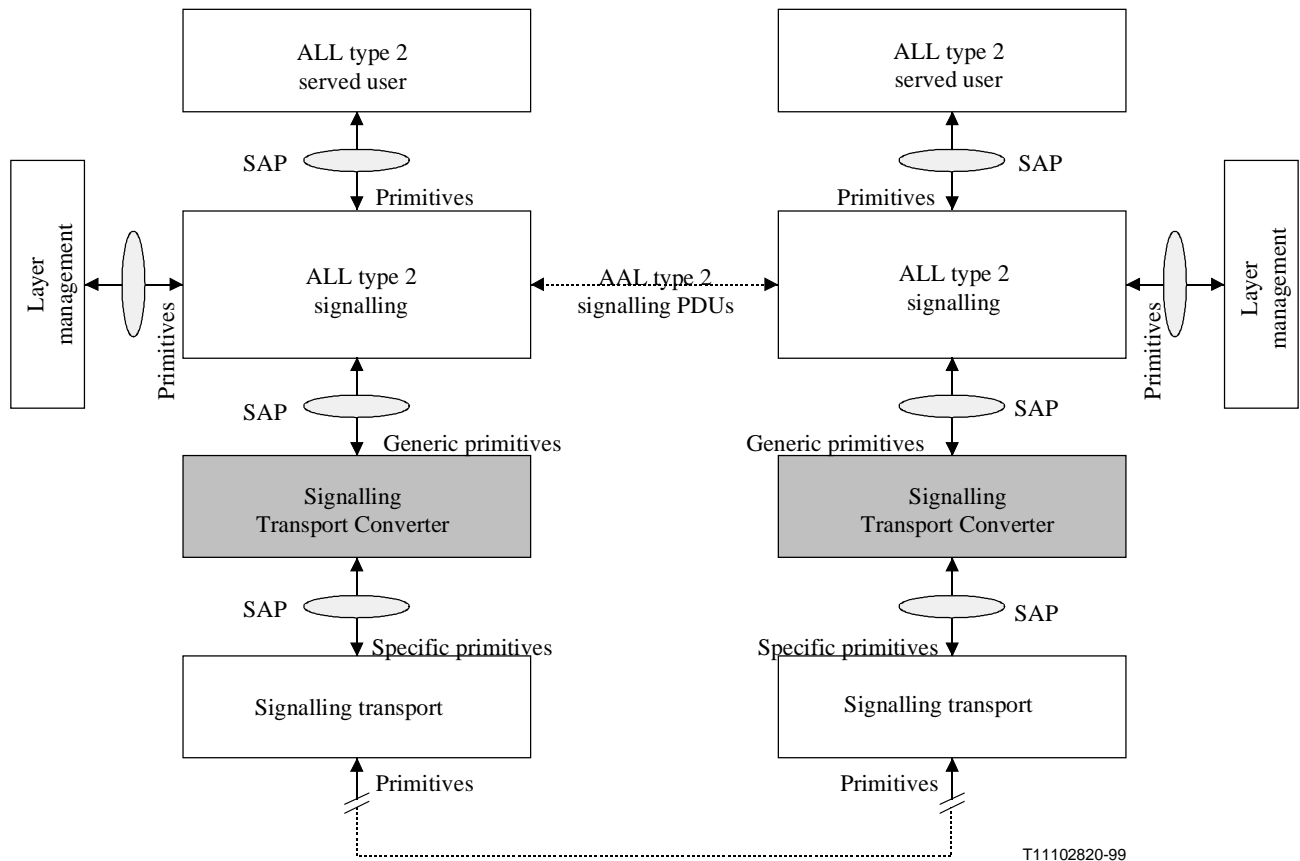
The above information is only used for AAL type 2 path selection and Connection Admission Control.

5.23 Served user transport information

The AAL type 2 signalling endpoint shall transport served user transport information between originating and terminating AAL type 2 served users during the connection establishment phase. If this information is generated optionally by the originating AAL type 2 served user, it may be conveyed transparently to the terminating AAL type 2 served user.

6 Architecture of AAL type 2 signalling

A generic "Signalling Transport Converter" has been defined as a base upon which the AAL type 2 signalling can be deployed. This "Signalling Transport Converter" entity maps a set of generic service layer-to-layer service primitives into one of the sets of layer-to-layer service primitives supported by the underlying signalling transport. These relations are depicted in Figure 2.



NOTE – The primitive between the AAL type 2 served user and the AAL type 2 signalling exist only in AAL type 2 signalling endpoints.

Figure 2 – Generic signalling transport protocol stack

In Figure 3, the situation with various signalling transport options is shown. The AAL type 2 signalling endpoint relies on a generic signalling transport service (represented with the generic primitives). Any protocol stack that provides this generic signalling transport service is allowed.

NOTE – Other possible protocol stacks not shown in Figure 3 are, e.g. the "Null" signalling transport converter, protocol stacks based on CID value "2" in AAL type 2.

"Signalling Transport Converter" operations may include:

- passing parameters from the generic primitives to the specific primitives and vice versa;
- adding parameters to specific primitives issued and ignoring parameters from specific primitives received;
- issuing specific primitives upon receiving specific primitives without any action on the generic interface, etc.

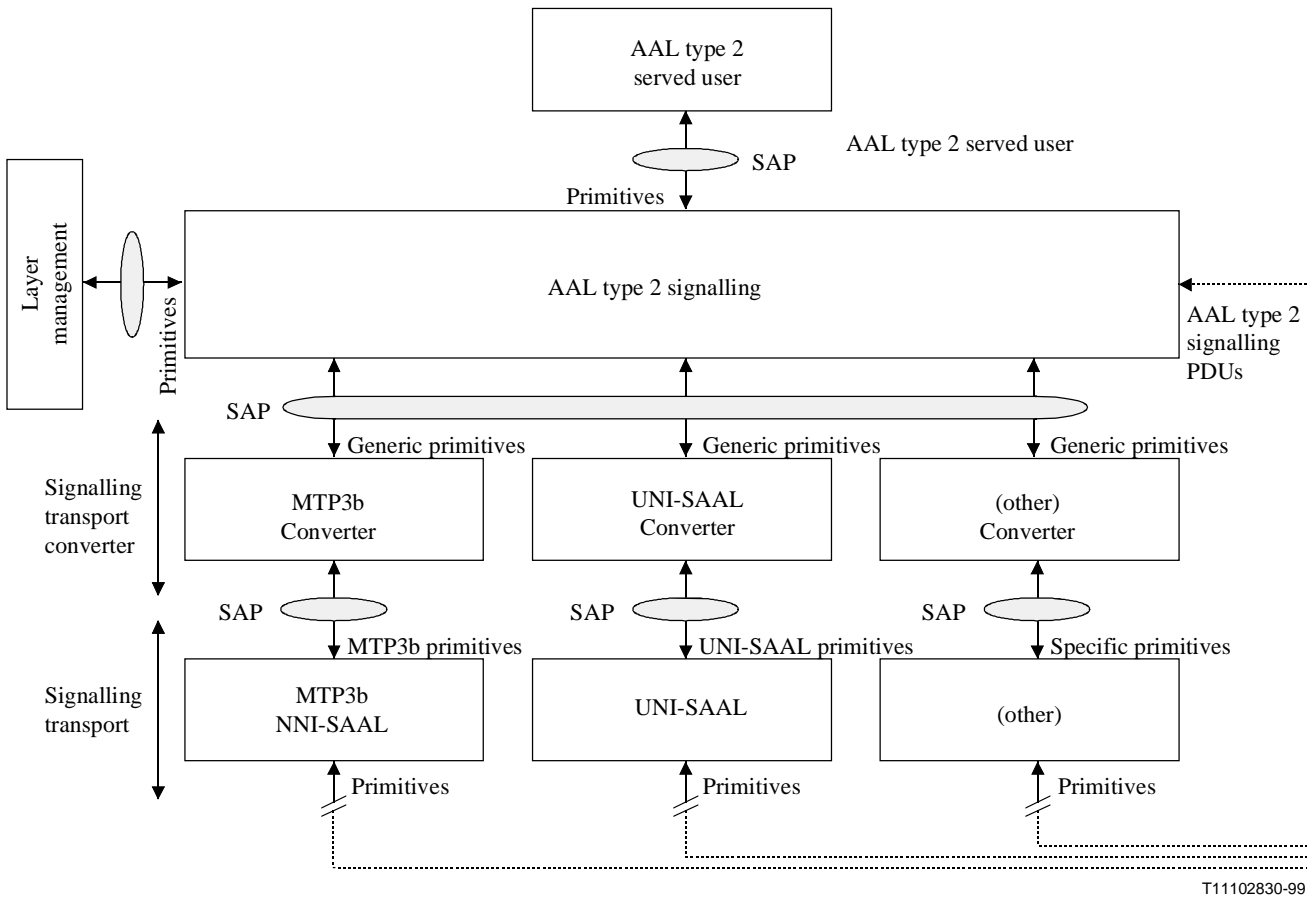


Figure 3 – AAL type 2 signalling transport protocol stack options

7 AAL type 2 signalling flows

The following diagrams illustrate the establishment (successful and unsuccessful) and release of an AAL type 2 connection.

7.1 Successful AAL type 2 Connection Establishment Information Flows

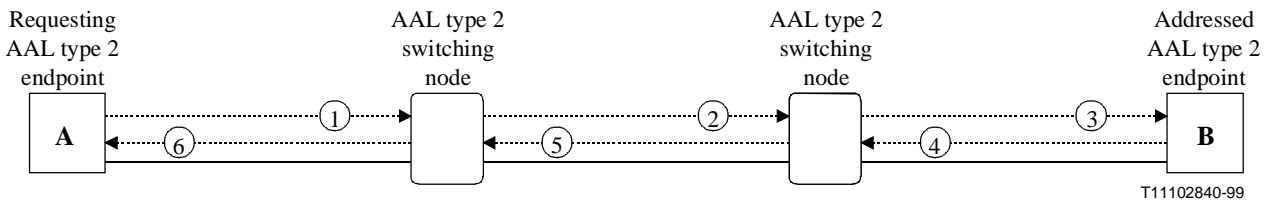


Figure 4 – Successful AAL type 2 Connection Establishment Information Flows

The flows illustrated in Figure 4 are as follows:

— **Flow ①** —

AAL type 2 Setup-Request.ready	Requesting endpoint to switching node	
<u>User information</u>	<u>Connection information</u>	<u>Link information</u>
AAL type 2 served user generated reference = 1 Served user transport information	Endpt. Address = B, AAL type 2 Link Characteristics	CID = 15, AAL type 2 Path Identifier = 27

Initiation of information flow: The requesting endpoint starts to establish an AAL type 2 network connection.

Processing upon receipt: The switching node selects a route towards the addressed endpoint that can provide enough resources to carry the AAL type 2 network connection to be established. It then issues Information Flow 2.

— **Flow ②** —

AAL type 2 Setup-Request.ready	Switching node to switching node	
<u>User information</u>	<u>Connection information</u>	<u>Link information</u>
AAL type 2 served user generated reference = 1 Served user transport information	EndPt. Address = B, AAL type 2 Link Characteristics	CID = 25, AAL type 2 Path Identifier = 18

Processing upon receipt: The switching node selects a route towards the addressed endpoint that can provide enough resources to carry the AAL type 2 network connection to be established. It then issues Information Flow 3.

— **Flow ③** —

AAL type 2 Setup-Request.ready	Switching node to addressed endpoint	
<u>User information</u>	<u>Connection information</u>	<u>Link information</u>
AAL type 2 served user generated reference = 1 Served user transport information	End Pt. Address = B, AAL type 2 Link Characteristics	CID = 10, AAL type 2 Path Identifier = 55

Processing upon receipt: The addressed endpoint assures that enough resources in the endpoint remain for the new AAL type 2 network connection. It then issues Information Flow 4 to confirm the establishment. Finally, the AAL type 2 signalling served user is informed about the establishment of the new AAL type 2 network connection.

— **Flow ④** —

AAL type 2 Setup-Request.commit	Addressed endpoint to switching node	
<u>User information</u>	<u>Connection information</u>	<u>Link information</u>
(none)	(none)	CID = 10, AAL type 2 Path Identifier = 55

Processing upon receipt: The switching node propagates the confirmation of the AAL type 2 network connection establishment as Information Flow 5.

— **Flow ⑤** —

AAL type 2 Setup-Request.commit

User information

(none)

Switching node to switching node

Connection information

(none)

Link information

CID = 25,
AAL type 2 Path Identifier = 18

Processing upon receipt: The switching node propagates the confirmation of the AAL type 2 network connection establishment as Information Flow 6.

— **Flow ⑥** —

AAL type 2 Setup-Request.commit

User information

(none)

Switching node to requesting endpoint

Connection information

(none)

Link information

CID = 15,
AAL type 2 Path Identifier = 27

Processing upon receipt: The requesting endpoint informs the AAL type 2 signalling served user about the completion of the requested AAL type 2 network connection establishment.

NOTE 1 – The CID values, the AAL type 2 Path Identifier values and the AAL type 2 Connection Identifier values are chosen for illustrative purposes only.

NOTE 2 – The combination of CID value and AAL type 2 Path Identifier value identifies the AAL type 2 link controlled by the AAL type 2 signalling peer entities.

7.2 Unsuccessful AAL type 2 Connection Establishment Information Flows

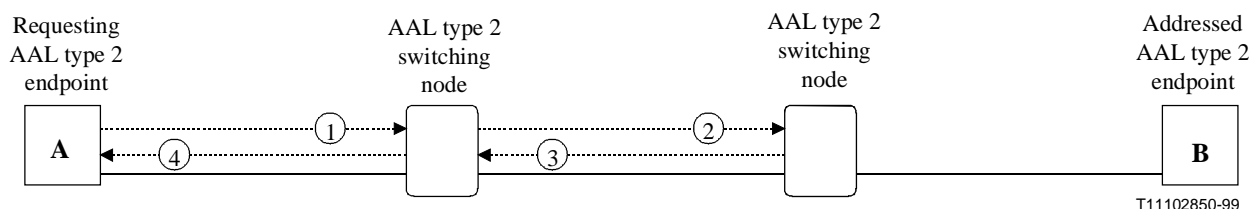


Figure 5 – Unsuccessful AAL type 2 Connection Establishment Information Flows

The flows illustrated in Figure 5 are as follows:

— **Flow ①** —

AAL type 2 Setup-Request.ready

User information

AAL type 2 served user generated reference = 1
Served user transport information

Requesting endpoint to switching node

Connection information

Endpt. Address = B,
AAL type 2 Link Characteristics

Link information

CID = 15,
AAL type 2 Path Identifier = 27

Initiation of information flow: The requesting endpoint starts to establish an AAL type 2 network connection.

Processing upon receipt: The switching node selects a route towards the addressed endpoint that can provide enough resources to carry the AAL type 2 network connection to be established. It then issues Information Flow 2.

Flow ②

AAL type 2 Setup-Request.ready

Switching node to switching node

User information

Connection information

Link information

AAL type 2 served user generated reference = 1
Served user transport information

Endpt. Address = B,
AAL type 2 Link Characteristics

CID = 25,
AAL type 2 Path Identifier = 18

Processing upon receipt: The switching node attempts to select a route towards the addressed endpoint; however, no route is available that can provide enough resources to carry the AAL type 2 network connection to be established – the establishment has to be cancelled. The switching node then releases all resources already committed to the new AAL type 2 network connection and issues Information Flow 3.

Flow ③

AAL type 2 Setup-Request.cancel

Switching node to switching node

User information

Connection information

Link information

(none)

(none)

CID = 25,
AAL type 2 Path Identifier = 18

Processing upon receipt: The switching node releases all resources already committed to the new AAL type 2 network connection and propagates the cancellation of the AAL type 2 network connection establishment as Information Flow 4.

Flow ④

AAL type 2 Setup-Request.cancel

Switching Node to Requesting EndPoint

User information

Connection information

Link information

(none)

(none)

CID = 15,
AAL type 2 Path Identifier = 27

Processing upon receipt: The requesting endpoint releases all resources already committed to the new AAL type 2 network connection and informs the AAL type 2 signalling served user about the cancellation of the requested AAL type 2 network connection establishment.

NOTE 1 – The CID values, the AAL type 2 Path Identifier values and the AAL type 2 Connection Identifier values are chosen for illustrative purposes only.

NOTE 2 – The combination of CID value and AAL type 2 Path Identifier value identifies the AAL type 2 link controlled by the AAL type 2 signalling peer entities.

7.3 AAL type 2 Connection Release Information Flows

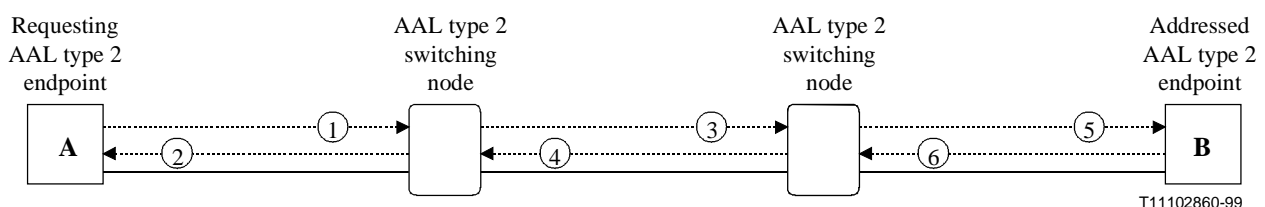


Figure 6 – AAL type 2 Connection Release Information Flows

The flows illustrated in Figure 6 are as follows:

— **Flow ①** —

AAL type 2 Release-Request.ready	Requesting endpoint to switching node	
<u>User information</u>	<u>Connection information</u>	<u>Link information</u>
(none)	(none)	CID = 15, AAL type 2 Path Identifier = 27

Initiation of information flow: The requesting endpoint starts to release an AAL type 2 network connection.

Processing upon receipt: The switching node may release some resources committed to the AAL type 2 network connection, issues Information Flow 2 to confirm the release and Information Flow 3 to propagate the release along the route of the AAL type 2 network connection.

— **Flow ②** —

AAL type 2 Release-Request.commit	Switching node to requesting endpoint	
<u>User information</u>	<u>Connection information</u>	<u>Link information</u>
(none)	(none)	CID = 15, AAL type 2 Path Identifier = 27

Processing upon receipt: The requesting endpoint releases all remaining resources committed to the AAL type 2 network connection and confirms the release to the AAL type 2 signalling served user.

— **Flow ③** —

AAL type 2 Release-Request.ready	Switching node to switching node	
<u>User information</u>	<u>Connection information</u>	<u>Link information</u>
(none)	(none)	CID = 25, AAL type 2 Path Identifier = 18

Initiation of information flow: Information Flow 1 has been processed.

Processing upon receipt: The switching node may release some resources committed to the AAL type 2 network connection, issues Information Flow 4 to confirm the release and Information Flow 5 to propagate the release.

— **Flow ④** —

AAL type 2 Release-Request.commit	Switching node to switching node	
<u>User information</u>	<u>Connection information</u>	<u>Link information</u>
(none)	(none)	CID = 25, AAL type 2 Path Identifier = 18

Processing upon receipt: The switching node releases all remaining resources.

Flow ⑤

AAL type 2 Release-Request.ready**Switching node to addressed endpoint****User information****Connection information****Link information**

(none)

(none)

CID = 10,

AAL type 2 Path

Identifier = 55

Initiation of information flow: Information Flow 3 has been processed.

Processing upon receipt: The addressed endpoint releases all resources committed to the AAL type 2 network connection, issues Information Flow 6 to confirm the release and informs the AAL type 2 signalling served user about the release of the AAL type 2 network connection.

Flow ⑥

AAL type 2 Release-Request.commit**Addressed endpoint to switching node****User information****Connection information****Link information**

(none)

(none)

CID = 10,

AAL type 2 Path

Identifier = 55

Processing upon receipt: The switching node releases all remaining resources.

NOTE 1 – The CID values and the AAL type 2 Path Identifier values are chosen for illustrative purposes only.

NOTE 2 – The combination of CID value and AAL type 2 Path Identifier value identifies the AAL type 2 link controlled by the AAL type 2 signalling peer entities.

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