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European Standard (Telecommunications series)

Transmission and Multiplexing (TM); Generic requirements of Asynchronous Transfer Mode (ATM) transport functionality within equipment; Part 2-1: Functional model for the transfer and layer management plane

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Contents

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Transmission and Multiplexing (TM), in order to provide inter-vendor and inter-operator compatibility of Asynchronous Transfer Mode (ATM) equipment.

The present document is part 2 of a multi-part EN covering the generic requirements of Asynchronous Transfer Mode (ATM) transport functionality within equipment, as identified below:

Part 1: "Functional characteristics and equipment performance";

Part 2: "Functional model for the transfer and layer management plane".

National transposition dates	
Date of adoption of this EN:	23 April 1999
Date of latest announcement of this EN (doa):	31 July 1999
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 January 2000
Date of withdrawal of any conflicting National Standard (dow):	31 January 2000

1 Scope

The purpose of the present document is to provide specifications for Asynchronous Transfer Mode (ATM) equipment to be used in the ETSI region. Such specifications will ensure compatibility between equipment by identifying which functions are mandatory for interworking and which can be considered as truly optional. Of course it is not the intention to prevent manufacturers or procurers from following an alternative specification, but the consequences should become clear from the present document.

The document will be in two parts, producing a list of functions and processes in the first part and a formal representation of transfer transport and layer management functions in the second part. The specification will take advantage of the work done in ITU but will take the work further with an ETSI European view. This means: the identification of ITU options to be mandatory in Europe, deletion of options not required for Europe, creation of new or revised descriptions where necessary, identification of guideline or benchmark performance parameters for classes of equipment.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] ETS 300 147: "Transmission and Multiplexing (TM); Synchronous Digital Hierarchy (SDH); Multiplexing structure".

[2] ETS 300 298-1: "Broadband Integrated Services Digital Network (B-ISDN); Asynchronous Transfer Mode (ATM); Part 1: B-ISDN ATM functional characteristics [ITU-T Recommendation I.150 (1995)]".

[3] ETS 300 298-2: "Broadband Integrated Services Digital Network (B-ISDN); Asynchronous Transfer Mode (ATM); Part 2: B-ISDN ATM layer specification".

[4] ETS 300 300 (1997): "Broadband Integrated Services Digital Network (B-ISDN); Synchronous Digital Hierarchy (SDH) based user network access; Physical layer User Network Interfaces (UNI) for 155 520 kbit/s and 622 080 kbit/s Asynchronous Transfer Mode (ATM) B-ISDN applications".

[5] EN 300 301 (V1.2): "Broadband Integrated Services Digital Network (B-ISDN); Traffic control and congestion control in B-ISDN".

[6] ETS 300 337: "Transmission and Multiplexing (TM); Generic frame structures for the transport of various signals (including Asynchronous Transfer Mode (ATM) cells and Synchronous Digital Hierarchy (SDH) elements) at the ITU-T Recommendation G.702 hierarchical rates of 2 048 kbit/s, 34 368 kbit/s and 139 264 kbit/s".

[7] ETS 300 354: "Broadband Integrated Services Digital Network (B-ISDN); B-ISDN Protocol Reference Model (PRM)".

[8] ETS 300 404: "Broadband Integrated Services Digital Network (B-ISDN); B-ISDN Operation And Maintenance (OAM) principles and functions".

[9] EN 300 417-1-1 (V1.1): "Transmission and Multiplexing (TM); Generic requirements of transport functionality of equipment; Part 1-1: Generic processes and performance".

[10] ITU-T Recommendation G.707: "Network node interface for the synchronous digital hierarchy (SDH)".

[11] ITU-T Recommendation G.803: "Architecture of transport networks based on the synchronous digital hierarchy (SDH)".

[12] ITU-T Recommendation G.804: "ATM cell mapping into plesiochronous digital hierarchy (PDH)".

[13] ITU-T Recommendation G.805: "Generic functional architecture of transport networks".

[14] ITU-T Recommendation G.832: "Transport of SDH elements on PDH networks: Frame and multiplexing structures".

[15] ITU-T Recommendation I.150: "B-ISDN asynchronous transfer mode functional characteristics".

[16] ITU-T Recommendation I.321: "B-ISDN protocol reference model and its application".

[17] ITU-T Recommendation I.326: "Functional architecture of transport networks based on ATM".

[18] ITU-T Recommendation I.361: "B-ISDN ATM layer specification".

[19] ITU-T Recommendation I.371: "Traffic control and congestion control in B-ISDN".

[20] ITU-T Recommendation I.432: "B-ISDN user-network interface - Physical layer specification".

[21] ITU-T Recommendation I.432.1: "B-ISDN user-network interface - Physical layer specification: General characteristics".

[22] ITU-T Recommendation I.432.2: "B-ISDN user-network interface - Physical layer specification: 155 520 kbit/s and 622 080 kbit/s operation".

[23] ITU-T Recommendation I.610: "B-ISDN operation and maintenance principles and functions".

[24] ITU-T Recommendation I.732: "Functional characteristics of ATM equipment".

3 Definitions, abbreviations and symbols

3.1 Definitions

For the purposes of the present document, the terms and definitions given in EN 300 417-1-1 [9] apply.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

3.2.1 Modelling specific abbreviations

A	Adaptation function
a	consequent action
AI	Adapted Information
AP	Access Point
APId	Access Point Identifier
C	Connection function
c	defect cause
CI	Characteristic Information
CK	ClocK
CP	Connection Point
D	Data
d	defect correlation

G	Group
L	Layer
m	monitoring function
MI	Management Information
P12s	2 048 kbit/s PDH path layer with synchronous 125 µs frame structure
P31s	34 368 kbit/s PDH path layer with synchronous 125 µs frame structure
RI	Remote Information
S	Segment
S4	VC-4 path layer
Sk	Sink
So	Source
SSF	Server Signal Fail
T	Traffic management
TI	Timing Information
TT	Trail Termination function
vc	virtual channel
vp	virtual path

3.2.2 General abbreviations

AAL	ATM Adaptation Layer
ACS	ATM Cell Start
AIS	Alarm Indication Signal
ATM	Asynchronous Transfer Mode
BRPM	Backward Report Performance Monitoring
CBDS	Connectionless Broadband Data Service
CC	Continuity Check
CCAD	Continuity Check Activation/Deactivation
CLP	Cell Loss Priority
CNGI	CoNGestion Indication
dLCD	Loss of Cell Delineation defect
EFCI	Explicit Forward Congestion Indicator
EMF	Element Management Function
F_DS	Far-end Defect Second
FS	Frame Start signal
GFC	Generic Flow Control
HDLC	High-level Data Link Control procedure
HEC	Header Error Check
Hex	Hexadecimal
ID	IDentifier
LAN	Local Area Network
LB	LoopBack
LLID	Loopback Location IDentifier
LOC	Loss of Continuity
MA	Maintenance and Adaptation
N_DS	Near-end Defect Second
NE	Network Element
N-ISDN	Narrowband Integrated Services Digital Network
NNI	Network Node Interface
NPC	Network Parameter Control
OAM	Operation, Administration and Maintenance
OCD	Out of Cell Delineation
PDH	Plesiochronous Digital Hierarchy
PLM	PayLoad Mismatch
PM	Performance Monitoring
PMAD	Performance Monitoring Activation/Deactivation
POH	Path OverHead
PRM	Protocol Reference Model
PTI	Payload Type Identifier
QoS	Quality Of Service

RDI	Remote Defect Indicator
RLCD	Remote Loss of Cell Delineation
SDH	Synchronous Digital Hierarchy
SLOC	Segment Loss Of Continuity
SSF	Server Signal Fail
TP	Timing Point
TP	Transmission Path
TSF	Trail Signal Fail
UNI	User Network Interface
UPC	Usage Parameter Control
VC	Virtual Channel
VC	Virtual Container
VCC	Virtual Channel Connection
VP	Virtual Path
VPC	Virtual Path Connection
VPI	Virtual Path Identifier

3.3 Symbols and diagrammatic conventions

For the purposes of the present document, the symbols and diagrammatic conventions described in EN 300 417-1-1 [9] apply.

3.4 Introduction

The atomic functions used in the Transmission Path (TP) convergence, ATM Virtual Path (VP) and Virtual Channel (VC) Layer Networks and their associated Adaptation functions are defined in the present document.

The document is structured in the following manner:

- Transmission Path to Avp Adaptation Functions:
  - SDH Adaptation Functions;
  - Cell Based Adaptation Functions;
  - PDH Adaptation Function.
- VP Layer Network, including Connection, Trail Termination, Segment, Traffic Management, Monitoring and Loopback Functions;
- Avp to Avc Adaptation Functions;
- VC Layer Network, including Connection, Trail Termination, Segment, Traffic Management, Monitoring and Loopback Functions;
- Avc to ATM Client Layer Adaptation Functions.

The Layer Networks and Adaptation functions are defined for the purpose of the user to group them into a higher level grouping, if required. The decomposition of the atomic function sequence into Layer Networks and Adaptation functions correspond to the view of ITU-T Recommendation G.805 [13]. It also represents the common basis view from the Synchronous Digital Hierarchy (SDH) and ATM history perspective, since ITU-T Recommendation G.803 [11] (defining SDH networks) as well as ITU-T Recommendation I.326 [17] (defining ATM networks) are both based on ITU-T Recommendation G.805 [13].

For the SDH view, the grouping used in ITU-T Recommendation G.803 [11] is the Network Layer (or simply called Layer). It associates the Layer Network and the Adaptation function in Client Layer direction into the grouping called "Network Layer".

For the ATM view, the grouping used in ITU-T Recommendation I.326 [17] is the Transport Assembly, also called VP Level resp. VC Level. It associates the Layer Network and the Adaptation function in Server direction into the grouping called respectively "VP Level" and "VC Level".

Figure 1 shows the grouping of the Adaptation function to the Layer Network according to the two views.

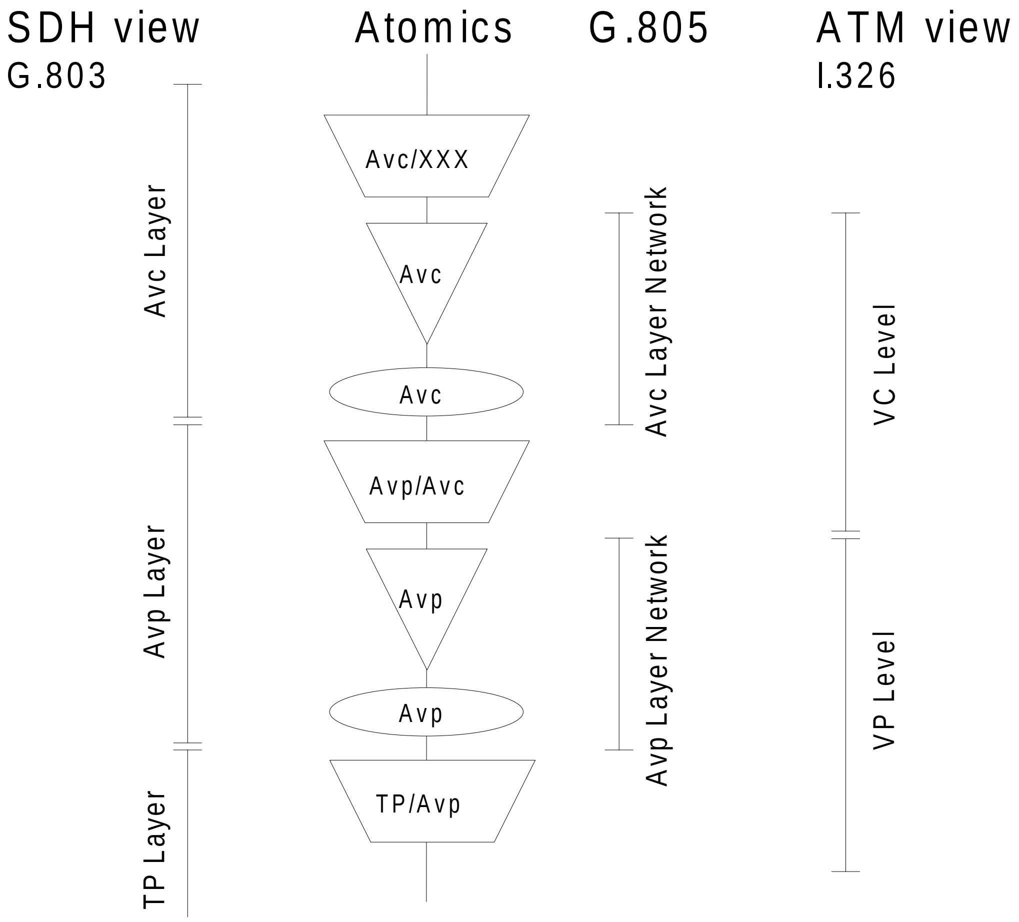


Figure 1: Different views for the grouping of the adaptation functions

4 Transmission path to ATM virtual path adaptation functions

4.1 S3 path adaptation functions

4.1.1 S3 path to ATM virtual path adaptation source function S3/Avp_A_So

Symbol:

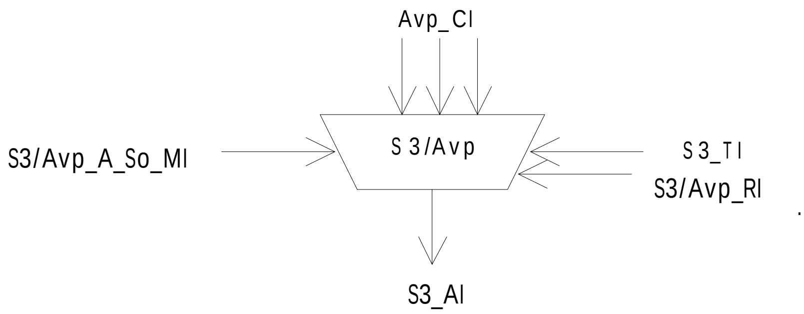


Figure 2: S3/Avp_A_So symbol

Interfaces:

Table 1: S3/Avp_A_So input and output signals

Input(s)	Output(s)
per Avp_CI for each VP configured: Avp_CI_D Avp_CI_ACS Avp_CI_SSF S3_TI_CK S3_TI_FS S3/Avp_RI_RLCD S3/Avp_A_So_MI_Active S3/Avp_A_So_MI_CellDiscardActive S3/Avp_A_So_MI_TPusgActive S3/Avp_A_So_MI_GFCActive S3/Avp_A_So_MI_VPI-KActive	S3_AI_D S3_AI_CK S3_AI_FS

The S3/Avp_A_So function provides adaptation from the ATM Virtual Path to the VC-3 path. This is performed by a grouping of Specific Processes and Common Processes as shown in figure 3.

Activation: The function shall access the access point when it is activated (MI_Active is true). Otherwise, it shall not access the access point.

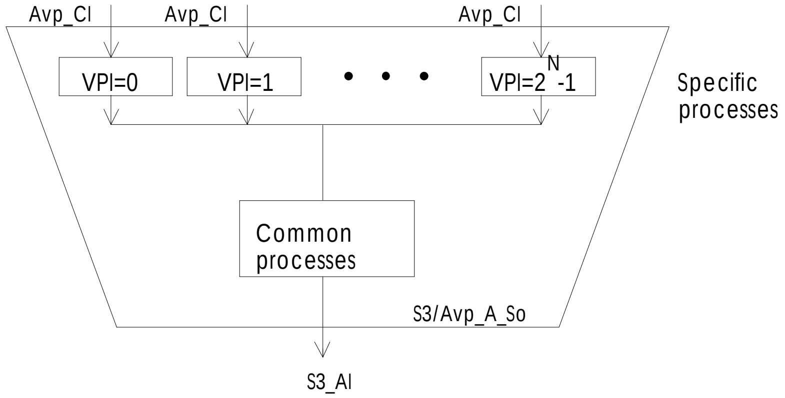


Figure 3: S3/Avp_A_So atomic function decomposed into Specific and Common processes parts

NOTE 1: The sequential order of the processes within the atomic functions is important. For the correct order, refer to the ordering of the processes given below.

Specific Processes:

These Processes include VPI setting as well as VP asynchronous multiplexing. Each of these Specific Processes is characterized by the Virtual Path Identifier number K, where $0 \leq K \leq 2^N - 1$.

VPI-K Activation: The Specific Processes perform the operation specified below when it is activated (MI_VPI-KActive is true).

The format of the Characteristic Information (Avp_CI) is given in figure 4.

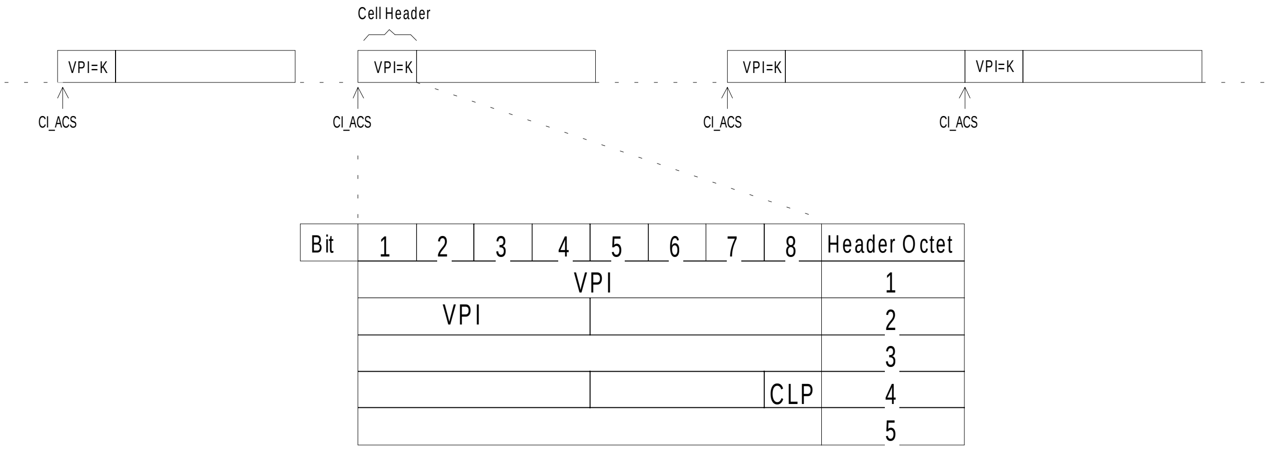


Figure 4: Avp_CI (NNI format)

VPI setting is based on the activation of the Specific function by MI_VPI-KActive and inserts the value of "K" as VPI.

NOTE 2: The value of N represents the number of bits in the VPI field and is an integer number. Its maximum value is equal to 12 for the ATM NNI. Its maximum value is equal to 8 for the ATM UNI.

VP multiplexing: Asynchronous multiplexing is performed for each active Specific function.

Common Processes:

The Common Processes include: Congestion control (selective cell discard (CLP based)), GFC processing, TP usage measurement, cell rate decoupling, HEC processing, cell information field scrambling, cell stream mapping and processing of the payload specific bytes C2 and H4, as well as bits 6 and 7 of G1, to the VC-3 Path OverHead (POH). The logical ordering of the processes from input to output shall be maintained.

Bit	1	2	3	4	5	6	7	8	Header Octet
	GFC								1
									2
									3
									4
	HEC								5

Figure 5: Cell header information processed in S3/Avp_A_So

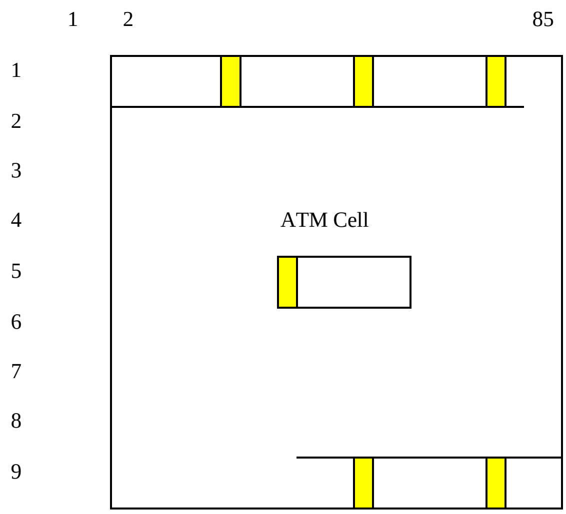


Figure 6: ATM cell stream mapping into Container-3 structure

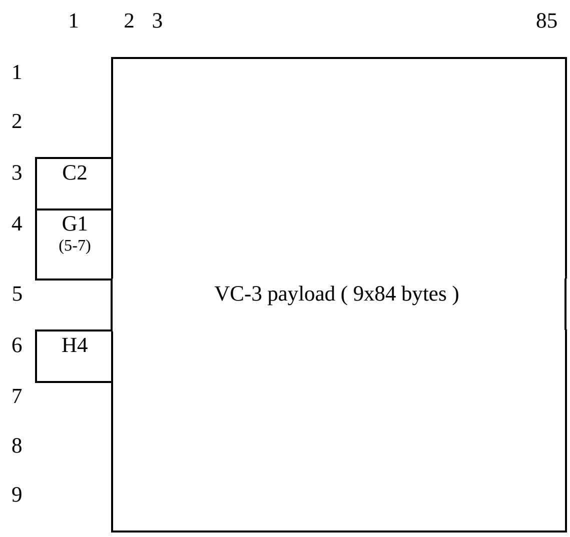


Figure 7: S3_AI_So_D

Congestion control: If enabled by MI_CellDiscardActive, this function shall perform selective cell discard according to CLP value. In the event of congestion, cells with CLP = 1 are subject to be discarded prior to cells with CLP = 0. See EN 300 301 [5] (ITU-T Recommendation I.371 [19]) for further details about the use of the CLP. In the event of congestion, the Explicit Forward Congestion Indicator (EFCI) marking in the Payload Type Identifier (PTI) field is set according to ETS 300 298-2 [3] (ITU-T Recommendation I.361 [18]).

GFC processing: The support of the GFC protocol applies to the UNI and in point-to-point configuration only and is an option. The GFC function uses assigned and unassigned cells. Two modes of operation are available: Uncontrolled Transmission (MI_GFCActive = false) and Controlled Transmission (MI_GFCActive = true). If enabled by MI_GFCActive = true, this function shall insert the GFC protocol in the GFC field. The GFC field processing is defined in ETS 300 298-1 [2] (ITU-T Recommendation I.150 [15]) and ETS 300 298-2 [3] (ITU-T Recommendation I.361 [18]). If the GFC function is not supported or the GFC function disabled by MI_GFCActive = false, the binary contents of the GFC field shall be set to "0000". In Uncontrolled Transmission mode, neither the controlling nor the controlled Network Element (NE) performs the GFC procedure.

NOTE 3: The application of the GFC function in the ETSI environment is for further study.

TP usage measurement: The function shall count the transmitted cells for cell measurement purposes. This cell counting shall be activated/deactivated by MI_TPusgActive.

Cell rate decoupling: This process takes the ATM cell stream present at its input and inserts it into the synchronous container having a capacity of 765 bytes adding fixed stuff idle cells. The idle cells format is specified in ETS 300 298-2 [3]. The cell rate decoupling process makes use of the VC-3 timing clock, frame position (S3_TI), and idle cell generator.

HEC Processing: The HEC value for each cell is calculated and inserted into the HEC field. The method of HEC value calculation shall be according to ETS 300 300 [4] (ITU-T Recommendation I.432.1 [21]).

Cell information field scrambling: The self synchronizing scrambler polynomial $x^{43} + 1$ has been identified for the SDH-based transmission paths and minimizes the error multiplication introduced by the self synchronizing scrambling process. It scrambles the information field bits only. The operation of the scrambler shall be according to ETS 300 300 [4], subclause 10.5.3 (ITU-T Recommendation I.432.1 [21], subclause 4.3.4).

Cell stream mapping: The octet structure of ATM cells shall be aligned with the octet structure of Container-3 as shown in figure 6.

Processing of the payload specific bytes:

H4: This payload dependent byte is not used for the mapping of ATM cells into VC-3. The contents of this byte shall be 00Hex.

G1: Bits 5, 6 and 7 of this byte are used to signal RLCD to the remote end. However, bits 5-7 may be overwritten by the server layer (TP). Refer to table 4 of ITU-T Recommendation I.432.2 [22].

NOTE 4: For backward compatibility with equipment complying with the 1993 version of ITU-T Recommendation I.432.1 [21], old equipment may use "100" or "111" codes in bits 5-7 of G1 to indicate a Remote Loss of Cell Delineation (RLCD).

NOTE 5: Up to date, no application for the RLCD indication in G1 byte was found. However, in order to maintain compatibility with ITU-T, the RLCD indication has to be set in source direction; it will be ignored in sink direction.

C2: In this byte the function shall insert code "0001 0011" (ATM mapping) as defined in ETS 300 147 [1].

Defects: None.

Consequent Actions:

On declaration of RI_RLCD, the function shall output RLCD (pattern "010" in bits 5-7 of G1 byte) within x µs; on clearing of RI_RLCD the function shall clear the RLCD indication defined in this byte within x µs.

NOTE 6: The value of x is for further study. Refer to the processing of RLCD.

Defect Correlations: None.

Performance Monitoring:

The use of the Performance Monitoring parameters are for further study. The parameters for the following functions need to be defined:

- TP usage measurement;
- Count of discarded cells from congestion control.

4.1.2 S3 path to ATM virtual path adaptation sink function S3/Avp_A_Sk

Symbol:

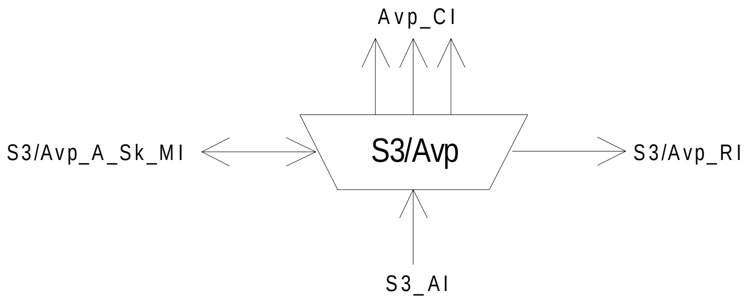


Figure 8: S3/Avp_A_Sk symbol

Interfaces:

Table 2: S3/Avp_A_Sk input and output signals

Input(s)	Output(s)
S3_AI_D S3_AI_CK S3_AI_FS S3_AI_TSF S3/Avp_A_Sk_MI_Active S3/Avp_A_Sk_MI_CellDiscardActive S3/Avp_A_Sk_MI_TPusgActive S3/Avp_A_Sk_MI_VPIrange S3/Avp_A_Sk_MI_HECactive S3/Avp_A_Sk_MI_GFCActive S3/Avp_A_Sk_MI_DFLOC S3/Avp_A_Sk_MI_VPI-KActive	per Avp_CI, for each VP configured: Avp_CI_D Avp_CI_ACS Avp_CI_SSF Avp_CI_CNGI S3/Avp_RI_RLCD S3/Avp_A_Sk_MI_cPLM S3/Avp_A_Sk_MI_cLCD

Processes:

The S3/Avp_A_Sk function provides adaptation from the VC-3 Path to the ATM Virtual Path. This is performed by a grouping of Specific Processes and Common Processes as shown in figure 9.

Activation: The S3/Avp_A_Sk function shall perform the Common and Specific Processes operation specified below when it is activated (MI_Active is true). Otherwise, it shall activate the SSF signals at its output (CI_SSF) and not report its status via the management point.

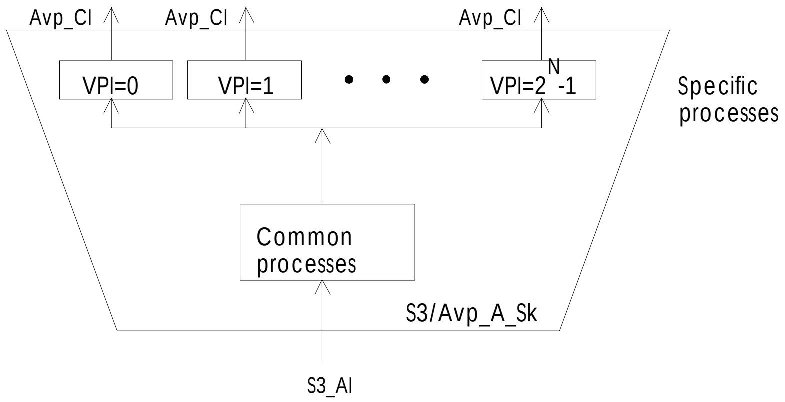


Figure 9: S3/Avp_A_Sk atomic function decomposed into Specific and Common Processes parts

NOTE 1: The sequential order of the processes within the atomic functions is important. For the correct order, refer to the ordering of the processes given below.

Common Processes:

These Common Processes include: Handling of the payload specific bytes (C2, H4 and G1), demapping, cell delineation, cell information field descrambling, HEC processing, cell rate decoupling, TP usage measurement, header verification, GFC processing, VPI verification and congestion control (selective cell discard (CLP based)). The logical ordering of these processes from input to output shall be maintained.

Handling of payload specific bytes:

C2: The function shall compare the contents of the accepted C2 byte with the expected value code "0001 0011" (ATM mapping) as a check on consistency between the provisioning operation at each end. The application, acceptance and mismatch detection processes are described in EN 300 417-1-1 [9], subclauses 7.2 and 8.2.1.

H4: This payload dependent byte is not used for this mapping and the receiver shall ignore its contents.

G1: The use of the information for RLCD in bits 6-7 is not defined. The receiver shall ignore its contents.

Demapping: The cell stream shall be extracted from C-3 container in the S3_AI in accordance with ETS 300 147 [1] (ITU-T Recommendation G.707 [10]).

Cell Delineation: Loss of Cell Delineation defect (dLCD) shall be declared if an incorrect HEC is obtained ALPHA times consecutively. dLCD shall be cleared if the cell delineation algorithm enters SYNC state. (According to subclause 10.5.1.1, item 3 of ETS 300 300 [4], (subclause 4.3.3.2 of ITU-T Recommendation I.432.1 [21])).

Cell information field descrambling: The self synchronizing descrambler polynomial $x^{43} + 1$ has been identified for the SDH-based transmission paths and minimizes the error multiplication introduced by the self synchronizing scrambling process (factor 2). It descrambles the information field bits only. The operation of the descrambler in relation to the HEC cell delineation state diagram shall be according to ETS 300 300 [4], subclause 10.5.3 (ITU-T Recommendation I.432.1 [21], subclause 4.3.4).

HEC Processing: HEC verification and correction shall be according to ETS 300 300 [4] (ITU-T Recommendation I.432.1 [21]). Cells determined to have an invalid and incorrectible HEC pattern shall be discarded. A count of invalid HEC events and a count of invalid HEC cell discard events are maintained with threshold crossings checked. HEC correction mode may be activated/deactivated by MI_HECactive. The HEC correction mode should be activated by default.

Cell rate decoupling: The function shall extract the Idle cells used as fixed stuff in the far-end S3/Avp adaptation source function.

TP usage measurement: The function shall count the received cells for cell measurement purposes. This cell counting shall be activated/deactivated by MI_TPusgActive.

Header verification: Invalid header patterns from paths based on SDH/PDH transmission systems are as follows (except idle cell)(x = any value):

	GFC	VPI	VCI	PTI	CLP
UNI	xxxx	all 0's	all 0's	xxx	1

	VPI		VCI	PTI	CLP
NNI	all 0's		all 0's	xxx	1

GFC processing: The support of the GFC protocol applies to the UNI and in point-to-point configuration only and is an option. The GFC function uses assigned and unassigned cells. Two modes of operation are available: Uncontrolled Transmission (MI_GFCActive = false) and Controlled Transmission (MI_GFCActive = true). In Uncontrolled Transmission mode, neither the controlling nor the controlled NE performs the GFC procedure. If enabled by MI_GFCActive = true, this function shall extract the GFC protocol from the GFC field. The GFC field processing is defined in ETS 300 298-1 [2] (ITU-T Recommendation I.150 [15]) and ETS 300 298-2 [3] (ITU-T Recommendation I.361 [18]).

NOTE 2: The application of the GFC function in the ETSI environment is for further study.

NOTE 3: According to the Protocol Reference Model (PRM) (ETS 300 354 [7] (ITU-T Recommendation I.321 [16])), the unassigned cells should be processed in the ATM layer. Some of the ATM layer processes are adaptation processes belonging to the adaptation function between the TP and the Avp layer network. The unassigned cells as well as idle cells are per physical connection (VPI = 0, VCI = 0). For this reason the idle and unassigned cells processing is allocated to the same atomic function.

VPI verification: The function shall verify that the received cell VPI is valid. If the VPI is determined to be invalid (i.e. out-of-range VPI or not assigned), the cell shall be discarded. The range of valid VPI is given by MI_VPIrange.

Congestion control: If enabled by MI_CellDiscardActive, this function shall perform selective cell discard according to CLP value. In the event of congestion, cells with CLP = 1 are subject to be discarded prior to cells with CLP = 0. See EN 300 301 [5] (ITU-T Recommendation I.371 [19]) for further details about the use of the CLP. In the event of congestion, the indication Avp_CI_CNGI is set for the traffic management function AvpT_TT_So to insert EFCI.

Specific Processes:

The function performs VP-AIS insertion and demultiplexing on a per VP basis.

VPI-K Activation: The Specific Processes perform the operation specified below when it is activated (MI_VPI-KActive is true). Otherwise, it shall send no cells and Server Signal Fail (SSF) = false.

VP-AIS insertion: If the Specific Processes are activated, theVP-AIS insertion shall be performed as in the Consequent Actions subclause.

VP demultiplexing: The adaptation sink function has access to a specific Avp identified by the number K ($0 \leq K \leq 2^N - 1$). When the function is activated only the cells of that specific Avp-K are passed in client direction.

NOTE 4: The value of N represents the number of bits in the VPI field and is an integer number. Its maximum value is equal to 12 for the ATM NNI. Its maximum value is equal to 8 for the ATM UNI.

Defects:

The function shall detect for the dPLM defect according EN 300 417-1-1 [9], subclause 8.2.1 and for the dLCD defect according to ETS 300 300 [4] (ITU-T Recommendation I.432.1 [21]).

Consequent Actions:

aCNGI ← "Event of Congestion" and CellDiscardActive.

aSSF ← dPLM or dLCD or AI_TSF.

aRLCD ← dLCD and (not AI_TSF) and (not dPLM).

aAIS ← dPLM or dLCD or AI_TSF.

On declaration of aAIS the function shall output VP-AIS Operation And Maintenance (OAM) cells on all active VPCs according to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.1.1); on clearing of aAIS the generation of VP-AIS cells shall be stopped. If implemented, the defect type and defect location field (provided by MI_DFLOC) of the VP-AIS cell shall be inserted in the information field. The contents of these fields is for further study.

NOTE 5: Concerning the declaration of aRLCD, refer to note 6 of G1 byte setting in S3/Avp_A_So function.

Defect Correlations:

cPLM ← dPLM and (not AI_TSF).

cLCD ← dLCD and (not dPLM) and (not AI_TSF).

Performance Monitoring:

The use of the Performance Monitoring parameters are for further study. The parameters for the following functions need to be defined:

- TP usage measurement;
- Count of discarded cells from congestion control;
- Count of invalid HEC events;
- Count of invalid HEC discard events;
- Count of invalid header discard events (one common counter for invalid header/invalid VPI/invalid Virtual Channel Identifier (VCI) is maintained);
- OCD event.

4.2 S4 path adaptation functions

4.2.1 S4 path to ATM virtual path adaptation source function S4/Avp_A_So

Symbol:

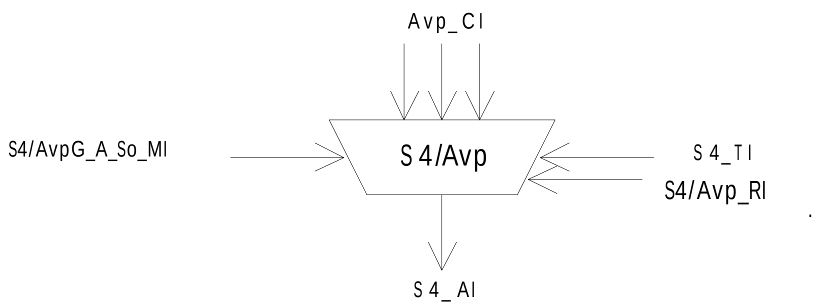


Figure 10: S4/Avp_A_So symbol

Interfaces:

Table 3: S4/Avp_A_So input and output signals

Input(s)	Output(s)
per Avp_CI for each VP configured: Avp_CI_D Avp_CI_ACS Avp_CI_SSF S4_TI_CK S4_TI_FS S4/Avp_RI_RLCD S4/Avp_A_So_MI_Active S4/Avp_A_So_MI_CellDiscardActive S4/Avp_A_So_MI_TPusgActive S4/Avp_A_So_MI_GFCActive S4/Avp_A_So_MI_VPI-KActive	S4_AI_D S4_AI_CK S4_AI_FS

Processes:

The S4/Avp_A_So function provides adaptation from the ATM Virtual Path layer to the VC-4 path. This is performed by a grouping of Specific Processes and Common Processes as shown in figure 11.

Activation: The function shall access the access point when it is activated (MI_Active is true). Otherwise, it shall not access the access point.

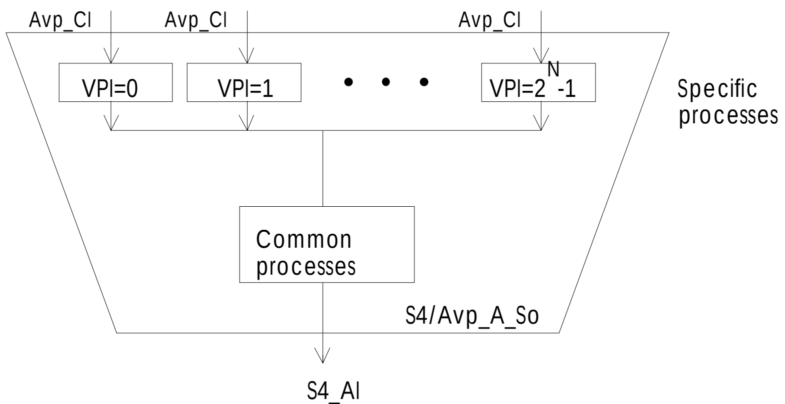


Figure 11: S4/Avp_A_So atomic function decomposed into Specific and Common processes parts

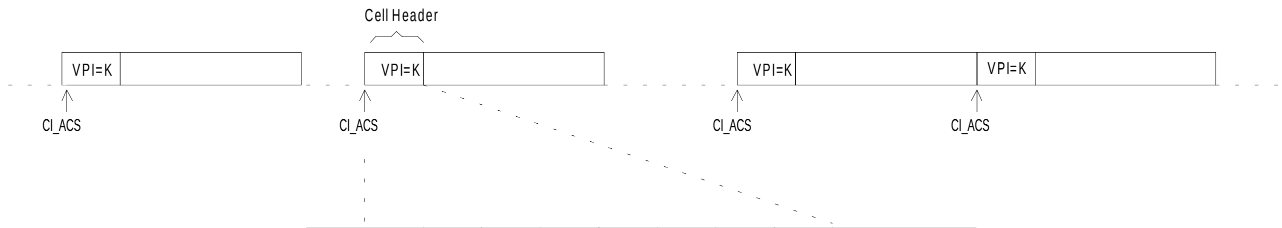
NOTE 1: The sequential order of the processes within the atomic functions is important. For the correct order, refer to the ordering of the processes given below.

Specific Processes:

These Processes include VPI setting as well as VP asynchronous multiplexing. Each of these Specific Processes is characterized by the Virtual Path Identifier number K, where $0 \leq K \leq 2^N - 1$.

VPI-K Activation: The Specific Processes perform the operation specified below when it is activated (MI_VPI-KActive is true).

The format of the Characteristic Information (Avp_CI) is given in figure 12.



Bit	1	2	3	4	5	6	7	8	Header Octet
	VPI								1
	VPI								2
									3
								CLP	4
									5

Figure 12: Avp_CI (NNI format)

VPI setting is based on the activation of the Specific function by MI_VPI-KActive and inserts the value of "K" as VPI.

NOTE 2: The value of N represents the number of bits in the VPI field and is an integer number. Its maximum value is equal to 12 for the ATM NNI. Its maximum value is equal to 8 for the ATM UNI.

VP multiplexing: Asynchronous multiplexing is performed for each active Specific function.

Common Processes:

The Common Processes include: Congestion control (selective cell discard (CLP based)), GFC processing, TP usage measurement, cell rate decoupling, HEC processing, cell information field scrambling, cell stream mapping and processing of the payload specific bytes C2 and H4, as well as bits 6 and 7 of G1, to the VC-4 POH. The logical ordering of the processes from input to output shall be maintained.

Bit	1	2	3	4	5	6	7	8	Header Octet
	GFC								1
									2
									3
									4
	HEC								5

Figure 13: Cell header information processed in S4/Avp_A_So

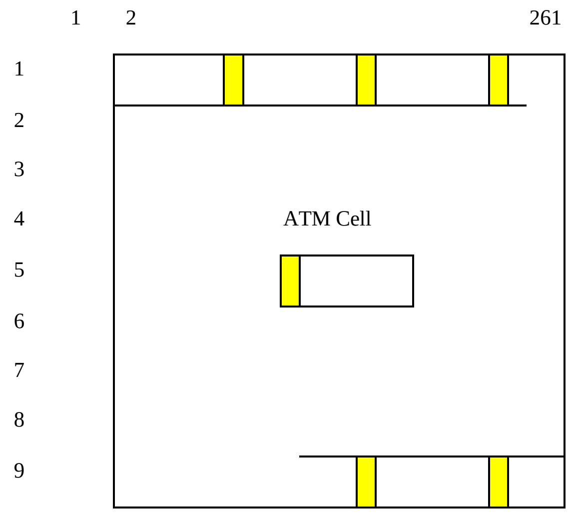


Figure 14: ATM cell stream mapping into Container-4 structure

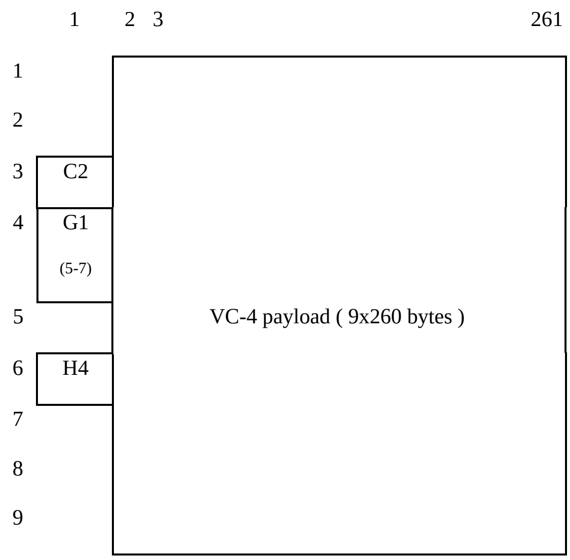


Figure 15: S4_AI_So_D

Congestion control: If enabled by MI_CellDiscardActive, this function shall perform selective cell discard according to CLP value. In the event of congestion, cells with CLP = 1 are subject to be discarded prior to cells with CLP = 0. See EN 300 301 [5] (ITU-T Recommendation I.371 [19]) for further details about the use of the CLP. In the event of congestion, the EFCI marking in the PTI field is set according to ETS 300 298-2 [3] (ITU-T Recommendation I.361 [18]).

GFC processing: The support of the GFC protocol applies to the UNI and in point-to-point configuration only and is an option. The GFC function uses assigned and unassigned cells. Two modes of operation are available: Uncontrolled Transmission (MI_GFCActive = false) and Controlled Transmission (MI_GFCActive = true). If enabled by MI_GFCActive = true, this function shall insert the GFC protocol in the GFC field. The GFC field processing is defined in ETS 300 298-1 [2] (ITU-T Recommendation I.150 [15]) and ETS 300 298-2 [3] (ITU-T Recommendation I.361 [18]). If the GFC function is not supported or the GFC function disabled by MI_GFCActive = false, the binary contents of the GFC field shall be set to "0000". In Uncontrolled Transmission mode, neither the controlling nor the controlled NE performs the GFC procedure.

NOTE 3: The application of the GFC function in the ETSI environment is for further study.

TP usage measurement: The function shall count the transmitted cells for cell measurement purposes. This cell counting shall be activated/deactivated by MI_TPusgActive.

Cell rate decoupling: This process takes the ATM cell stream present at its input and inserts it into the synchronous container having a capacity of 2 340 bytes adding fixed stuff idle cells. The idle cells format is specified in ETS 300 298-2 [3]. The cell rate decoupling process makes use of the VC-4 timing clock, frame position (S4_TI), and idle cell generator.

HEC Processing: The HEC value for each cell is calculated and inserted into the HEC field. The method of HEC value calculation shall be according to ETS 300 300 [4] (ITU-T Recommendation I.432.1 [21]).

Cell information field scrambling: The self synchronizing scrambler polynomial $x^{43} + 1$ has been identified for the SDH-based transmission paths and minimizes the error multiplication introduced by the self synchronizing scrambling process. It scrambles the information field bits only. The operation of the scrambler shall be according to ETS 300 300 [4], subclause 10.5.3 (ITU-T Recommendation I.432.1 [21], subclause 4.3.4).

Cell stream mapping: The octet structure of ATM cells shall be aligned with the octet structure of Container-4 as shown in figure 14.

Processing of the payload specific bytes:

H4: This payload dependent byte is not used for the mapping of ATM cells into VC-4. The contents of this byte shall be 00Hex.

G1: Bits 5, 6 and 7 of this byte are used to signal RLCD to the remote end. However, bits 5-7 may be overwritten by the server layer (TP). Refer to table 4 of ITU-T Recommendation I.432.2 [22].

NOTE 4: For backward compatibility with equipment complying with the 1993 version of ITU-T Recommendation I.432 [20], old equipment may use "100" or "111" codes in bits 5-7 of G1 to indicate a RLCD.

NOTE 5: Up to date, no application for the RLCD indication in G1 byte was found. However, in order to maintain compatibility with ITU-T, the RLCD indication has to be set in source direction; it will be ignored in sink direction.

C2: In this byte the function shall insert code "0001 0011" (ATM mapping) as defined in ETS 300 147 [1].

Defects: None.

Consequent Actions:

On declaration of RI_RLCD, the function shall output RLCD (pattern "010" in bits 5-7 of G1 byte) within x μs; on clearing of RI_RLCD the function shall clear the RLCD indication defined in this byte within x μs.

NOTE 6: The value of x is for further study. Refer to the processing of RLCD.

Defect Correlations: None.

Performance Monitoring:

The use of the Performance Monitoring parameters are for further study. The parameters for the following functions need to be defined:

- TP usage measurement;
- Count of discarded cells from congestion control.

4.2.2 S4 path to ATM virtual path adaptation sink function S4/Avp_A_Sk

Symbol:

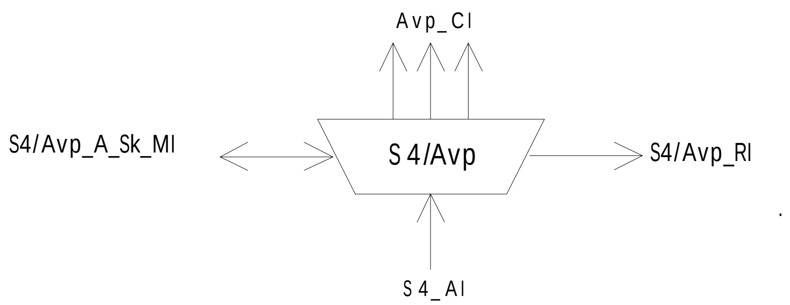


Figure 16: S4/Avp_A_Sk symbol

Interfaces:

Table 4: S4/Avp_A_Sk input and output signals

Input(s)	Output(s)
S4_AI_D S4_AI_CK S4_AI_FS S4_AI_TSF S4/Avp_A_Sk_MI_Active S4/Avp_A_Sk_MI_CellDiscardActive S4/Avp_A_Sk_MI_TPusgActive S4/Avp_A_Sk_MI_VPIrange S4/Avp_A_Sk_MI_HECactive S4/Avp_A_Sk_MI_GFCActive S4/Avp_A_Sk_MI_DFLOC S4/Avp_A_Sk_MI_VPI-KActive	per Avp_CI, for each VP configured: Avp_CI_D Avp_CI_ACS Avp_CI_SSF Avp_CI_CNGI S4/Avp_RI_RLCD S4/Avp_A_Sk_MI_cPLM S4/Avp_A_Sk_MI_cLCD

Processes:

The S4/Avp_A_Sk function provides adaptation from the VC-4 Path to the ATM Virtual Path. This is performed by a grouping of Specific Processes and Common Processes as shown in figure 17.

Activation: The S4/Avp_A_Sk function shall perform the Common and Specific Processes operation specified below when it is activated (MI_Active is true). Otherwise, it shall activate the SSF signals at its output (CI_SSF) and not report its status via the management point.

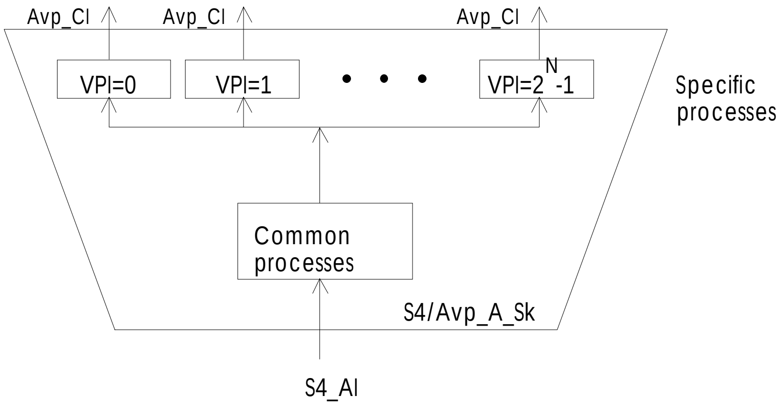


Figure 17: S4/Avp_A_Sk atomic function decomposed into Specific and Common Processes parts

NOTE 1: The sequential order of the processes within the atomic functions is important. For the correct order, refer to the ordering of the processes given below.

Common Processes:

These Common Processes include: Handling of the payload specific bytes (C2, H4 and G1), demapping, cell delineation, cell information field descrambling, HEC processing, cell rate decoupling, TP usage measurement, header verification, GFC processing, VPI verification and congestion control (selective cell discard (CLP based)). The logical ordering of these processes from input to output shall be maintained.

Handling of payload specific bytes:

C2: The function shall compare the contents of the accepted C2 byte with the expected value code "0001 0011" (ATM mapping) as a check on consistency between the provisioning operation at each end. The application, acceptance and mismatch detection processes are described in EN 300 417-1-1 [9], subclauses 7.2 and 8.2.1.

H4: This payload dependent byte is not used for this mapping and the receiver shall ignore its contents.

G1: The use of the information for RLCD in bits 6-7 is not defined. The receiver shall ignore its contents.

Demapping: The cell stream shall be extracted from C-4 container in the S4_AI in accordance with ETS 300 147 [1] (ITU-T Recommendation G.707 [10]).

Cell Delineation: dLCD shall be declared if an incorrect HEC is obtained ALPHA times consecutively. dLCD shall be cleared if the cell delineation algorithm enters SYNC state. (According to subclause 10.5.1.1., item 3 of ETS 300 300 [4], (subclause 4.3.2.2 of ITU-T Recommendation I.432.1 [21])).

Cell information field descrambling: The self synchronizing descrambler polynomial $x^{43} + 1$ has been identified for the SDH-based transmission paths and minimizes the error multiplication introduced by the self synchronizing scrambling process (factor 2). It descrambles the information field bits only. The operation of the descrambler in relation to the HEC cell delineation state diagram shall be according to ETS 300 300 [4], subclause 10.5.3 (ITU-T Recommendation I.432.1 [21], subclause 4.3.4).

HEC Processing: HEC verification and correction shall be according to ETS 300 300 [4] (ITU-T Recommendation I.432.1 [21]). Cells determined to have an invalid and incorrectible HEC pattern shall be discarded. A count of invalid HEC events and a count of invalid HEC cell discard events are maintained with threshold crossings checked. HEC correction mode may be activated/deactivated by MI_HECactive. The HEC correction mode should be activated by default.

Cell rate decoupling: The function shall extract the Idle cells used as fixed stuff in the far-end S4/Avp adaptation source function.

TP usage measurement: The function shall count the received cells for cell measurement purposes. This cell counting shall be activated/deactivated by MI_TPusgActive.

Header verification: Invalid header patterns from paths based on SDH/PDH transmission systems are as follows (except idle cell)(x = any value):

	GFC	VPI	VCI	PTI	CLP
UNI	xxxx	all 0's	all 0's	xxx	1

	VPI	VCI	PTI	CLP
NNI	all 0's	all 0's	xxx	1

GFC processing: The support of the GFC protocol applies to the UNI and in point-to-point configuration only and is an option. The GFC function uses assigned and unassigned cells. Two modes of operation are available: Uncontrolled Transmission (MI_GFCActive = false) and Controlled Transmission (MI_GFCActive = true). In Uncontrolled Transmission mode, neither the controlling nor the controlled NE performs the GFC procedure. If enabled by MI_GFCActive = true, this function shall extract the GFC protocol from the GFC field. The GFC field processing is defined in ETS 300 298-1 [2] (ITU-T Recommendation I.150 [15]) and ETS 300 298-2 [3] (ITU-T Recommendation I.361 [18]).

NOTE 2: The application of the GFC function in the ETSI environment is for further study.

NOTE 3: According to the PRM (ETS 300 354 [7] (ITU-T Recommendation I.321 [16])), the unassigned cells should be processed in the ATM layer. Some of the ATM layer processes are adaptation processes belonging to the adaptation function between the TP and the Avp layer network. The unassigned cells as well as idle cells are per physical connection (VPI = 0, VCI = 0). For this reason the idle and unassigned cells processing is allocated to the same atomic function.

VPI verification: The function shall verify that the received cell VPI is valid. If the VPI is determined to be invalid (i.e. out-of-range VPI or not assigned), the cell shall be discarded. The range of valid VPI is given by MI_VPIrange.

Congestion control: If enabled by MI_CellDiscardActive, this function shall perform selective cell discard according to CLP value. In the event of congestion, cells with CLP = 1 are subject to be discarded prior to cells with CLP = 0. See EN 300 301 [5] (ITU-T Recommendation I.371 [19]) for further details about the use of the CLP. In the event of congestion, the indication Avp_CI_CNGI is set for the traffic management function AvpT_TT_So to insert EFCI.

Specific Processes:

The function performs VP-AIS insertion and demultiplexing on a per VP basis.

VPI-K Activation: The Specific Processes perform the operation specified below when it is activated (MI_VPI-KActive is true). Otherwise, it shall send no cells and Server Signal Fail (SSF) = false.

VP-AIS insertion: If the Specific Processes are activated, theVP-AIS insertion shall be performed as in the Consequent Actions subclause.

VP demultiplexing: The adaptation sink function has access to a specific Avp identified by the number K ($0 \le K \le 2$ - 1). When the function is activated only the cells of that specific Avp-K are passed in client direction.

NOTE 4: The value of N represents the number of bits in the VPI field and is an integer number. Its maximum value is equal to 12 for the ATM NNI. Its maximum value is equal to 8 for the ATM UNI.

Defects:

The function shall detect for the dPLM defect according EN 300 417-1-1 [9], subclause 8.2.1 and for the dLCD defect according to ETS 300 300 [4] (ITU-T Recommendation I.432.1 [21]).

Consequent Actions:

aCNGI ← "Event of Congestion" and CellDiscardActive.

aSSF ← dPLM or dLCD or AI_TSF.

aRLCD ← dLCD and (not AI_TSF) and (not dPLM).

aAIS ← dPLM or dLCD or AI_TSF.

On declaration of aAIS the function shall output VP-AIS OAM cells on all active VPCs according to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.1.1); on clearing of aAIS the generation of VP-AIS cells shall be stopped. If implemented, the defect type and defect location field (provided by MI_DFLOC) of the VP-AIS cell shall be inserted in the information field. The contents of these fields is for further study.

NOTE 5: Concerning the declaration of aRLCD, refer to note 6 of G1 byte setting in S4/Avp_A_So function.

Defect Correlations:

cPLM ← dPLM and (not AI_TSF).

cLCD ← dLCD and (not dPLM) and (not AI_TSF).

Performance Monitoring:

The use of the Performance Monitoring parameters are for further study. The parameters for the following functions need to be defined:

- TP usage measurement;
- Count of discarded cells from congestion control;
- Count of invalid HEC events;
- Count of invalid HEC discard events;
- Count of invalid header discard events (one common counter for invalid header/invalid VPI/invalid VCI is maintained);
- OCD event.

4.3 S4-4v path adaptation functions

4.3.1 S4-4v path to ATM virtual path adaptation source function S4-4v/Avp_A_So

For further study.

4.3.2 S4-4v path to ATM virtual path adaptation sink function S4-4v/Avp_A_Sk

For further study.

4.4 S4-4c path layer adaptation functions

4.4.1 S4-4c path to ATM virtual path adaptation source function S4-4c/Avp_A_So

For further study.

4.4.2 S4-4c path to ATM virtual path adaptation sink function S4-4c/Avp_A_Sk

For further study.

4.5 Cell based adaptation functions

NOTE: This placeholder subclause is intended to incorporate in future the adaptation function for the Cell Based transmission layers. The Cell Based transmission layer networks itself will not be specified in the main body of the present document.

4.6 P12s path adaptation functions

4.6.1 P12s path to ATM virtual path adaptation source function P12s/Avp_A_So

Symbol:

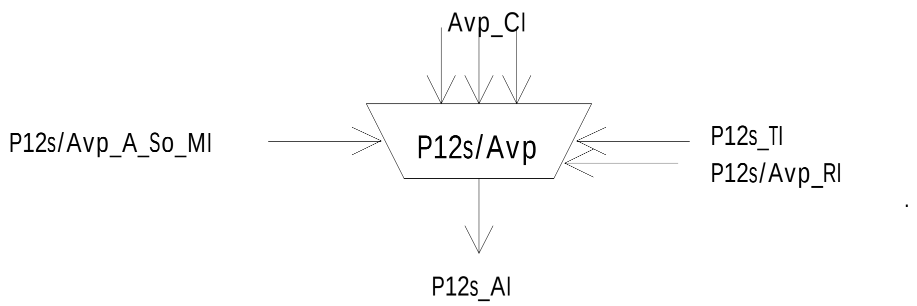


Figure 18: P12s/Avp_A_So symbol

Interfaces:

Table 5: P12s/Avp_A_So input and output signals

Input(s)	Output(s)
per Avp_CI for each VP configured: Avp_CI_D Avp_CI_ACS Avp_CI_SSF P12s_TI_CK P12s_TI_FS P12s/Avp_A_So_MI_Active P12s/Avp_A_So_MI_CellDiscardActive P12s/Avp_A_So_MI_TPusgActive P12s/Avp_A_So_MI_GFCActive P12s/Avp_A_So_MI_VPI-KActive	P12s_AI_D P12s_AI_CK P12s_AI_FS

Processes:

The P12s/Avp_A_So function provides adaptation from the ATM Virtual Path to the P12s path. This is performed by a grouping of Specific Processes and Common Processes as shown in figure 19.

Activation: The function shall access the access point when it is activated (MI_Active is true). Otherwise, it shall not access the access point.

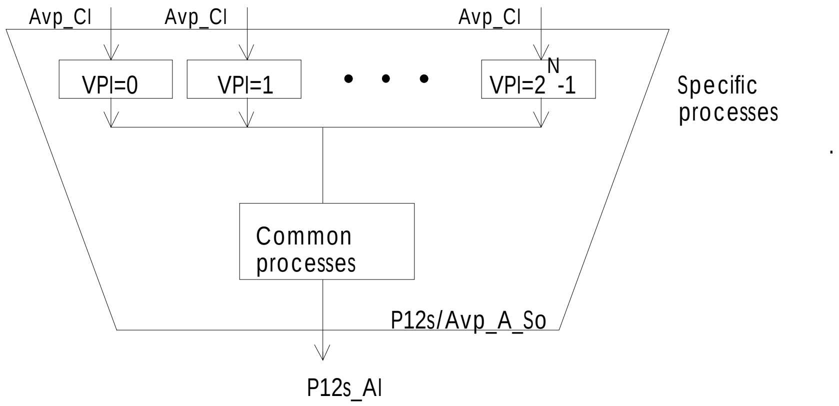


Figure 19: P12s/Avp_A_So atomic function decomposed into Specific and Common processes parts

NOTE 1: The sequential order of the processes within the atomic functions is important. For the correct order, refer to the ordering of the processes given below.

Specific Processes:

These Processes include VPI setting as well as VP asynchronous multiplexing. Each of these Specific Processes is characterized by the Virtual Path Identifier number K, where $0 \leq K \leq 2^N -1$.

VPI-K Activation: The Specific Processes perform the operation specified below when it is activated (MI_VPI-KActive is true).

The format of the Characteristic Information (Avp_CI) is given in figure 20.

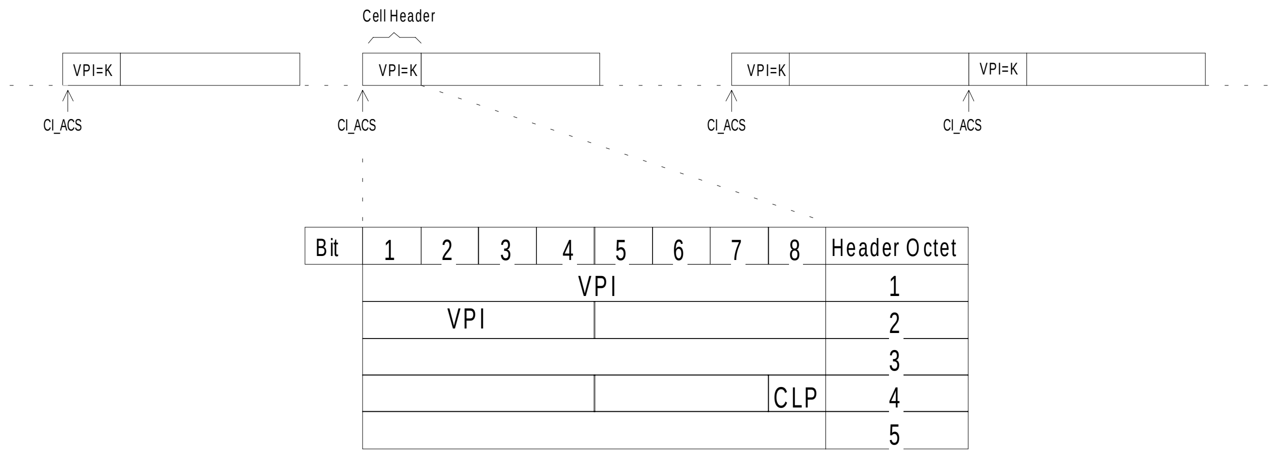


Figure 20: Avp_CI (NNI format)

VPI setting is based on the activation of the Specific function by MI_VPI-KActive and inserts the value of "K" as VPI.

NOTE 2: The value of N represents the number of bits in the VPI field and is an integer number. Its maximum value is equal to 12 for the ATM NNI. Its maximum value is equal to 8 for the ATM UNI.

VP multiplexing: Asynchronous multiplexing is performed for each active Specific function.

Common Processes:

The Common Processes include: congestion control (selective cell discard (CLP based)), GFC processing, TP usage measurement, cell rate decoupling, HEC generation, cell information field scrambling, cell stream mapping and insertion into the synchronous payload having a capacity of 30 bytes adding fixed stuff idle cells. The logical ordering of the processes from input to output shall be maintained.

Bit	1	2	3	4	5	6	7	8	Header Octet
	GFC								1
									2
									3
									4
	HEC								5

Figure 21: Cell header information processed in P12s/Avp_A_So

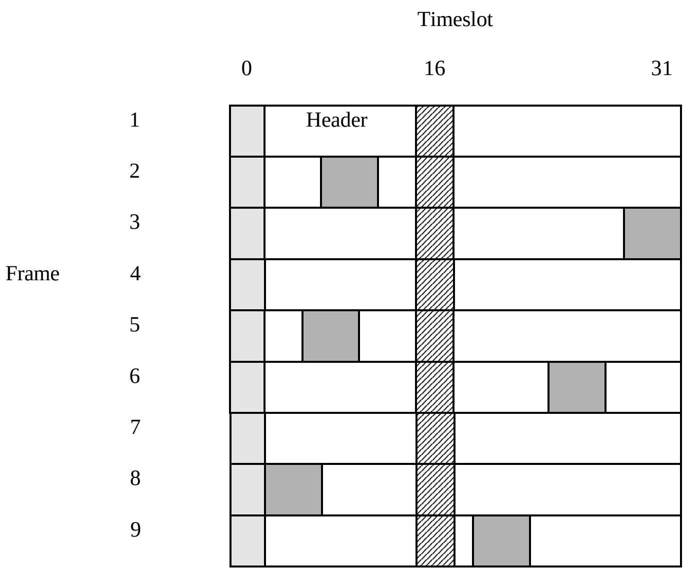


Figure 22: ATM cell stream mapping into P12s payload structure

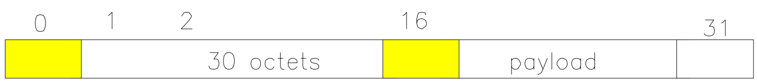


Figure 23: P12s_AI_So_D

Congestion control: If enabled by MI_CellDiscardActive, this function shall perform selective cell discard according to CLP value. In the event of congestion, cells with CLP = 1 are subject to be discarded prior to cells with CLP = 0. See EN 300 301 [5] (ITU-T Recommendation I.371 [19]) for further details about the use of the CLP. In the event of congestion, the EFCI marking in the PTI field is set according to ETS 300 298-2 [3] (ITU-T Recommendation I.361 [18]).

GFC processing: The support of the GFC protocol applies to the UNI and in point-to-point configuration only and is an option. The GFC function uses assigned and unassigned cells. Two modes of operation are available: Uncontrolled Transmission (MI_GFCActive = false) and Controlled Transmission (MI_GFCActive = true). If enabled by MI_GFCActive = true, this function shall insert the GFC protocol in the GFC field. The GFC field processing is defined in ETS 300 298-1 [2] (ITU-T Recommendation I.150 [15]) and ETS 300 298-2 [3] (ITU-T Recommendation I.361 [18]). If the GFC function is not supported or the GFC function disabled by MI_GFCActive = false, the binary contents of the GFC field shall be set to "0000". In Uncontrolled Transmission mode, neither the controlling nor the controlled NE performs the GFC procedure.

NOTE 3: The application of the GFC function in the ETSI environment is for further study.

TP usage measurement: The function shall count the transmitted cells for cell measurement purposes. This cell counting shall be activated/deactivated by MI_TPusgActive.

Cell rate decoupling: This process takes the ATM cell stream present at its input and inserts it into the synchronous container having a capacity of 30 bytes adding fixed stuff idle cells. The idle cells format is specified in ETS 300 298-2 [3]. The cell rate decoupling process makes use of the P12s timing clock, frame position (P12s_TI), and idle cell generator.

HEC Processing: The HEC value for each cell is calculated and inserted into the HEC field. The method of HEC value calculation shall be according to ETS 300 300 [4] (ITU-T Recommendation I.432.1 [21]).

Cell information field scrambling: The self synchronizing scrambler polynomial $x^{43} + 1$ has been identified for the SDH-based transmission paths and minimizes the error multiplication introduced by the self synchronizing scrambling process. It scrambles the information field bits only. The operation of the scrambler shall be according to ETS 300 300 [4], subclause 10.5.3 (ITU-T Recommendation I.432.1 [21], subclause 4.3.4).

Cell stream mapping: The octet structure of ATM cells shall be aligned with the octet structure of P12s as shown in figure 22.

Defects: None.

Consequent Actions: None.

Defect Correlations: None.

Performance Monitoring:

The use of the Performance Monitoring parameters are for further study. The parameters for the following functions need to be defined:

- TP usage measurement;
- Count of discarded cells from congestion control.

4.6.2 P12s path to ATM virtual path adaptation sink function P12s/Avp_A_Sk

Symbol:

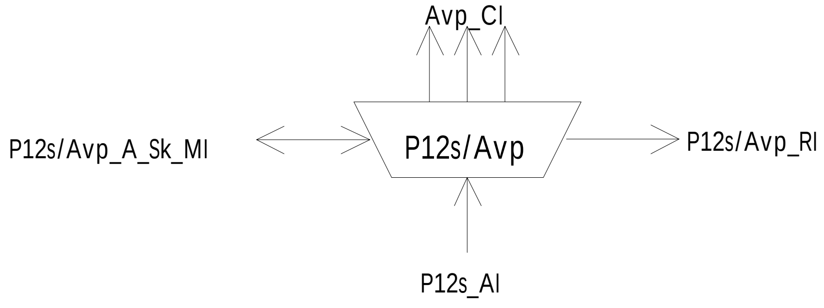


Figure 24: P12s/Avp_A_Sk symbol

Interfaces:

Table 6: P12s/Avp_A_Sk input and output signals

Input(s)	Output(s)
P12s_AI_D P12s_AI_CK P12s_AI_FS P12s_AI_TSF P12s/Avp_A_Sk_MI_Active P12s/Avp_A_Sk_MI_CellDiscardActive P12s/Avp_A_Sk_MI_TPusgActive P12s/Avp_A_Sk_MI_VPIrange P12s/Avp_A_Sk_MI_HECactive P12s/Avp_A_Sk_MI_GFCActive P12s/Avp_A_Sk_MI_DFLOC P12s/Avp_A_Sk_MI_VPI-KActive	per Avp_CI, for each VP configured: Avp_CI_D Avp_CI_ACS Avp_CI_SSF Avp_CI_CNGI P12s/Avp_A_Sk_MI_cLCD

Processes:

The P12s/Avp_A_Sk function provides adaptation from the P12s Path to the ATM Virtual Path. This is performed by a grouping of Specific Processes and Common Processes as shown in figure 25.

Activation: The P12s/Avp_A_Sk function shall perform the Common and Specific Processes operation specified below when it is activated (MI_Active is true). Otherwise, it shall activate the SSF signals at its output (CI_SSF) and not report its status via the management point.

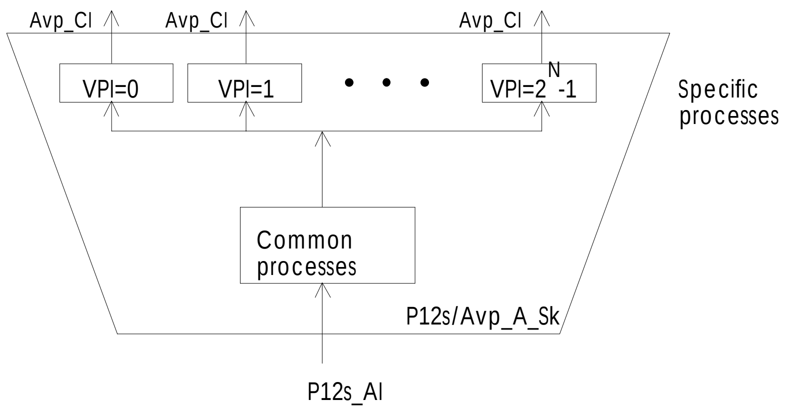


Figure 25: P12s/Avp_A_Sk atomic function decomposed into Specific and Common Processes parts

NOTE 1: The sequential order of the processes within the atomic functions is important. For the correct order, refer to the ordering of the processes given below.

Common Processes:

These Common Processes include: Demapping, cell delineation, cell information field descrambling, HEC processing, cell rate decoupling, TP usage measurement, header verification, GFC processing, VPI verification and congestion control (selective cell discard (CLP based)). The logical ordering of these processes from input to output shall be maintained.

Demapping: The cell stream shall be extracted from P12s payload in the P12s_AI in accordance with ETS 300 337 [6] (ITU-T Recommendation G.804 [12]).

Cell Delineation: dLCD shall be declared if an incorrect HEC is obtained ALPHA times consecutively. dLCD shall be cleared if the cell delineation algorithm enters SYNC state. (According to subclause 10.5.1.1, item 3 of ETS 300 300 [4], (subclause 4.3.3.2 of ITU-T Recommendation I.432.1 [21])).

Cell information field descrambling: The self synchronizing descrambler polynomial $x^{43} + 1$ has been identified for the SDH-based transmission paths and minimizes the error multiplication introduced by the self synchronizing scrambling process (factor 2). It descrambles the information field bits only. The operation of the descrambler in relation to the HEC cell delineation state diagram shall be according to ETS 300 300 [4], subclause 10.5.3 (ITU-T Recommendation I.432.1 [21], subclause 4.3.4).

HEC Processing: HEC verification and correction shall be according to ETS 300 300 [4] (ITU-T Recommendation I.432.1 [21]). Cells determined to have an invalid and incorrectible HEC pattern shall be discarded. A count of invalid HEC events and a count of invalid HEC cell discard events are maintained with threshold crossings checked. HEC correction mode may be activated/deactivated by MI_HECactive. The HEC correction mode should be activated by default.

Cell rate decoupling: The function shall extract the Idle cells used as fixed stuff in the far-end P12s/Avp adaptation source function.

TP usage measurement: The function shall count the received cells for cell measurement purposes. This cell counting shall be activated/deactivated by MI_TPusgActive.

Header verification: Invalid header patterns from paths based on SDH/PDH transmission systems are as follows (except idle cell)(x = any value):

	GFC	VPI	VCI	PTI	CLP
UNI	xxxx	all 0's	all 0's	xxx	1

	VPI	VCI	PTI	CLP
NNI	all 0's	all 0's	xxx	1

GFC processing: The support of the GFC protocol applies to the UNI and in point-to-point configuration only and is an option. The GFC function uses assigned and unassigned cells. Two modes of operation are available: Uncontrolled Transmission (MI_GFCActive = false) and Controlled Transmission (MI_GFCActive = true). In Uncontrolled Transmission mode, neither the controlling nor the controlled NE performs the GFC procedure. If enabled by MI_GFCActive = true, this function shall extract the GFC protocol from the GFC field. The GFC field processing is defined in ETS 300 298-1 [2] (ITU-T Recommendation I.150 [15]) and ETS 300 298-2 [3] (ITU-T Recommendation I.361 [18]).

NOTE 2: The application of the GFC function in the ETSI environment is for further study.

NOTE 3: According to the PRM (ETS 300 354 [7] (ITU-T Recommendation I.321 [16])), the unassigned cells should be processed in the ATM layer. Some of the ATM layer processes are adaptation processes belonging to the adaptation function between the TP and the Avp layer network. The unassigned cells as well as idle cells are per physical connection (VPI = 0, VCI = 0). For this reason the idle and unassigned cells processing is allocated to the same atomic function.

VPI verification: The function shall verify that the received cell VPI is valid. If the VPI is determined to be invalid (i.e. out-of-range VPI or not assigned), the cell shall be discarded. The range of valid VPI is given by MI_VPIrange.

Congestion control: If enabled by MI_CellDiscardActive, this function shall perform selective cell discard according to CLP value. In the event of congestion, cells with CLP = 1 are subject to be discarded prior to cells with CLP = 0. See EN 300 301 [5] (ITU-T Recommendation I.371 [19]) for further details about the use of the CLP. In the event of congestion, the indication Avp_CI_CNGI is set for the traffic management function AvpT_TT_So to insert EFCI.

Specific Processes:

The function performs VP-AIS insertion and demultiplexing on a per VP basis.

VPI-K Activation: The Specific Processes perform the operation specified below when it is activated (MI_VPI-KActive is true). Otherwise, it shall send no cells and Server Signal Fail (SSF) = false.

VP-AIS insertion: If the Specific Processes are activated, theVP-AIS insertion shall be performed as in the Consequent Actions subclause.

VP demultiplexing: The adaptation sink function has access to a specific Avp identified by the number K ($0 \le K \le 2 - 1$). When the function is activated only the cells of that specific Avp-K are passed in client direction.

NOTE 4: The value of N represents the number of bits in the VPI field and is an integer number. Its maximum value is equal to 12 for the ATM NNI. Its maximum value is equal to 8 for the ATM UNI.

Defects:

The function shall detect for dLCD defect according to ETS 300 300 [4] (ITU-T Recommendation I.432.1 [21]).

Consequent Actions:

aCNGI ← "Event of Congestion" and CellDiscardActive.

aSSF ← dLCD or AI_TSF.

aAIS ← dLCD or AI_TSF.

On declaration of aAIS the function shall output VP-AIS OAM cells on all active VPCs according to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.1.1); on clearing of aAIS the generation of VP-AIS cells shall be stopped. If implemented, the defect type and defect location field (provided by MI_DFLOC) of the VP-AIS cell shall be inserted in the information field. The contents of these fields is for further study.

Defect Correlations:

cLCD ← dLCD and (not AI_TSF).

Performance Monitoring:

The use of the Performance Monitoring parameters are for further study. The parameters for the following functions need to be defined:

- TP usage measurement;
- Count of discarded cells from congestion control;
- Count of invalid HEC events;
- Count of invalid HEC discard events;
- Count of invalid header discard events (one common counter for invalid header/invalid VPI/invalid VCI is maintained);
- OCD event.

4.7 P31s path adaptation functions

4.7.1 P31s path to ATM virtual path adaptation source function P31s/Avp_A_So

Symbol:

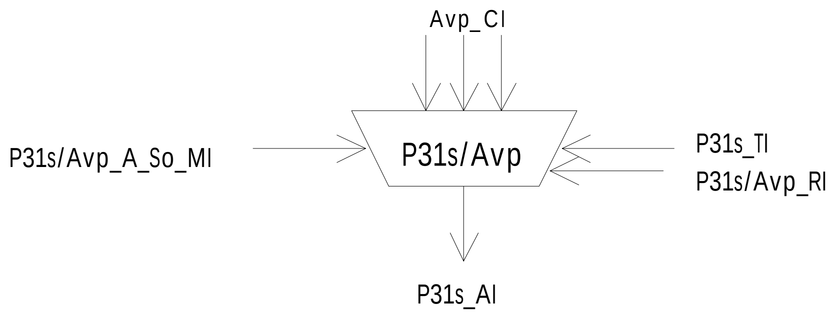


Figure 26: P31s/Avp_A_So symbol

Interfaces:

Table 7: P31s/Avp_A_So input and output signals

Input(s)	Output(s)
per Avp_CI for each VP configured: Avp_CI_D Avp_CI_ACS Avp_CI_SSF P31s_TI_CK P31s_TI_FS P31s/Avp_A_So_MI_Active P31s/Avp_A_So_MI_CellDiscardActive P31s/Avp_A_So_MI_TPusgActive P31s/Avp_A_So_MI_GFCActive P31s/Avp_A_So_MI_VPI-KActive	P31s_AI_D P31s_AI_CK P31s_AI_FS

The P31s/Avp_A_So function provides adaptation from the ATM Virtual Path to the P31s path. This is performed by a grouping of Specific Processes and Common Processes as shown in figure 27.

Activation: The function shall access the access point when it is activated (MI_Active is true). Otherwise, it shall not access the access point.

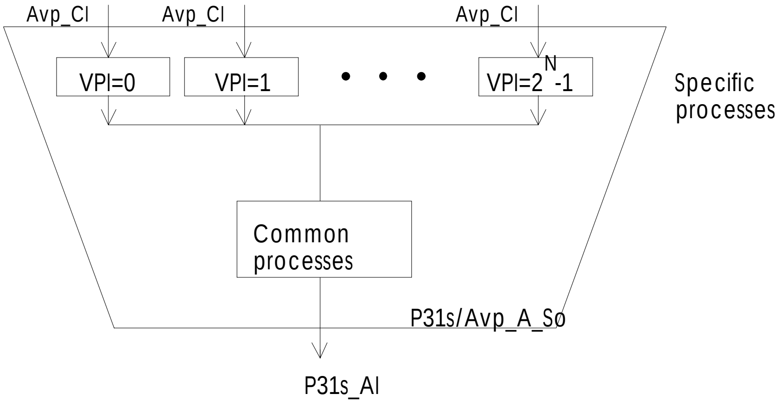


Figure 27: P31sAvp_A_So atomic function decomposed into Specific and Common processes parts

NOTE 1: The sequential order of the processes within the atomic functions is important. For the correct order, refer to the ordering of the processes given below.

Specific Processes:

These Processes include VPI setting as well as VP asynchronous multiplexing. Each of these Specific Processes is characterized by the Virtual Path Identifier number K, where $0 \le K \le 2^N - 1$.

VPI-K Activation: The Specific Processes perform the operation specified below when it is activated (MI_VPI-KActive is true).

The format of the Characteristic Information (Avp_CI) is given in figure 28.

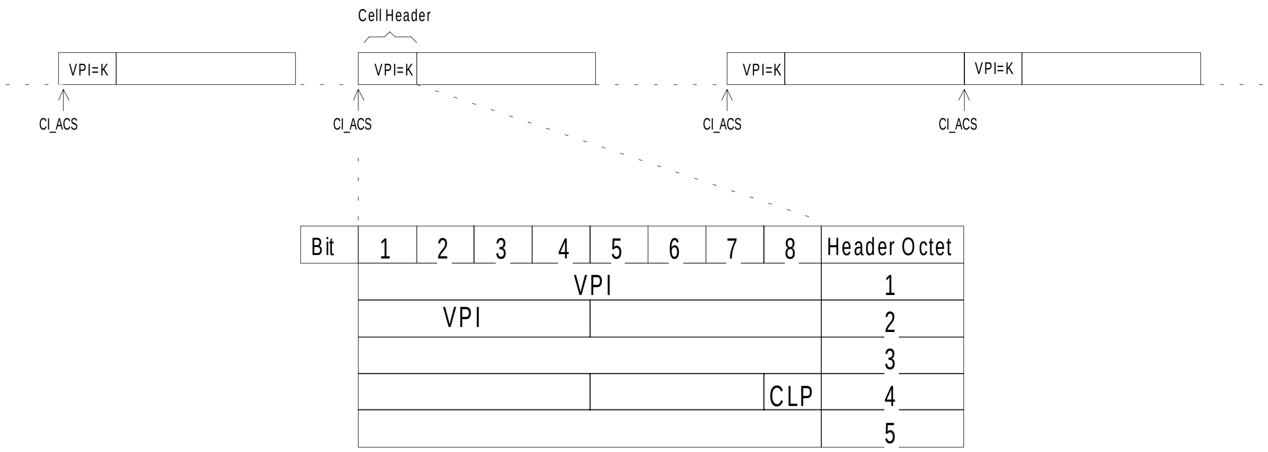


Figure 28: Avp_CI (NNI format)

VPI setting is based on the activation of the Specific function by MI_VPI-KActive and inserts the value of "K" as VPI.

NOTE 2: The value of N represents the number of bits in the VPI field and is an integer number. Its maximum value is equal to 12 for the ATM NNI. Its maximum value is equal to 8 for the ATM UNI.

VP multiplexing: Asynchronous multiplexing is performed for each active Specific function.

Common Processes:

The Common Processes include: Congestion control (selective cell discard (CLP based)), GFC processing, TP usage measurement, cell rate decoupling, HEC processing, cell information field scrambling, cell stream mapping and processing of the payload specific signals (bits MA[3-5] and MA[6-7]) to the P31s POH. The logical ordering of the processes from input to output shall be maintained.

Bit	1	2	3	4	5	6	7	8	Header Octet
	GFC								1
									2
									3
									4
	HEC								5

Figure 29: Cell header information processed in P31s/Avp_A_So

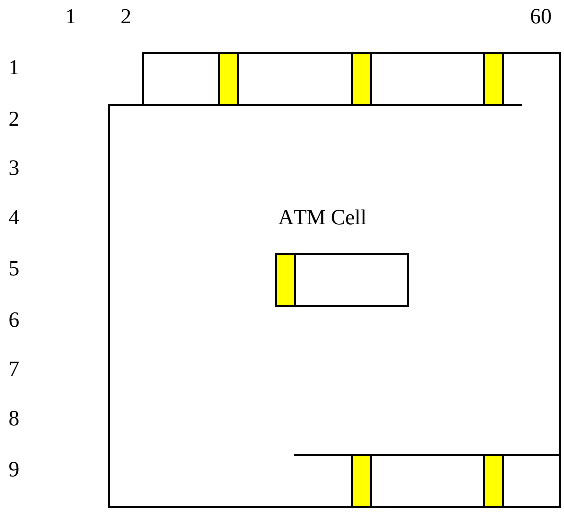


Figure 30: ATM cell stream mapping into P31s payload structure

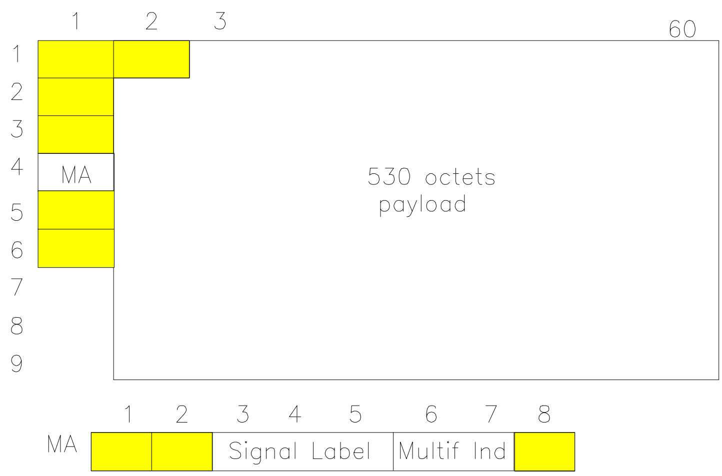


Figure 31: P31s_AI_So_D

Congestion control: If enabled by MI_CellDiscardActive, this function shall perform selective cell discard according to CLP value. In the event of congestion, cells with CLP = 1 are subject to be discarded prior to cells with CLP = 0. See EN 300 301 [5] (ITU-T Recommendation I.371 [19]) for further details about the use of the CLP. In the event of congestion, the EFCI marking in the PTI field is set according to ETS 300 298-2 [3] (ITU-T Recommendation I.361 [18]).

GFC processing: The support of the GFC protocol applies to the UNI and in point-to-point configuration only and is an option. The GFC function uses assigned and unassigned cells. Two modes of operation are available: Uncontrolled Transmission (MI_GFCActive = false) and Controlled Transmission (MI_GFCActive = true). If enabled by MI_GFCActive = true, this function shall insert the GFC protocol in the GFC field. The GFC field processing is defined in ETS 300 298-1 [2] (ITU-T Recommendation I.150 [15]) and ETS 300 298-2 [3] (ITU-T Recommendation I.361 [18]). If the GFC function is not supported or the GFC function disabled by MI_GFCActive = false, the binary contents of the GFC field shall be set to "0000". In Uncontrolled Transmission mode, neither the controlling nor the controlled NE performs the GFC procedure.

NOTE 3: The application of the GFC function in the ETSI environment is for further study.

TP usage measurement: The function shall count the transmitted cells for cell measurement purposes. This cell counting shall be activated/deactivated by MI_TPusgActive.

Cell rate decoupling: This process takes the ATM cell stream present at its input and inserts it into the synchronous container having a capacity of 530 bytes adding fixed stuff idle cells. The idle cells format is specified in ETS 300 298-2 [3]. The cell rate decoupling process makes use of the P31s timing clock, frame position (P31s_TI), and idle cell generator.

HEC Processing: The HEC value for each cell is calculated and inserted into the HEC field. The method of HEC value calculation shall be according to ETS 300 300 [4] (ITU-T Recommendation I.432.1 [21]).

Cell information field scrambling: The self synchronizing scrambler polynomial $x^{43} + 1$ has been identified for the SDH-based transmission paths and minimizes the error multiplication introduced by the self synchronizing scrambling process. It scrambles the information field bits only. The operation of the scrambler shall be according to ETS 300 300 [4], subclause 10.5.3 (ITU-T Recommendation I.432.1 [21], subclause 4.3.4).

Cell stream mapping: The octet structure of ATM cells shall be aligned with the octet structure of P31s payload as shown in figure 30.

Processing of the payload specific bytes:

MA[3-5]: In this byte the function shall insert code "010" (ATM payload) as defined in ETS 300 337 [6] (ITU-T Recommendation G.832 [14]).

MA[6-7]: The multiframe indicator bits are not used for the ATM mapping into P31s option. The contents of these bits shall be "00".

Defects: None.

Consequent Actions: None.

Defect Correlations: None.

Performance Monitoring:

The use of the Performance Monitoring parameters are for further study. The parameters for the following functions need to be defined:

- TP usage measurement;
- Count of discarded cells from congestion control.

4.7.2 P31s path to ATM virtual path adaptation sink function P31s/Avp_A_Sk

Symbol:

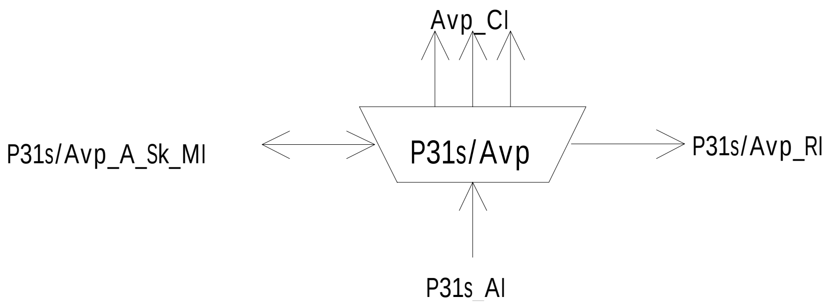


Figure 32: P31s/Avp_A_Sk symbol

Interfaces:

Table 8: P31s/Avp_A_Sk input and output signals

Input(s)	Output(s)
P31s_AI_D P31s_AI_CK P31s_AI_FS P31s_AI_TSF P31s/Avp_A_Sk_MI_Active P31s/Avp_A_Sk_MI_CellDiscardActive P31s/Avp_A_Sk_MI_TPusgActive P31s/Avp_A_Sk_MI_VPIrange P31s/Avp_A_Sk_MI_HECactive P31s/Avp_A_Sk_MI_GFCActive P31s/Avp_A_Sk_MI_DFLOC P31s/Avp_A_Sk_MI_VPI-KActive	per Avp_CI, for each VP configured: Avp_CI_D Avp_CI_ACS Avp_CI_SSF Avp_CI_CNGI P31s/Avp_A_Sk_MI_cLCD P31s/Avp_A_Sk_MI_cPLM

Processes:

The P31s/Avp_A_Sk function provides adaptation from the P31s Path to the ATM Virtual Path. This is performed by a grouping of Specific Processes and Common Processes as shown in figure 33.

Activation: The P31s/Avp_A_Sk function shall perform the Common and Specific Processes operation specified below when it is activated (MI_Active is true). Otherwise, it shall activate the SSF signals at its output (CI_SSF) and not report its status via the management point.

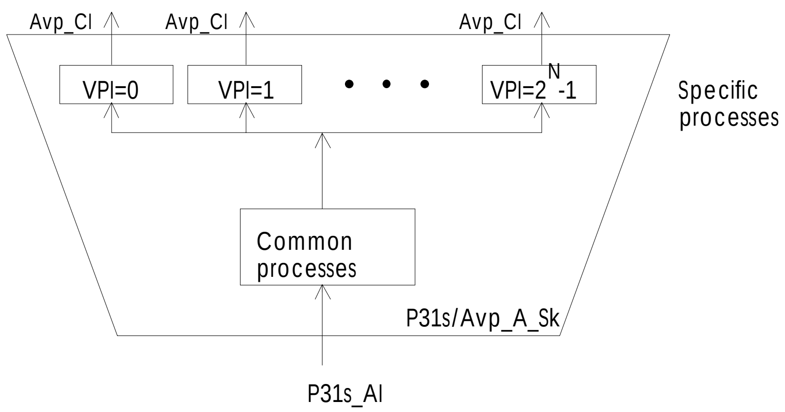


Figure 33: P31s/Avp_A_Sk atomic function decomposed into Specific and Common Processes parts

NOTE 1: The sequential order of the processes within the atomic functions is important. For the correct order, refer to the ordering of the processes given below.

Common Processes:

These Common Processes include: Handling of the payload specific bits (MA[3-5], MA[6-7]), demapping, cell delineation, cell information field descrambling, HEC processing, cell rate decoupling, TP usage measurement, header verification, GFC processing, VPI verification and congestion control (selective cell discard (CLP based)). The logical ordering of these processes from input to output shall be maintained.

Handling of payload specific bytes:

MA[3-5]: The function shall compare the contents of the accepted MA[3-5] bits with the expected value code "010" (ATM cell mapping) as a check on consistency between the provisioning operation at each end. The application, acceptance and mismatch detection process are described in EN 300 417-1-1 [9], subclauses 7.2 and 8.2.1.

MA[6-7]: Multiframe indicator. The contents of these bits shall be ignored by the receiver.

Demapping: The cell stream shall be extracted from P31s payload in the P31s_AI in accordance with ETS 300 337 [6] (ITU-T Recommendation G.804 [12]).

Cell Delineation: dLCD shall be declared if an incorrect HEC is obtained ALPHA times consecutively. dLCD shall be cleared if the cell delineation algorithm enters SYNC state. (According to subclause 10.5.1.1, item 3 of ETS 300 300 [4], (subclause 4.3.3.2. of ITU-T Recommendation I.432.1 [21])).

Cell information field descrambling: The self synchronizing descrambler polynomial $x^{43} + 1$ has been identified for the SDH-based transmission paths and minimizes the error multiplication introduced by the self synchronizing scrambling process (factor 2). It descrambles the information field bits only. The operation of the descrambler in relation to the HEC cell delineation state diagram shall be according to ETS 300 300 [4], subclause 10.5.3 (ITU-T Recommendation I.432.1 [21], subclause 4.3.4).

HEC Processing: HEC verification and correction shall be according to ETS 300 300 [4] (ITU-T Recommendation I.432.1 [21]). Cells determined to have an invalid and incorrectible HEC pattern shall be discarded. A count of invalid HEC events and a count of invalid HEC cell discard events are maintained with threshold crossings checked. HEC correction mode may be activated/deactivated by MI_HECactive. The HEC correction mode should be activated by default.

Cell rate decoupling: The function shall extract the Idle cells used as fixed stuff in the far-end P31s/Avp adaptation source function.

TP usage measurement: The function shall count the received cells for cell measurement purposes. This cell counting shall be activated/deactivated by MI_TPusgActive.

Header verification: Invalid header patterns from paths based on SDH/PDH transmission systems are as follows (except idle cell)(x = any value):

	GFC	VPI	VCI	PTI	CLP
UNI	xxxx	all 0's	all 0's	xxx	1

	VPI	VCI	PTI	CLP
NNI	all 0's	all 0's	xxx	1

GFC processing: The support of the GFC protocol applies to the UNI and in point-to-point configuration only and is an option. The GFC function uses assigned and unassigned cells. Two modes of operation are available: Uncontrolled Transmission (MI_GFCActive = false) and Controlled Transmission (MI_GFCActive = true). In Uncontrolled Transmission mode, neither the controlling nor the controlled NE performs the GFC procedure. If enabled by MI_GFCActive = true, this function shall extract the GFC protocol from the GFC field. The GFC field processing is defined in ETS 300 298-1 [2] (ITU-T Recommendation I.150 [15]) and ETS 300 298-2 [3] (ITU-T Recommendation I.361 [18]).

NOTE 2: The application of the GFC function in the ETSI environment is for further study.

NOTE 3: According to the PRM (ETS 300 354 [7] (ITU-T Recommendation I.321 [16])), the unassigned cells should be processed in the ATM layer. Some of the ATM layer processes are adaptation processes belonging to the adaptation function between the TP and the Avp layer network. The unassigned cells as well as idle cells are per physical connection (VPI = 0, VCI = 0). For this reason the idle and unassigned cells processing is allocated to the same atomic function.

VPI verification: The function shall verify that the received cell VPI is valid. If the VPI is determined to be invalid (i.e. out-of-range VPI or not assigned), the cell shall be discarded. The range of valid VPI is given by MI_VPIrange.

Congestion control: If enabled by MI_CellDiscardActive, this function shall perform selective cell discard according to CLP value. In the event of congestion, cells with CLP = 1 are subject to be discarded prior to cells with CLP = 0. See EN 300 301 [5] (ITU-T Recommendation I.371 [19]) for further details about the use of the CLP. In the event of congestion, the indication Avp_CI_CNGI is set for the traffic management function AvpT_TT_So to insert EFCI.

Specific Processes:

The function performs VP-AIS insertion and demultiplexing on a per VP basis.

VPI-K Activation: The Specific Processes perform the operation specified below when it is activated (MI_VPI-KActive is true). Otherwise, it shall send no cells and Server Signal Fail (SSF) = false.

VP-AIS insertion: If the Specific Processes are activated, theVP-AIS insertion shall be performed as in the Consequent Actions subclause.

VP demultiplexing: The adaptation sink function has access to a specific Avp identified by the number K ($0 \le K \le 2^N - 1$). When the function is activated only the cells of that specific Avp-K are passed in client direction.

NOTE 4: The value of N represents the number of bits in the VPI field and is an integer number. Its maximum value is equal to 12 for the ATM NNI. Its maximum value is equal to 8 for the ATM UNI.

Defects:

The function shall detect for the dPLM defect according EN 300 417-1-1 [9], subclause 8.2.1 and for the dLCD defect according to ETS 300 300 [4] (ITU-T Recommendation I.432.1 [21]).

Consequent Actions:

aCNGI ← "Event of Congestion" and CellDiscardActive.

aSSF ← dPLM or dLCD or AI_TSF.

aAIS ← dPLM or dLCD or AI_TSF.

On declaration of aAIS the function shall output VP-AIS OAM cells on all active VPCs according to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.1.1); on clearing of aAIS the generation of VP-AIS cells shall be stopped. If implemented, the defect type and defect location field (provided by MI_DFLOC) of the VP-AIS cell shall be inserted in the information field. The contents of these fields is for further study.

Defect Correlations:

cPLM ← dPLM and (not AI_TSF).

cLCD ← dLCD and (not dPLM) and (not AI_TSF).

Performance Monitoring:

The use of the Performance Monitoring parameters are for further study. The parameters for the following functions need to be defined:

- TP usage measurement;
- Count of discarded cells from congestion control;

- Count of invalid HEC events;
- Count of invalid HEC discard events;
- Count of invalid header discard events (one common counter for invalid header/invalid VPI/invalid VCI is maintained);
- OCD event.

5 ATM virtual path layer network functions

The following figure shows the relative sequencing of the atomic functions of the Virtual Path (VP) layer network that has to be maintained if they are present.

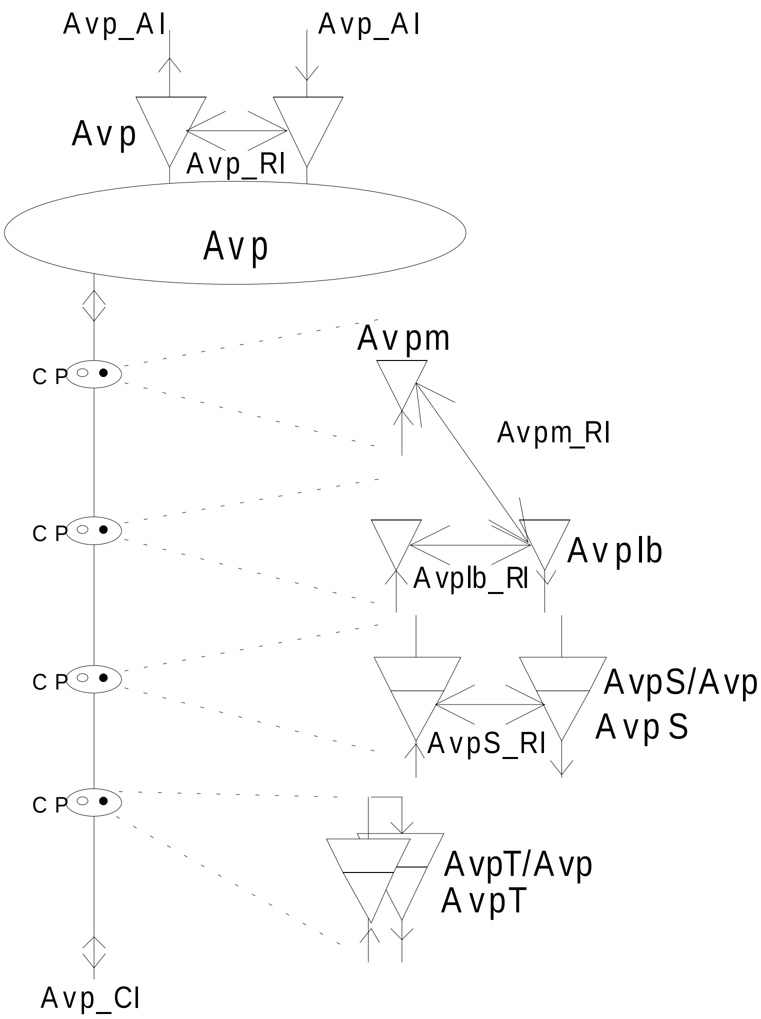


Figure 34: Expanded view of the same VP layer network

NOTE: Currently, the relative ordering of the AvpS, Avplb and Avpm functions is for further study. This includes the question of whether the ordering is significant.

ATM Virtual Path Layer Characteristic Information

For further study.

ATM Virtual Path Layer Adaptation Information

For further study.

5.1 ATM virtual path connection function Avp_C

Symbol:

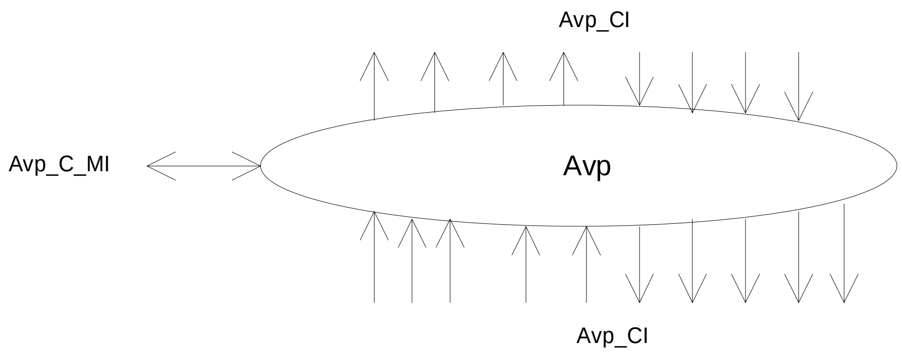


Figure 35: Avp_C symbol

Interfaces:

Table 9: Avp_C input and output signals

Input(s)	Output(s)
per Avp_CI, n x for the function: Avp_CI_D Avp_CI_ACS for inputs from the server layer: Avp_CI_SSF per input and output connection point: Avp_C_MI_ConnectionPortIds per matrix connection: Avp_C_MI_ConnectionType Avp_C_MI_Directionality	per Avp_CI, m x per function: Avp_CI_D Avp_CI_ACS Avp_CI_SSF

Processes:

In the Avp_C function ATM Virtual Path Layer CI is routed between input (Termination) Connection Points ((T)CPs) and output (T)CPs by means of matrix connections.

NOTE 1: Neither the number of input/output signals to the connection function, nor the connectivity is specified in the present document. That is a property of individual network elements.

NOTE 2: If CI_SSF is not connected (when connected to the client layer TT_So), CI_SSF is assumed to be false.

Routing: The function shall be able to connect a specific input with a specific output by means of establishing a matrix connection between the specified input and output. It shall be able to remove an established matrix connection.

Each (matrix) connection in the Avp_C function shall be characterized by the:

Type of connection: unprotected,
1 + 1 protected (for further study);

Traffic direction: uni-directional,
bidirectional;

Input and output connection points: set of connection point identifiers (refer to EN 300 417-1-1 [9], subclause 3.3.6).

NOTE 3: Multipoint connections are handled as separate connections from the same input Connection Point (CP) and are for further study.

It shall be possible to connect one or more CI outputs to one input CP of the Avp_C function.

Defects: None.

Consequent Actions:

If an output of this function is not connected to one of its inputs, the connection function shall send no cells and SSF = false to the output.

Defect Correlations: None.

Performance Monitoring: None.

5.2 ATM virtual path trail termination functions

5.2.1 ATM virtual path trail termination source function Avp_TT_So

Symbol:

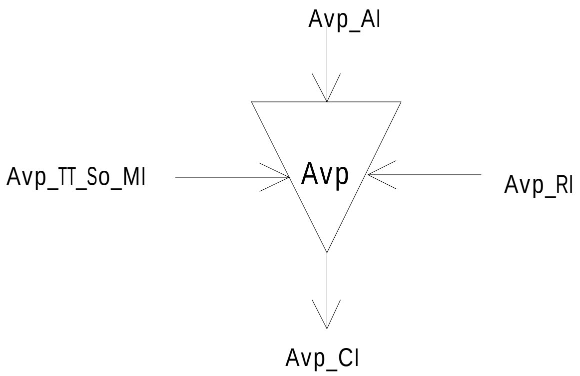


Figure 36: Avp_TT_So symbol

Interfaces:

Table 10: Avp_TT_So input and output signals

Input(s)	Output(s)
Avp_AI_D Avp_AI_ACS Avp_RI_RDI Avp_TT_So_MI_CCADrequest Avp_TT_So_MI_CCADresponse Avp_RI_BRPMdata Avp_TT_So_MI_PMADrequest Avp_TT_So_MI_PMADresponse Avp_TT_So_MI_PMActive Avp_TT_So_MI_CCActive	Avp_CI_D Avp_CI_ACS

Processes:

This function performs VP-RDI insertion, Continuity Check, PM cell generation and PM and CC activation/deactivation.

VP-RDI insertion: This function inserts VP-RDI cells according to the consequent actions section.

Continuity Check:

CC activation (and associated deactivation) can be initiated either by the TMN/end user by one endpoint with associated OAM flow or entirely via TMN. The corresponding Management Information for direct TMN activation/deactivation is MI_CCActive. The corresponding Management Information for AD OAM flows activation/deactivation is MI_CCAD.

If enabled by the Continuity Check (CC) activation process (MI_CCActive or MI_CCAD), this function monitors the user cell stream activity at the input (Avp_AI) and generates CC cells. There are two options defined in ITU-T Recommendation I.610 [23] for CC. Option 1 defines that a CC cell shall be inserted if no user cell is to be transmitted for ≥1 second. Option 2 defines that a CC cell shall be inserted with a periodicity of 1 cell/s. The procedure of CC is described in ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.2). In ETS 300 404 [8] only Option 1 is retained; this is for further study in TM1).

PM cell generation:

PM activation (and associated deactivation) can be initiated either by the TMN/end user by one endpoint with associated OAM flow or entirely via TMN. The corresponding Management Information for direct TMN activation/deactivation is MI_PMActive. The corresponding Management Information for AD OAM flows activation/deactivation is MI_PMAD. If enabled by the Performance Monitoring (PM) activation process (MI_PMActive or MI_PMAD), the PM forward monitoring cells shall be generated; the Backward Reporting Performance Monitoring (BRPM) cells shall be generated using the PM data from Avp_RI_BRPMdata being collected by the Avp_TT_Sk. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 10.3).

AD OAM flow: On Avp_MI_CCADrequest or Avp_MI_PMADrequest, an ACTIVATE/DEACTIVATE cell for CC or PM shall be generated. Depending on the received type of CCADresponse or PMADresponse, from the Management Layer, one of the following F4 OAM cells for CC or PM activation/deactivation process shall be sent:

- ACTIVATION CONFIRMED;
- ACTIVATION REQUEST DENIED;
- DEACTIVATION CONFIRMED.

Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclauses 9.2.3 and 10.4).

Defects: None.

Consequent Actions:

On declaration of RI_RDI, the function shall output VP-RDI OAM cells according to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.1.2); on clearing of RI_RDI, the generation of VP-RDI cells shall be stopped. If implemented, the defect type and defect location field of the VP-RDI cell shall contain the value provided by the Avp_TT_Sk. If these fields are not used, the binary contents shall be coded as 6AHex.

Defect Correlations: None.

Performance Monitoring: None.

5.2.2 ATM virtual path trail termination sink function Avp_TT_Sk

Symbol:

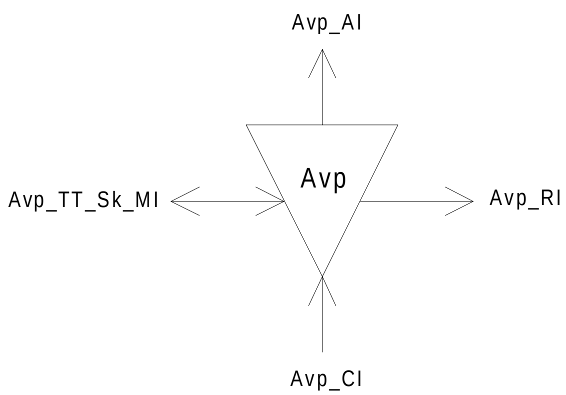


Figure 37: Avp_TT_Sk symbol

Interfaces:

Table 11: Avp_TT_Sk input and output signals

Input(s)	Output(s)
Avp_CI_D Avp_CI_ACS Avp_CI_SSF Avp_TT_Sk_ MI_RDIreported Avp_TT_Sk_ MI_AISreported Avp_TT_Sk_ MI_LOCreported Avp_TT_Sk_ MI_CCActive Avp_TT_Sk_ MI_PMActive	Avp_AI_D Avp_AI_ACS Avp_AI_TSF Avp_RI_RDI Avp_RI_BRPMdata Avp_TT_Sk_MI_CCADrequest Avp_TT_Sk_MI_CCADreport Avp_TT_Sk_MI_PMADrequest Avp_TT_Sk_MI_PMADreport Avp_TT_Sk_MI_cRDI Avp_TT_Sk_MI_RDIdata Avp_TT_Sk_MI_cAIS Avp_TT_Sk_MI_AISdata Avp_TT_Sk_MI_cLOC

Processes:

This function performs VP-RDI detection, Continuity Check, PM cell extraction, VP-AIS detection and PM and CC activation/deactivation. It extracts all the F4 end-to-end OAM cells from the Characteristic Information.

VP-RDI: The information carried in the F4 OAM RDI cell shall be extracted. The VP-RDI provides information as to the status of the remote receiver, as well as to the defect type and defect location. The information extracted from the defect type and defect location field is reported to the Element Management Function (EMF) via MI_RDIdata. The presence of an RDI cell indicates a Remote Defect Indication state, while the absence of RDI cells for longer than 2,5 ± 0,5 seconds indicates the normal, working state. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclauses 9.2.1.1.1.2 and 10.2.1).

Continuity Check:

CC activation (and associated deactivation) can be initiated either by the TMN/end user by one endpoint with associated OAM flow or entirely via TMN. The corresponding Management Information for direct TMN activation/deactivation is MI_CCActive. The corresponding Management Information for AD OAM flows activation/deactivation is MI_CCAD. If enabled by the CC activation process (MI_CCActive or MI_CCAD), the function shall process the CC cells according to the Defects subclause below.

PM cell extraction:

PM activation (and associated deactivation) can be initiated either by the TMN/end user by one endpoint with associated OAM flow or entirely via TMN. The corresponding Management Information for direct TMN activation/deactivation is MI_PMActive. The corresponding Management Information for AD OAM flows activation/deactivation is MI_PMAD. If enabled by the Performance Monitoring (PM) activation process (MI_PMActive or MI_PMAD), the PM forward monitoring cells shall be extracted and processed according to the Performance Monitoring subclause below.

VP-AIS: The information carried in the F4 OAM AIS cell shall be extracted. The VP-AIS provides information as to the status of the VP connection, as well as to the defect type and defect location. The information extracted from the defect type and defect location field is reported to the EMF via MI_AISdata. The presence of an AIS cell indicates an Alarm Indication state, while the reception of a user cell or CC cell indicates the normal, working state. In case of Continuity Check is not activated, the absence of AIS cells for longer than 2,5 ± 0,5 seconds also indicates the normal, working state. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclauses 9.2.1.1.1.1 and 10.2.1).

AD OAM flows: If a CC or PM ACTIVATE request cell is received, MI_CCAD request or MI_PMADrequest is generated towards the Management Layer. On receipt of ACTIVATION CONFIRMED, ACTIVATION REQUEST DENIED or DEACTIVATION CONFIRMED F4 end-to-end OAM cell, an MI_PMADreport, resp. MI_CCADreport is sent to the Management Layer. For more detail see ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.3 and annex B).

In case this function detects F4 segment OAM cells that were not extracted by the segment termination function, these cells shall be discarded.

According to ETS 300 404 [8], subclause 9.2.1.1.2, permanent end-to-end CC mechanism shall be provided simultaneously for all reserved, permanent and semi-permanent VPCs.

Defects:

If enabled by the CC activation process, the function shall declare dLOC if no user cell or continuity check cell is received within a time interval of 3,5 seconds, with a margin of ±0,5 seconds (sliding window). Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.2). dLOC shall be cleared when any user cell or CC cell is received. Also refer to ITU-T Recommendation I.732 [24], subclause 5.6.1.1.2.

The function shall declare dRDI on receipt of a VP-RDI cell. dRDI shall be cleared when no VP-RDI is received during a nominally 2,5 seconds period, with a margin of ±0,5 seconds. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.1.2).

The function shall declare dAIS on receipt of a VP-AIS cell. The dAIS shall be cleared when an user cell is received. The dAIS shall also be cleared when VP-AIS cells are absent during a nominally 2,5 seconds period within a margin of ±0,5seconds. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.1.1).

NOTE 1: dAIS as of the present document is not identical to the AIS state of ITU-T Recommendation I.610 [23].

Consequent Actions:

aTSF ← CI_SSF or dLOC or dAIS.

aRDI ← CI_SSF or dLOC or dAIS.

The consequent action aRDI is conveyed through RI_RDI to the Avp_TT_So together with the defect type and defect location (if implemented). In case of dAIS, defect type and location through RI_RDI are as in the received VP-AIS cell. In case of CI_SSF and dLOC, defect type and location are in respect to the equipment this function is built into.

NOTE 2: VC-AIS insertion is performed in the Avp/Avc_A_Sk function under control of AI_TSF.

Defect Correlations:

cRDI ← dRDI and RDIreported.

cAIS ← dAIS and (not CI_SSF) and AISreported.

cLOC ← dLOC and (not CI_SSF) and (not dAIS) and LOCreported.

It shall be an option to report AIS as a fault cause. This is controlled by means of the parameter AISreported. The default shall be AISreported = false.

It shall be an option to report RDI as a fault cause. This is controlled by means of the parameter RDIreported. The default shall be RDIreported = false.

It shall be an option to report LOC as a fault cause. This is controlled by means of the parameter LOCreported. The default shall be LOCreported = false.

Performance Monitoring:

If activated by the PM activation process, the function shall monitor the performance derived from the comparison between received block of user cells and information in a received Forward Monitoring PM cell. The definition of user cells is given in ETS 300 404 [8] (table 1 of ITU-T Recommendation I.610 [23]). The result is backward reported via RI_BRPMdata. The received backward reporting PM cell on the near end contains the performance information regarding the unidirectional connection, set up from the near end to the far end. This information is reported to the EMF.

NOTE 3: Supported parameters (e.g. Near/Far End Defect Seconds (pN_DS, pF_DS), Cell Loss Ratio, Cell Error Ratio, Cell Misinsertion Rate) as well as the process need to be added. PM will detect errored blocks and total received user cell counts. Performances or backward report results of the received PM cell are reported to the EMF.

5.3 ATM virtual path monitoring functions

5.3.1 ATM virtual path non-intrusive monitoring function Avpm_TT_Sk

Symbol:

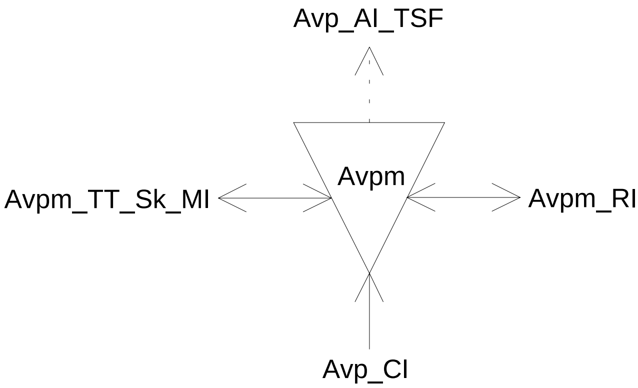


Figure 38: Avpm_TT_Sk symbol

Interfaces:

Table 12: Avpm_TT_Sk input and output signals

Input(s)	Output(s)
Avp_CI_D Avp_CI_ACS Avp_CI_SSF Avpm_TT_Sk_MI_AISreported Avpm_TT_Sk_MI_RDIreported Avpm_TT_Sk_MI_LOCreported Avp_TT_Sk_MI_LBdiscard Avpm_TT_Sk_ MI_CCActive Avpm_TT_Sk_ MI_PMActive Avpm_RI_LBtimer	Avp_AI_TSF Avpm_RI_LBresponse Avpm_TT_Sk_MI_cAIS Avpm_TT_Sk_MI_AISdata Avpm_TT_Sk_MI_cRDI Avpm_TT_Sk_MI_RDIdata Avpm_TT_Sk_MI_cLOC Avpm_TT_Sk_MI_LBdata Avpm_TT_Sk_MI_LBfail Avpm_TT_Sk_MI_LBcompleted

Processes:

This function monitors the F4 end-to-end and segment OAM cell flow. It performs VP-RDI detection, Continuity Check, VP-AIS detection, PM and CC activation/deactivation and loopback processing.

VP-RDI: The information carried in the F4 OAM RDI cell shall be monitored. The VP-RDI provides information as to the status of the remote receiver, as well as to the defect type and defect location. The information extracted from the defect type and defect location field is reported to the EMF via MI_RDIdata. The presence of an RDI cell indicates a Remote Defect Indication state, while the absence of RDI cells for longer than 2,5 ± 0,5 seconds indicates the normal, working state. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclauses 9.2.1.1.1.2 and 10.2.1).

Continuity Check: If enabled by the CC activation process (MI_CCActive), the function shall process the CC cells according to the Defects subclause below.

PM cell monitoring: If enabled by the Performance Monitoring (PM) activation process (MI_PMActive), the PM cells shall be monitored and processed according to the Performance Monitoring subclause below. *VP-AIS:* The information carried in the F4 OAM AIS cell shall be monitored. The VP-AIS provides information as to the status of the VP connection, as well as to the defect type and defect location. The information extracted from the defect type and defect location field is reported to the EMF via MI_AISdata. The presence of an AIS cell indicates an Alarm Indication state, while the reception of a user cell or CC cell indicates the normal, working state. In case of Continuity Check is not activated, the absence of AIS cells for longer than 2,5 ± 0,5 seconds also indicates the normal, working state. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclauses 9.2.1.1.1.1 and 10.2.1).

NOTE 1: ETS 300 404 [8] (ITU-T Recommendation I.610 [23]) currently does not specify Continuity Check at intermediate Connection Points. Continuity Check could be useful in future for e.g. SNC protection. This issue is for further study.

Loopback processing:

If MI_LBdiscard = false, the function shall monitor the cell flow for F4 OAM end-to-end Loopback cells being inserted by the Avplb_TT_So function. On RI_LBtimer from Avplb_TT_So, a 5 seconds timer is started. If within this time period an F4 OAM end-to-end Loopback cell with Loopback Indication set to "0" is monitored, an MI_LBcompleted indication is generated and the received Loopback Location IDentifier (LLID) and Source ID reported to the EMF via MI_LBdata; if no Loopback cell with Loopback Indication set to "0" is received within this time period, an MI_LBfail indication is generated. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.3, network-to-endpoint loopback).

If MI_LBdiscard = false, the function shall monitor the cell flow for F4 OAM segment Loopback cells being inserted by the Avplb_TT_So function. If an F4 OAM segment Loopback cell with Loopback Indication set to "1" and an LLID matching the CPID or an LLID = all "1"s or an LLID = all "0"s is received, this function copies and forwards the cell via RI_LBresponse to the Avplb_TT_So function for insertion of the Loopback cell in reverse direction. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.3, connecting point for single and multiple loopback technique).

Table 13 summarizes these conditions:

Table 13: Loopback conditions

Received cell (LBdiscard = false)	Loopback indication	LLID	Action
e-t-e loopback cell	0	- any value	If LBtimer < 5 seconds: - report LBcompleted - LLID/Source ID reported to LBdata
			If LBtimer > 5 seconds: - report LBfail
segment loopback cell	1	single LB: - all ONE's or - LLID = CPID multiple LB: - all ZERO's	- copy loopback cell to LBresponse

NOTE 2: In-band activation/deactivation via AD OAM cells of Avpm_TT_Sk function for CC and PM is for further study.

Defects:

If enabled by the CC activation process, the function shall declare dLOC if no user cell or continuity check cell is received within a time interval of 3,5 seconds, with a margin of ±0,5 seconds (sliding window). Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.2). dLOC shall be cleared when any user cell or CC cell is received. Also refer to ITU-T Recommendation I.732 [24], subclause 5.6.1.1.2.

The function shall declare dRDI on receipt of a VP-RDI cell. dRDI shall be cleared when no VP-RDI is received during a nominally 2,5 seconds period, with a margin of ±0,5 seconds. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.1.2).

The function shall declare dAIS on receipt of a VP-AIS cell. The dAIS shall be cleared when an user cell is received. The dAIS shall also be cleared when VP-AIS cells are absent during a nominally 2,5 seconds period within a margin of ±0,5seconds. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.1.1).

NOTE 3: dAIS as of the present document is not identical to the AIS state of ITU-T Recommendation I.610 [23].

Consequent Actions:

aTSF ← CI_SSF or dLOC or dAIS

NOTE 4: The use and definition of the Avp_AI_TSF e.g. for SNC protection purposes is for further study in the ITU-T (ITU-T Recommendation I.630).

Defect Correlations:

cRDI ← dRDI and RDIreported.

cAIS ← dAIS and (not CI_SSF) and AISreported.

cLOC ← dLOC and (not CI_SSF) and (not dAIS) and LOCreported.

It shall be an option to report AIS as a fault cause. This is controlled by means of the parameter AISreported. The default shall be AISreported = false.

It shall be an option to report RDI as a fault cause. This is controlled by means of the parameter RDIreported. The default shall be RDIreported = false.

It shall be an option to report LOC as a fault cause. This is controlled by means of the parameter LOCreported. The default shall be LOCreported = false.

Performance Monitoring:

If activated by the PM activation process, the forward monitoring function shall monitor blocks of user cells. If activated by the PM activation process, the backward monitoring function shall process backward reporting cells. The definition of user cells is given in ETS 300 404 [8] (ITU-T Recommendation I.610 [23], table 1).

NOTE 5: Supported parameters (e.g. Near/Far End Defect Seconds (pN_DS, pF_DS), Cell Loss Ratio, Cell Error Ratio, Cell Misinsertion Rate) as well as the process need to be added. PM will detect errored blocks and total received user cell counts. Performances or backward report results of the received PM cell are reported to the EMF.

5.4 ATM virtual path segment functions

5.4.1 ATM virtual path segment trail termination source function AvpS_TT_So

Symbol:

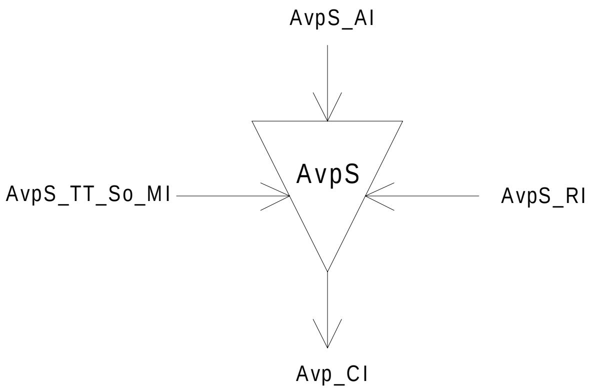


Figure 39: AvpS_TT_So symbol

Interfaces:

Table 14: AvpS_TT_So input and output signals

Input(s)	Output(s)
AvpS_AI_D AvpS_AI_ACS AvpS_RI_BRPMdata AvpS_TT_So_MI_CCADrequest AvpS_TT_So_MI_CCADresponse AvpS_TT_So_MI_PMADrequest AvpS_TT_So_MI_PMADresponse AvpS_TT_So_MI_CCActive AvpS_TT_So_MI_PMActive	Avp_CI_D Avp_CI_ACS

Processes:

This function performs Continuity Check, PM cell generation and PM and CC activation/deactivation on the segment level.

Segment VP-RDI: For further study.

Segment Continuity Check:

CC activation (and associated deactivation) can be initiated either by the TMN/end user by one endpoint with associated OAM flow or entirely via TMN. The corresponding Management Information for direct TMN activation/deactivation is MI_CCActive. The corresponding Management Information for AD OAM flows activation/deactivation is MI_CCAD. If enabled by the CC activation process (MI_CCActive or MI_CCAD), this function monitors the user cell stream activity at the input (AvpS_AI) and generates segment CC cells. There are two options defined in ITU-T Recommendation I.610 [23] for CC. Option 1 defines that a CC cell shall be inserted if no user cell is to be transmitted for ≥ 1 second. Option 2 defines that a CC cell shall be inserted with a periodicity of 1 cell/s. The procedure of CC is described in ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.2). In ETS 300 404 [8] only Option 1 is retained; this is for further study in TM1).

Segment PM cell generation:

PM activation (and associated deactivation) can be initiated either by the TMN/end user by one endpoint with associated OAM flow or entirely via TMN. The corresponding Management Information for direct TMN activation/deactivation is MI_PMActive. The corresponding Management Information for AD OAM flows activation/deactivation is MI_PMAD. If enabled by the PM activation process (MI_PMActive or MI_PMAD), the PM forward monitoring cells shall be generated; the BRPM cells shall be generated using the PM data from AvpS_RI_BRPMdata being collected by the AvpS_TT_Sk. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 10.3). Forced insertion of performance monitoring cells (forward monitoring) is permitted at VP segment level (ETS 300 404 [8], subclause 6.2.1.2).

AD OAM flows: On MI_CCADrequest or MI_PMADrequest, an ACTIVATE/DEACTIVATE cell for segment CC or segment PM shall be generated. Depending on the received type of CCADresponse or PMADresponse from the Management Layer, one of the following F4 OAM cells for CC or PM activation/deactivation process shall be sent:

- ACTIVATION CONFIRMED;
- ACTIVATION REQUEST DENIED;
- DEACTIVATION CONFIRMED.

Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclauses 9.2.3 and 10.4).

Defects: None.

Consequent Actions:

NOTE: Insertion of segment VP-RDI cells is for further study

Defect Correlations: None.

Performance Monitoring: None.

5.4.2 ATM virtual path segment trail termination sink function AvpS_TT_Sk

Symbol:

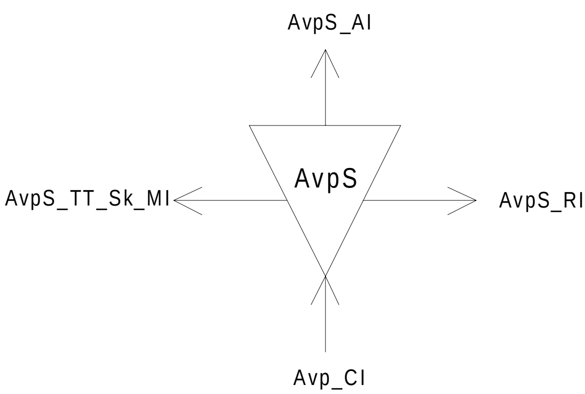


Figure 40: AvpS_TT_Sk symbol

Interfaces:

Table 15: AvpS_TT_Sk input and output signals

Input(s)	Output(s)
Avp_CI_D Avp_CI_ACS Avp_CI_SSF AvpS_TT_Sk_MI_SLOCreported AvpS_TT_Sk_MI_CCActive AvpS_TT_Sk_MI_PMActive	AvpS_AI_D AvpS_AI_ACS AvpS_AI_TSF AvpS_RI_BRPMdata AvpS_TT_Sk_MI_CCADrequest AvpS_TT_Sk_MI_CCADreport AvpS_TT_Sk_MI_PMADrequest AvpS_TT_Sk_MI_PMADreport AvpS_TT_Sk_MI_cSLOC

Processes:

This function performs Continuity Check, PM cell extraction and PM and CC activation/deactivation on the segment level. It extracts all F4 segment OAMs cells from the CI:

Segment VP-RDI: For further study.

Segment VP-AIS: For further study.

Segment Continuity Check:

CC activation (and associated deactivation) can be initiated either by the TMN/end user by one endpoint with associated OAM flow or entirely via TMN. The corresponding Management Information for direct TMN activation/deactivation is MI_CCActive. The corresponding Management Information for AD OAM flows activation/deactivation is MI_CCAD. If enabled by the CC activation process (MI_CCActive or MI_CCAD), the function shall process the CC cells according to the Defects subclause below.

PM cell extraction:

PM activation (and associated deactivation) can be initiated either by the TMN/end user by one endpoint with associated OAM flow or entirely via TMN. The corresponding Management Information for direct TMN activation/deactivation is MI_PMActive. The corresponding Management Information for AD OAM flows activation/deactivation is MI_PMAD. If enabled by the Performance Monitoring (PM) activation process, the PM forward monitoring cells shall be extracted and processed according to the Performance Monitoring subclause below.

AD OAM flows: If a segment CC or segment PM ACTIVATE request cell is received, MI_CCAD request or MI_PMADrequest is generated towards the Management Layer. On receipt of ACTIVATION CONFIRMED, ACTIVATION REQUEST DENIED or DEACTIVATION CONFIRMED F4 segment OAM cell, a MI_PMADreport, resp. MI_CCADreport is sent to the Management Layer. For more detail see ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.3 and annex B).

An F4 segment end point shall discard any F4 segment flow cell in outgoing direction.

According to ETS 300 404 [8], subclause 9.2.1.1.2, permanent segment CC mechanism shall be provided simultaneously for all reserved, permanent and semi-permanent VPCs. when the segment sink and sources are activated.

Defects:

If enabled by the CC activation process, the function shall declare dSLOC if no user cell or continuity check cell is received within a time interval of 3,5 seconds, with a margin of ±0,5 seconds (sliding window). Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.2). dSLOC shall be cleared when any user cell or CC cell is received. Also refer to ITU-T Recommendation I.732 [24], subclause 5.4.2.1.2.

NOTE 1: According to ETS 300 404 [8], subclause 9.2.1.1.2, activation/deactivation of end-to-end CC mechanism for reserved, permanent and semi-permanent VPCs remains as an option.

Consequent Actions:

aTSF ← CI_SSF or dSLOC.

aSRDI ← for further study.

Defect Correlations:

cSLOC ← dSLOC and (not dAIS) and (not CI_SSF) and SLOCreported.

It shall be an option to report LOC as a fault cause. This is controlled by means of the parameter LOCreported. The default shall be LOCreported = false.

NOTE 2: cSRDI and cSAIS are for further study.

Performance Monitoring:

If activated by the PM activation process, the function shall monitor the performance derived from the comparison between received block of user cells and information in a received Forward Monitoring PM cell. The definition of user cells is given in ETS 300 404 [8] (table 1 ITU-T Recommendation I.610 [23]). The result is backward reported via RI_BRPMdata. The received backward reporting PM cell on the near end contains the performance information regarding the unidirectional connection, set up from the near end to the far end. This information is reported to the EMF.

Forced insertion of performance monitoring cells is permitted at VP segment level.

NOTE 3: Supported parameters (e.g. Near/Far End Defect Seconds (pN_DS, pF_DS), Cell Loss Ratio, Cell Error Ratio, Cell Misinsertion Rate) as well as the process need to be added. PM will detect errored blocks and total received user cell counts. Performances or backward report results of the received PM cell are reported to the EMF.

5.4.3 ATM virtual path segment to ATM virtual path adaptation source function AvpS/Avp_A_So

Symbol:

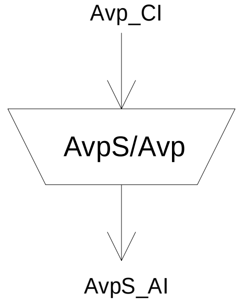


Figure 41: AvpS/Avp_A_So symbol

Interfaces:

Table 16: AvpS/Avp_A_So input and output signals

Input(s)	Output(s)
Avp_CI_D Avp_CI_ACS Avp_CI_SSF	AvpS_AI_D AvpS_AI_ACS

Processes: None.

Defects: None.

Consequent Actions: None.

Defect Correlations: None.

Performance Monitoring: None.

5.4.4 ATM virtual path segment to ATM virtual path adaptation sink function AvpS/Avp_A_Sk

Symbol:

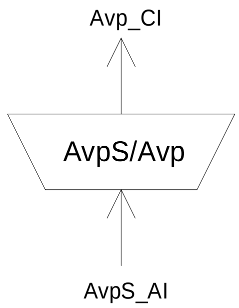


Figure 42: AvpS/Avp_A_Sk symbol

Interfaces:

Table 17: AvpS/Avp_A_Sk input and output signals

Input(s)	Output(s)
AvpS_AI_D AvpS_AI_ACS AvpS_AI_TSF	Avp_CI_D Avp_CI_ACS Avp_CI_SSF

Processes: None.

Defects: None.

Consequent Actions:

aSSF ← AI_TSF.

aAIS ← AI_TSF.

On declaration of aAIS the function shall output VP-AIS OAM cells on all active VPCs according to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.1.1); on clearing of aAIS the generation of VP-AIS cells shall be stopped. If implemented, the defect type and defect location field of the VP-AIS cell shall be inserted in the information field. The contents of these fields is for further study.

Defect Correlations: None.

Performance Monitoring: None.

5.5 ATM virtual path traffic management functions

NOTE: The ATM Virtual Path Traffic Management Functions are, if activated, always present as a set. If active, the Avp_CI output of the AvpT/Avp_A_Sk is always connected to the Avp_CI input of the AvpT/Avp_A_So as shown in figure 43. This model allows the insertion of additional traffic management functions by not inserting an additional sub-layer in the network architecture view.

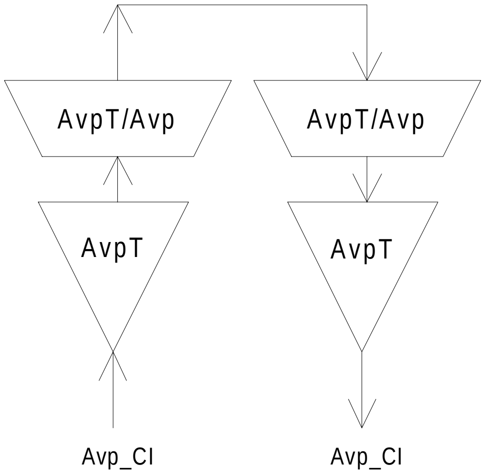


Figure 43: Model of active AvpT Traffic Management functions

5.5.1 ATM virtual path traffic management trail termination source function AvpT_TT_So

Symbol:

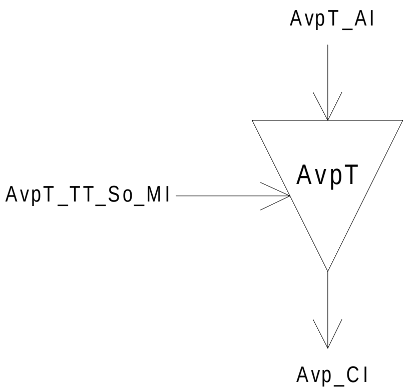


Figure 44: AvpT_TT_So symbol

Interfaces:

Table 18: AvpT_TT_So input and output signals

Input(s)	Output(s)
AvpT_AI_D AvpT_AI_ACS AvpT_AI_TSF AvpT_AI_CNGI	Avp_CI_D Avp_CI_ACS Avp_CI_SSF

Processes:

This function performs EFCI setting and RM cells insertion.

EFCI setting: This function is optional. The insertion of EFCI is driven by the input AvpT_AI_CNGI from the S4/Avp_A_Sk. The EFCI setting is done in the PTI field of the cell header on all VPs of this CI. For the coding, refer to ETS 300 298-2 [3] (ITU-T Recommendation I.361 [18]). The PTI field shall not be changed if the NE is not congested.

RM cells insertion: This function is for further study.

Defects: None.

Consequent Actions:

aSSF ← AI_TSF.

On declaration of AI_CNGI, any congested NE, upon receiving a user data cell, may modify the PTI as follows: Cells received with PTI = 000 or PTI = 010 are transmitted with PTI = 010. Cells received with PTI = 001 or PTI = 011 are transmitted with PTI = 011. For the use of EFCI, refer to EN 300 301 [5] (ITU-T Recommendation I.371 [19]).

Defect Correlations: None.

Performance Monitoring: None.

5.5.2 ATM virtual path traffic management trail termination sink function AvpT_TT_Sk

Symbol:

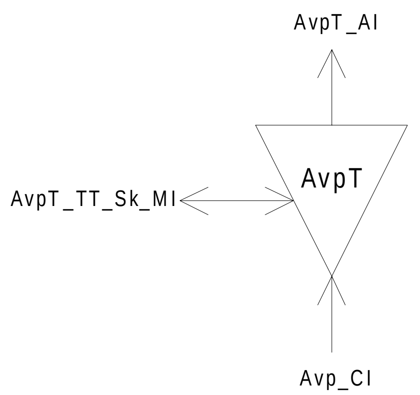


Figure 45: AvpT_TT_Sk symbol

Interfaces:

Table 19: AvpT_TT_Sk input and output signals

Input(s)	Output(s)
Avp_CI_D Avp_CI_ACS Avp_CI_SSF Avp_CI_CNGI AvpT_TT_Sk _MI_ShapingActive AvpT_TT_Sk _MI_UPC/NPCactive AvpT_TT_Sk _MI_VPusgActive	AvpT_AI_D AvpT_AI_ACS AvpT_AI_TSF AvpT_AI_CNGI

Processes:

This functions performs the Usage Parameter Control (UPC)/Network Parameter Control (NPC), VP traffic shaping VP usage measurement and RM cells extraction per Virtual Path Connection (VPC).

UPC/NPC: This function is optional and can only be present at the ingress direction of the Network Element. If implemented, the UPC/NPC function can be activated/deactivated by UPC/NPCactive. If activated, it shall detect violations of negotiated traffic parameters for purpose of protecting the QoS of other VPCs. The use of UPC may be required, whereas the use of NPC is optional. Processes and requirements of UPC/NPC are described in EN 300 301 [5] (ITU-T Recommendation I.371 [19]).

NOTE 1: The use of UPC in ATM equipment on the user side of S_B and T_B reference point is optional.

VP traffic shaping: This function is optional. If implemented, the shaping function can be activated/deactivated by MI_ShapingActive. If activated, it shall perform traffic shaping according to EN 300 301 [5] (ITU-T Recommendation I.371 [19]).

NOTE 2: The VP traffic shaping function should not be simultaneously activated on both sink and source directions of the same VPC.

VP usage measurement: This function is optional. If enabled by VPusgActive, this function shall count the incoming cells on the VPC.

RM cells extraction: This process is for further study.

Defects: None.

Consequent Actions:

aCNGI ← CI_CNGI.

aTSF ← CI_SSF.

Defect Correlations: None.

Performance Monitoring:

The Performance Monitoring parameters are for further study. The following parameters need to be defined:

- VP usage measurement: Count for CLP = 0 + 1; Count for CLP = 00;
- UPC/NPC (tagged cell count): Count for CLP = 0 + 1; Count for CLP = 0.

5.5.3 ATM virtual path traffic management to ATM virtual path adaptation source function AvpT/Avp_A_So

Symbol:

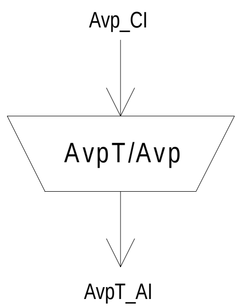


Figure 46: AvpT/Avp_A_So symbol

Interfaces:

Table 20: AvpT/Avp_A_So input and output signals

Input(s)	Output(s)
Avp_CI_D Avp_CI_ACS Avp_CI_SSF Avp_CI_CNGI AvpT/Avp_A_So_MI_Active	AvpT_AI_D AvpT_AI_ACS AvpT_AI_TSF AvpT_AI_CNGI

NOTE: If activated by MI_Active, the input of this function is always connected to the AvpT/Avp_A_Sk function.

Processes: None.

Defects: None.

Consequent Actions:

aTSF ← CI_SSF.

aCNGI ← CI_CNGI.

Defect Correlations: None.

Performance Monitoring: None.

5.5.4 ATM virtual path traffic management to ATM virtual path adaptation sink function AvpT/Avp_A_Sk

Symbol:

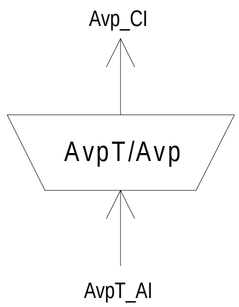


Figure 47: AvpT/Avp_A_Sk symbol

Interfaces:

Table 21: AvpT/Avp_A_Sk input and output signals

Input(s)	Output(s)
AvpT_AI_D AvpT_AI_ACS AvpT_AI_TSF AvpT_AI_CNGI AvpT/Avp_A_Sk_MI_Active	Avp_CI_D Avp_CI_ACS Avp_CI_SSF Avp_CI_CNGI

NOTE: If activated by MI_Active, the output of this function is always connected to the AvpT/Avp_A_So function.

Processes: None.

Defects: None.

Consequent Actions:

aSSF ← AI_TSF.

aCNGI ← AI_CNGI.

Defect Correlations: None.

Performance Monitoring: None.

5.6 ATM virtual path loopback functions

5.6.1 ATM virtual path loopback source function Avplb_TT_So

Symbol:

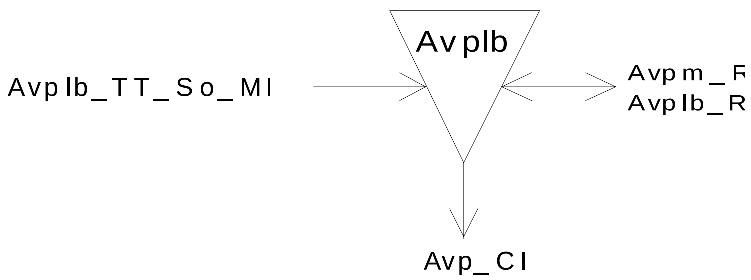


Figure 48: Avplb_TT_So symbol

Interfaces:

Table 22: Avplb_TT_So input and output signals

Input(s)	Output(s)
Avplb_RI_LBresponse Avpm_RI_LBresponse Avp_TT_So_MI_LBdiscard Avp_TT_So_MI_LBrequest	Avp_CI_D Avp_CI_ACS Avplb_RI_LBtimer Avpm_RI_LBtimer

Processes:

This function adds the following F4 loopback OAM cells to the CI:

Loopback:

On Avp_MI_LBrequest, an F4 end-to-end loopback cell shall be generated with Loopback Indication set to "1". The LLID and Source ID contain the addresses of the loopback point, resp. of the source point. The default value of the Source ID field is the all ONE's pattern. If the LLID field contains an all ONE's pattern, it indicates the end point of the VP connection. If MI_LBdiscard = true, an indication Avplb_RI_LBtimer shall be generated to start the timer at Avplb_TT_Sk. If MI_LBdiscard = false, an indication Avpm_RI_LBtimer shall be generated to start the timer at Avpm_TT_Sk. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.3, network-to-endpoint loopback).

On Avp_MI_LBrequest, an F4 segment loopback cell shall be generated with Loopback Indication set to "1". The LLID and Source ID contain the addresses of the loopback point (single loopback technique), resp. of the source point. The default value of the Source ID field is the all ONE's pattern. If the LLID field contains an all ZERO's pattern, it indicates that all intermediate connecting points and the end point of the VP segment should send back the received loopback cell (multiple loopback technique): If MI_LBdiscard = true, an indication Avplb_RI_LBtimer shall be generated to start the timer at Avplb_TT_Sk. If MI_LBdiscard = false, an indication Avpm_RI_LBtimer shall be generated to start the timer at Avpm_TT_Sk. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.3, intra-domain loopback).

On Avplb_RI_LBresponse (LBdiscard = true) or Avpm_RI_LBresponse (LBdiscard = false), an F4 loopback cell identical to the cell passed through Avplb_RI_LBresponse/Avpm_RI_LBresponse shall be generated, but with Loopback Indication set to "0" and the LLID set to the CPID of the Loopback point. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclauses 9.2.1.1.3 (connecting points) and 10.2.4).

The time interval of sending consecutive segment or end-to-end Loopback cells shall be longer than 5 seconds.

Defects: None.

Consequent Actions: None.

Defect Correlations: None.

Performance Monitoring: None.

5.6.2 ATM virtual path loopback sink function Avplb_TT_Sk

Symbol:

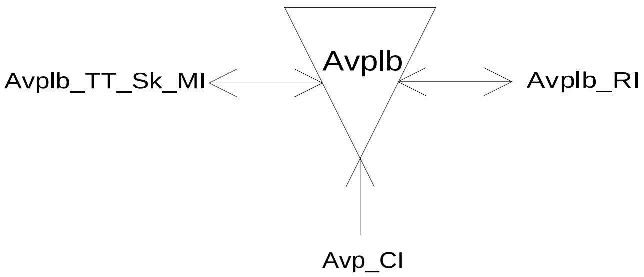


Figure 49: Avplb_TT_Sk symbol

Interfaces:

Table 23: Avplb_TT_Sk input and output signals

Input(s)	Output(s)
Avp_CI_D Avp_CI_ACS Avp_CI_SSF Avp_TT_Sk_MI_LBdiscard Avplb_RI_LBtimer	Avplb_RI_LBresponse Avplb_TT_Sk_MI_LBdata Avplb_TT_Sk_MI_LBfail Avplb_TT_Sk_MI_LBcompleted

Processes:
This function performs the following F4 OAM Loopback cells function:

Loopback processing:

If MI_LBdiscard = true, the function shall terminate the cell flow of F4 OAM end-to-end Loopback cells being inserted by the Avplb_TT_So function. On RI_LBtimer from Avplb_TT_So, a 5 seconds timer is started. If within this time period an F4 OAM end-to-end Loopback cell with Loopback Indication set to "0" is received, an MI_LBcompleted indication is generated and the received LLID and Source ID reported to the EMF via MI_LBdata; if no Loopback cell with Loopback Indication set to "0" is received within this time period, an MI_LBfail indication is generated. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.3, network-to-endpoint loopback).

If MI_LBdiscard = true, the function shall terminate the cell flow of F4 OAM end-to-end Loopback cells being inserted by the Avplb_TT_So function. If an F4 OAM end-to-end Loopback cell with Loopback Indication set to "1" and an LLID matching the CPID or an LLID = all "1"s is received, this function copies and forwards the cell via RI_LBresponse to the Avplb_TT_So function for insertion of the Loopback cell in reverse direction. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.3, connecting point for single loopback technique).

If MI_LBdiscard = true, the function shall terminate the cell flow of F4 OAM segment Loopback cells being inserted by the Avplb_TT_So function. If an F4 OAM segment Loopback cell with Loopback Indication set to "1" and an LLID matching the CPID or an LLID = all "1"s or an LLID = all "0"s is received, this function copies and forwards the cell via RI_LBresponse to the Avplb_TT_So function for insertion of the Loopback cell in reverse direction. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.3, connecting point for single and multiple loopback technique).

If MI_LBdiscard = true, the function shall terminate the cell flow of F4 OAM segment Loopback cells being inserted by the Avplb_TT_So function. On RI_LBtimer from Avplb_TT_So, a 5 seconds timer is started. If within this time period an F4 OAM segment Loopback cell with Loopback Indication set to "0" is received, an MI_LBcompleted indication is generated and the received LLID and Source ID reported to the EMF via MI_LBdata; if no Loopback cell with Loopback Indication set to "0" is received within this time period, an MI_LBfail indication is generated. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.3, loopback termination at connecting point for single loopback technique).

Table 24 summarizes these conditions:

Table 24: Loopback conditions

Received cell (LBdiscard = true)	Loopback indication	LLID	Action
e-t-e loopback cell	1	- all ONE's or - LLID = CPID	- copy loopback cell to LBresponse
e-t-e loopback cell	0	- any value	If LBtimer < 5 seconds: - report LBcompleted - LLID/Source ID reported to LBdata
			If LBtimer > 5 seconds: - report LBfail - discard loopback cell
segment loopback cell	1	single LB: - all ONE's or - LLID = CPID multiple LB: - all ZERO's	- copy loopback cell to LBresponse
segment loopback cell	0	- any value	If LBtimer < 5 seconds: - report LBcompleted - LLID/Source ID reported to LBdata
			If LBtimer > 5 seconds: - report LBfail - discard loopback cell

Defects: None.

Consequent Actions: None.

Defect Correlations: None.

Performance Monitoring: None.

6 ATM virtual path to ATM virtual channel adaptation functions

6.1 ATM virtual path to ATM virtual channel adaptation source function Avp/Avc_A_So

Symbol:

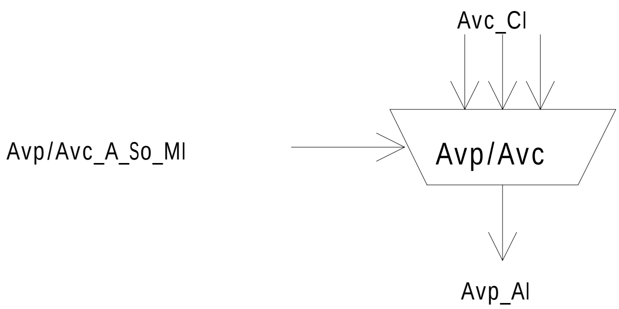


Figure 50: Avp/Avc_A_So symbol

Interfaces:

Table 25: Avp/Avc_A_So input and output signals

Input(s)	Output(s)
per Avc_CI for each VC configured: Avc_CI_D Avc_CI_ACS Avc_CI_SSF Avp/Avc_A_So_MI_CellDiscardActive Avp/Avc_A_So_MI_VCI-LActive Avp/Avc_A_So_MI_Active	Avp_AI_D Avp_AI_ACS

The Avp/Avc_A_So function provides adaptation from the ATM Virtual Channel to the ATM Virtual Path. This is performed by a grouping of Specific Processes and Common Processes as shown in figure 54.

Activation: The function shall access the access point when it is activated (MI_Active is true). Otherwise, it shall not access the access point.

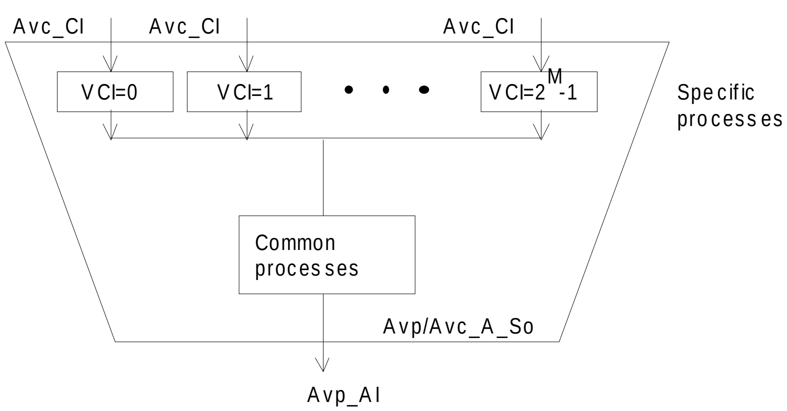


Figure 51: Avp/Avc_A_So atomic function decomposed into Specific and Common processes parts

NOTE 1: The sequential order of the processes within the atomic functions is important. For the correct order, refer to the ordering of the processes given below.

Metasignalling: The metasignalling cells (refer to ETS 300 298-2 [3] (ITU-T Recommendation I.361 [18])) are inserted. This function is optional. The modelling of this process is for further study.

Specific Processes:

These Processes include VCI setting as well as VC asynchronous multiplexing. Each of these Specific Processes is characterized by the VCI number L, where $0 \leq L \leq 2^M - 1$.

NOTE 2: The value of M represents the number of bits in the VCI field and is an integer number. Its maximum value is equal to 16.

VCI-L Activation: The Specific Processes perform the operation specified below when it is activated (MI_VCI-LActive is true).

VCI setting: Each VCC is characterized by the VCI number L, where $0 \leq L \leq 2^M - 1$. This process and the associated VC matrix connection perform the VCI translation.

VC multiplexing: Asynchronous multiplexing is performed for each active Specific function.

Common Processes:

The Common Processes include: Congestion control.

Congestion control: If enabled by MI_CellDiscardActive, this function shall perform selective cell discard according to CLP value. In the event of congestion, cells with CLP = 1 are subject to be discarded prior to cells with CLP = 0. See EN 300 301 [5] (ITU-T Recommendation I.371 [19]) for further details about the use of the CLP.

Defects: None.

Consequent Actions: None.

Defect Correlations: None.

Performance Monitoring:

The use of the Performance Monitoring parameters are for further study. The following parameters need to be defined:

- Count of discarded cells from congestion control.

6.2 ATM virtual path to ATM virtual channel adaptation sink function Avp/Avc_A_Sk

Symbol:

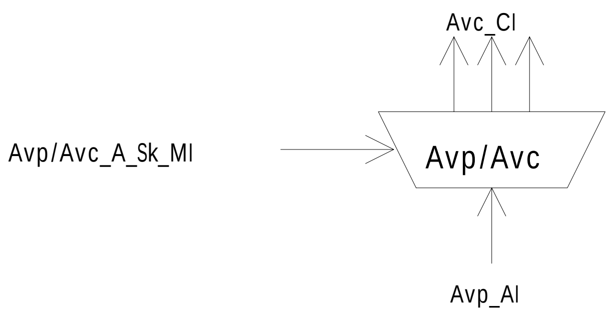


Figure 52: Avp/Avc_A_Sk symbol

Interfaces:

Table 26: Avp/Avc_A_Sk input and output signals

Input(s)	Output(s)
Avp_AI_D Avp_AI_ACS Avp_AI_TSF Avp/Avc_A_Sk_MI_VCIrange Avp/Avc_A_Sk_MI_CellDiscardActive Avp/Avc_A_Sk_MI_VCI-LActive Avp/Avc_A_Sk_MI_Active	per Avc_CI for each VC configured: Avc_CI_D Avc_CI_ACS Avc_CI_SSF Avc_CI_CNGI

NOTE 1: L is the VCI number, where $0 \le L \le 2^M - 1$. This parameter defines the VC value within the AI stream the function has access to. The value of M provided by VCI range represents the number of bits in the VCI fields and is an integer number; its maximum value is equal to 16.

The Avp/Avc_A_Sk function provides adaptation from the ATM Virtual Path to the ATM Virtual Channel. This is performed by a grouping of Specific Processes and Common Processes as shown in figure 56.

Activation: The Avp/Avc_A_Sk function shall perform the Common and Specific Processes operation specified below when it is activated (MI_Active is true). Otherwise, it shall activate the SSF signals at its output (CI_SSF) and not report its status via the management point.

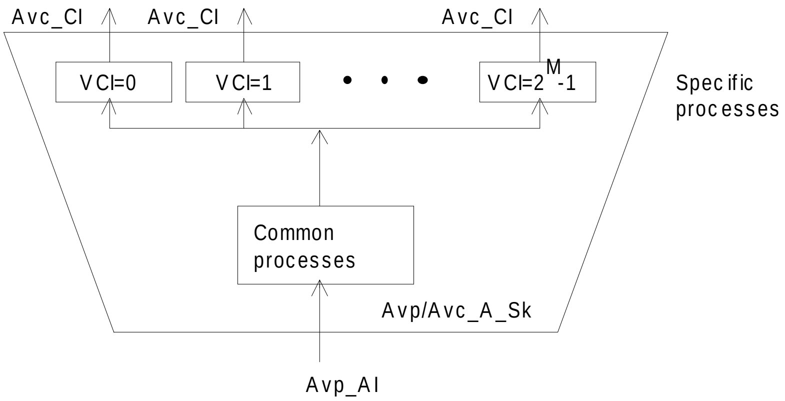


Figure 53: Avp/Avc_A_Sk atomic function decomposed into Specific and Common Processes parts

NOTE 2: The sequential order of the processes within the atomic functions is important. For the correct order, refer to the ordering of the processes given below.

Common Processes:

These Common Processes include: VCI verification and Congestion control.

VCI verification: This function shall verify that the received cell VCI is valid. If the VCI is determined to be invalid (i.e. out-of-range VCI or not assigned), the cell shall be discarded. The range of valid VCI values is given by MI_VCIrange.

Congestion control: If enabled by MI_CellDiscardActive, this function shall perform selective cell discard according to CLP value. In the event of congestion, cells with CLP = 1 are subject to be discarded prior to cells with CLP = 0. In the event of congestion, the indication Avc_CI_CNGI is set for the traffic management function AvcT_TT_So to insert EFCI.

See EN 300 301 [5] (ITU-T Recommendation I.371 [19]) for further details about the use of the CLP.

Metasignalling: The metasignalling cells (refer to ETS 300 298-2 [3] (ITU-T Recommendation I.361 [18])) are inserted with VCI = 1 (activation of Avp/Avc_A_Sk function with L = 1). This function is optional. The modelling of this process is for further study.

Specific Processes:

The function performs VC-AIS insertion and VC demultiplexing on a per VC basis.

VCI-L Activation: The Specific Processes perform the operation specified below when it is activated (MI_VCI-LActive is true). Otherwise, it shall send no cells and Server Signal Fail (SSF) = false.

VC-AIS insertion: If the Specific Processes are activated, the VC-AIS insertion shall be performed as in the Consequent Actions subclause.

VC demultiplexing: The adaptation sink function has access to a specific Avc identified by the number L ($0 \le L \le 2 - 1$). When the function is activated only the cells of that specific Avc-L are passed in client direction.

Defects: None.

Consequent Actions:

aCNGI ← "Event of Congestion" and CellDiscardActive.

aSSF ← AI_TSF.

aAIS ← AI_TSF.

On declaration of aAIS the function shall output VC-AIS OAM cells according to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.2.1.1.1); on clearing of aAIS the generation of VC-AIS cells shall be stopped. If implemented, the defect type and defect location field of the VC-AIS cell shall be inserted in the information field. The contents of these fields is for further study.

Defect Correlations: None.

Performance Monitoring:

The use of the Performance Monitoring parameters are for further study. The parameters for the following functions need to be defined:

- count of discarded cells from congestion control;
- count of cells with invalid VCI (one common counter for invalid header/invalid VPI/invalid VCI is maintained).

7 ATM virtual channel layer network functions

The following figure shows the relative sequencing of the atomic functions of the Virtual Channel (VC) layer network that has to be maintained if they are present (i.e. activated).

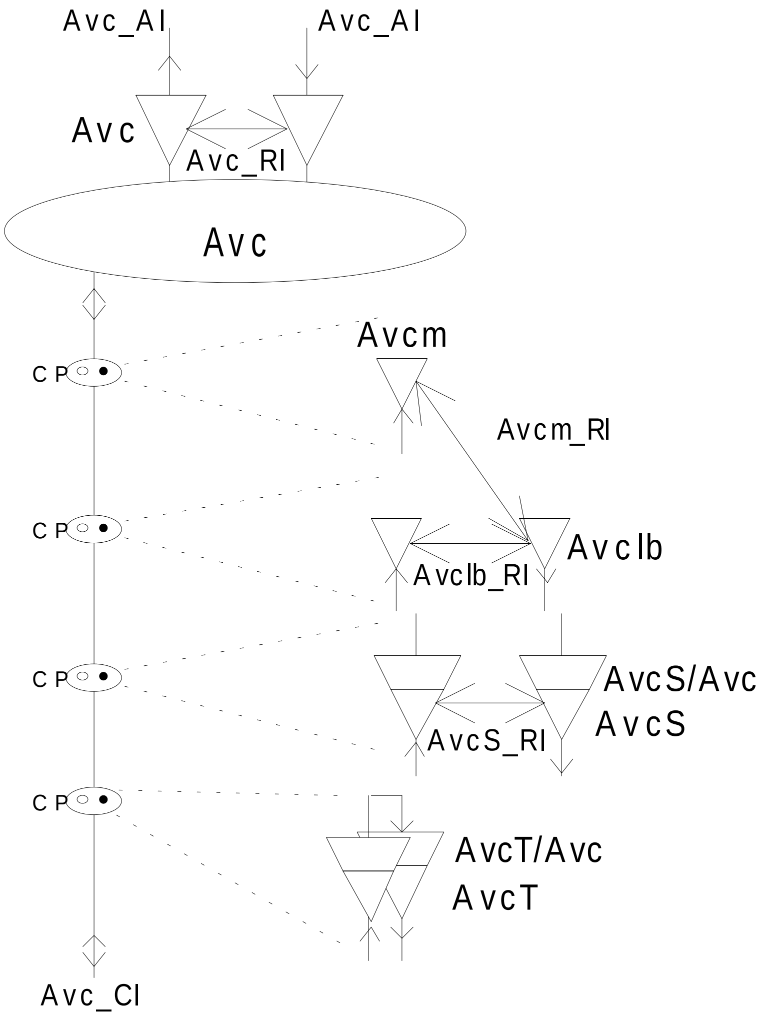


Figure 54: Expanded view of the same VC layer network

NOTE: Currently, the relative ordering of the AvcS, Avclb and Avcm functions is for further study. This includes the question of whether the ordering is significant.

ATM VC Layer Characteristic Information

For further study.

ATM VC Layer Adaptation Information

For further study.

7.1 ATM virtual channel connection function Avc_C

Symbol:

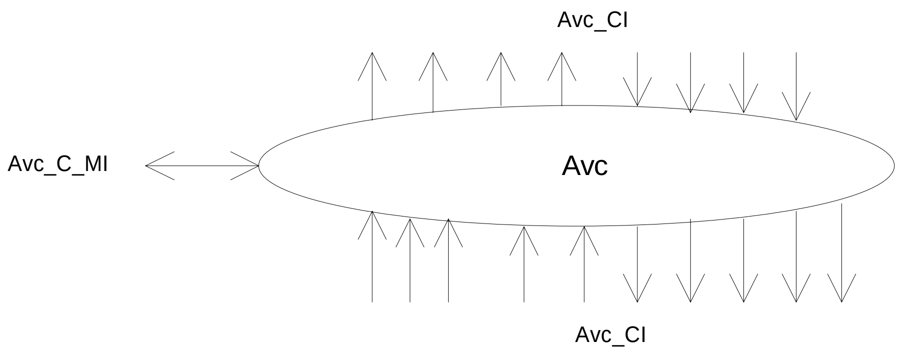


Figure 55: Avc_C symbol

Interfaces:

Table 27: Avc_C input and output signals

Input(s)	Output(s)
per Avc_CI, n x for the function: Avc_CI_D Avc_CI_ACS for inputs from the server layer: Avc_CI_SSF per input and output connection point: Avc_C_MI_ConnectionPortIds per matrix connection: Avc_C_MI_ConnectionType Avc_C_MI_Directionality	per Avc_CI, m x per function: Avc_CI_D Avc_CI_ACS Avc_CI_SSF

Processes:

In the Avc_C function ATM VC Layer Characteristic Information (CI) is routed between input (Termination) Connection Points ((T)CPs) and output (T)CPs by means of matrix connections.

NOTE 1: Neither the number of input/output signals to the connection function, nor the connectivity is specified in the present document. That is a property of individual network elements.

NOTE 2: If CI_SSF is not connected (when connected to the client layer TT_So), CI_SSF is assumed to be false.

Routing: The function shall be able to connect a specific input with a specific output by means of establishing a matrix connection between the specified input and output. It shall be able to remove an established matrix connection.

Each (matrix) connection in the Avc_C function shall be characterized by the:

Type of connection:	unprotected, 1 + 1 protected (for further study);
Traffic direction:	uni-directional, bidirectional;
Input and output connection points:	set of connection point identifiers (refer to EN 300 417-1-1 [9], subclause 3.3.6).

NOTE 3: Multipoint connections are handled as separate connections to the same input CP and are for further study.

It shall be possible to connect one or more CI outputs to one input CP of the Avc_C function.

Defects: None.

Consequent Actions:

If an output of this function is not connected to one of its inputs, the connection function shall send no cells and SSF = false to the output.

Defect Correlations: None.

Performance Monitoring: None.

7.2 ATM virtual channel trail termination functions

7.2.1 ATM virtual channel trail termination source function Avc_TT_So

Symbol:

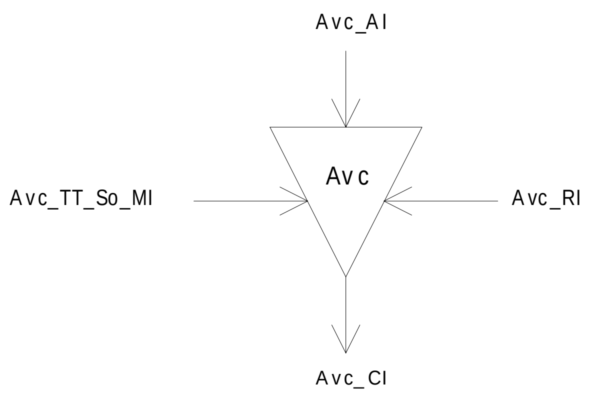


Figure 56: Avc_TT_So symbol

Interfaces:

Table 28: Avc_TT_So input and output signals

Input(s)	Output(s)
Avc_AI_D Avc_AI_ACS Avc_RI_RDI Avc_MI_ TT_So_CCADrequest Avc_MI_ TT_So_CCADresponse Avc_RI_BRPMdata Avc_MI_ TT_So_PMADrequest Avc_MI_ TT_So_PMADresponse Avc_TT_So_MI_PMActive Avc_TT_So_MI_CCActive	Avc_CI_D Avc_CI_ACS

Processes:

This function performs VC-RDI insertion, Continuity Check, PM cell generation and PM and CC activation/deactivation.

VC-RDI insertion: This function inserts VC-RDI cells according to the consequent actions section.

Continuity Check:

CC activation (and associated deactivation) can be initiated either by the TMN/end user by one endpoint with associated OAM flow or entirely via TMN. The corresponding Management Information for direct TMN activation/deactivation is MI_CCActive. The corresponding Management Information for AD OAM flows activation/deactivation is MI_CCAD. If enabled by the CC activation process (MI_CCActive or MI_CCAD), this function monitors the user cell stream activity at the input (Avc_AI) and generates CC cells. There are two options defined in ITU-T Recommendation I.610 [23] for CC. Option 1 defines that a CC cell shall be inserted if no user cell is to be transmitted for ≥ 1 second. Option 2 defines that a CC cell shall be inserted with a periodicity of 1 cell/s. The procedure of CC is described in ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.2). In ETS 300 404 [8] only Option 1 is retained; this is for further study in TM1).

PM cell generation:

PM activation (and associated deactivation) can be initiated either by the TMN/end user by one endpoint with associated OAM flow or entirely via TMN. The corresponding Management Information for direct TMN activation/deactivation is MI_PMActive. The corresponding Management Information for AD OAM flows activation/deactivation is MI_PMAD. If enabled by the PM activation process (MI_PMActive or MI_PMAD), the PM forward monitoring cells shall be generated; the BRPM cells shall be generated using the PM data from Avc_RI_BRPMdata being collected by the Avc_TT_Sk. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 10.3).

AD OAM flow: On Avc_MI_CCADrequest or Avc_MI_PMADrequest, an ACTIVATE/DEACTIVATE cell for CC or PM shall be generated. Depending on the received type of CCADresponse or PMADresponse, from the Management Layer, one of the following F5 OAM cells for CC or PM activation/deactivation process shall be sent:

- ACTIVATION CONFIRMED;
- ACTIVATION REQUEST DENIED;
- DEACTIVATION CONFIRMED.

Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclauses 9.2.3 and 10.4).

Defects: None.

Consequent Actions:

On declaration of RI_RDI, the function shall output VC-RDI OAM cells according to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.2.1.1.2); on clearing of RI_RDI, the generation of VC-RDI cells shall be stopped. If implemented, the defect type and defect location field of the VC-RDI cell shall contain the value provided by the Avc_TT_Sk. If these fields are not used, the binary contents shall be coded as 6AHex.

Defect Correlations: None.

Performance Monitoring: None.

7.2.2 ATM virtual channel trail termination sink function Avc_TT_Sk

Symbol:

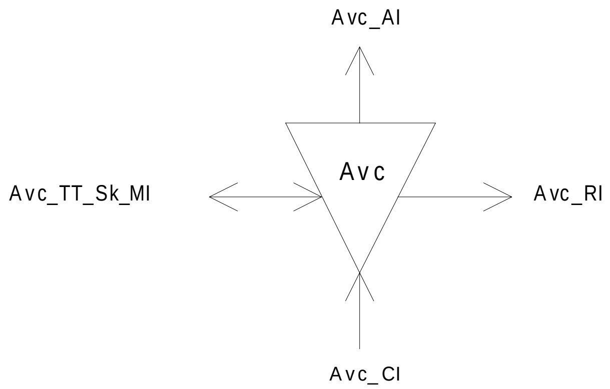


Figure 57: Avc_TT_Sk symbol

Interfaces:

Table 29: Avc_TT_Sk input and output signals

Input(s)	Output(s)
Avc_CI_D Avc_CI_ACS Avc_CI_SSF Avc_TT_Sk_ MI_RDIreported Avc_TT_Sk_ MI_AISreported Avc_TT_Sk_ MI_LOCreported Avc_TT_Sk_MI_CCActive Avc_TT_Sk_MI_PMActive	Avc_AI_D Avc_AI_ACS Avc_AI_TSF Avc_RI_RDI Avc_RI_BRPMdata Avc_TT_Sk_MI_CCADrequest Avc_TT_Sk_MI_CCADreport Avc_TT_Sk_MI_PMADrequest Avc_TT_Sk_MI_PMADreport Avc_TT_Sk_MI_cRDI Avc_TT_Sk_MI_RDIdata Avc_TT_Sk_MI_cAIS Avc_TT_Sk_MI_AISdata Avc_TT_Sk_MI_cLOC

Processes:

This function performs VC-RDI detection, Continuity Check, PM cell extraction, VC-AIS detection and PM and CC activation/deactivation. It extracts all the F5 end-to-end OAM cells from the Characteristic Information.

VC-RDI: The information carried in the F5 OAM RDI cell shall be extracted. The VC-RDI provides information as to the status of the remote receiver., as well as to the defect type and defect location. The information extracted from the defect type and defect location field is reported to the EMF via MI_RDIdata. The presence of an RDI cell indicates a Remote Defect Indication state, while the absence of RDI cells for longer than 2,5 ± 0,5 seconds indicates the normal, working state. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclauses 9.2.2.1.1.2 and 10.2.1).

Continuity Check:

CC activation (and associated deactivation) can be initiated either by the TMN/end user by one endpoint with associated OAM flow or entirely via TMN. The corresponding Management Information for direct TMN activation/deactivation is MI_CCActive. The corresponding Management Information for AD OAM flows activation/deactivation is MI_CCAD. If enabled by the CC activation process (MI_CCActive or MI_CCAD), the function shall process the CC cells according to the Defects subclause below.

PM cell extraction:

PM activation (and associated deactivation) can be initiated either by the TMN/end user by one endpoint with associated OAM flow or entirely via TMN. The corresponding Management Information for direct TMN activation/deactivation is MI_PMActive. The corresponding Management Information for AD OAM flows activation/deactivation is MI_PMAD. If enabled by the Performance Monitoring (PM) activation process, the PM forward monitoring cells shall be extracted and processed according to the Performance Monitoring subclause below.

VC-AIS: The information carried in the F5 OAM AIS cell shall be extracted. The VC-AIS provides information as to the status of the VC connection, as well as to the defect type and defect location. The information extracted from the defect type and defect location field is reported to the EMF via MI_AISdata. The presence of an AIS cell indicates an Alarm Indication state, while the reception of a user cell or CC cell indicates the normal, working state. In case of Continuity Check is not activated, the absence of AIS cells for longer than 2,5 ± 0,5 seconds also indicates the normal, working state. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclauses 9.2.2.1.1.1 and 10.2.1).

AD OAM flows: If a CC or PM ACTIVATE request cell is received, MI_CCADrequest or MI_PMADrequest is generated towards the Management Layer. On receipt of ACTIVATION CONFIRMED, ACTIVATION REQUEST DENIED or DEACTIVATION CONFIRMED F5 end-to-end OAM cell, a MI_PMADreport, resp. MI_CCADreport is sent to the Management Layer. For more detail see ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.3 and annex B).

In case this function detects F5 segment OAM cells that were not extracted by the segment termination function, these cells shall be discarded.

NOTE 1: According to ETS 300 404 [8], subclause 9.2.2.1.2, activation/deactivation of end-to-end CC mechanism for reserved, permanent and semi-permanent VPCs remains as an option.

Defects:

If enabled by the CC activation process, the function shall declare dLOC if no user cell or continuity check cell is received within a time interval of 3,5 seconds, with a margin of ±0,5 seconds (sliding window). Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.2). dLOC shall be cleared when any user cell or CC cell is received. Also refer to ITU-T Recommendation I.732 [24], subclause 5.10.1.1.2.

The function shall declare dRDI on receipt of a VC-RDI cell. dRDI shall be cleared when no VC-RDI is received during a nominally 2,5 seconds period, with a margin of ±0,5 seconds. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.1.2).

The function shall declare dAIS on receipt of a VP-AIS cell. The dAIS shall be cleared when an user cell is received. The dAIS shall also be cleared when VP-AIS cells are absent during a nominally 2,5 seconds period within a margin of ±0,5seconds. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.1.1).

NOTE 2: dAIS as of the present document is not identical to the AIS state of ITU-T Recommendation I.610 [23].

Consequent Actions:

aTSF ← CI_SSF or dLOC or dAIS.

aRDI ← CI_SSF or dLOC or dAIS.

The consequent action aRDI is conveyed through RI_RDI to the Avc_TT_So together with the defect type and defect location (if implemented). In case of dAIS, defect type and location through RI_RDI are as in the received VC-AIS cell. In case of CI_SSF and dLOC, defect type and location are in respect to the equipment this function is built into.

Defect Correlations:

cRDI ← dRDI and RDIreported.

cAIS ← dAIS and (not CI_SSF) and AISreported.

cLOC ← dLOC and (not CI_SSF) and (not dAIS) and LOCreported.

It shall be an option to report AIS as a fault cause. This is controlled by means of the parameter AISreported. The default shall be AISreported = false.

It shall be an option to report RDI as a fault cause. This is controlled by means of the parameter RDIreported. The default shall be RDIreported = false.

It shall be an option to report LOC as a fault cause. This is controlled by means of the parameter LOCreported. The default shall be LOCreported = false.

Performance Monitoring:

If activated by the PM activation process, the function shall monitor the performance derived from the comparison between received block of user cells and information in a received Forward Monitoring PM cell. The definition of user cells is given in ETS 300 404 [8] (table 1 ITU-T Recommendation I.610 [23]). The result is backward reported via RI_BRPMdata. The received backward reporting PM cell on the near end contains the performance information regarding the unidirectional connection, set up from the near end to the far end. This information is reported to the EMF.

NOTE 3: Supported parameters (e.g. Near/Far End Defect Seconds (pN_DS, pF_DS), Cell Loss Ratio, Cell Error Ratio, Cell Misinsertion Rate) as well as the process need to be added. PM will detect errored blocks and total received user cell counts. Performances or backward report results of the received PM cell are reported to the EMF.

7.3 ATM virtual channel monitoring functions

7.3.1 ATM virtual channel non-intrusive monitoring function Avcm_TT_Sk

Symbol:

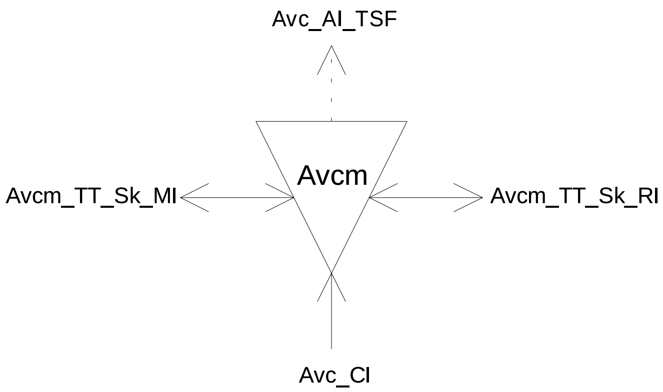


Figure 58: Avcm_TT_Sk symbol

Interfaces:

Table 30: Avcm_TT_Sk input and output signals

Input(s)	Output(s)
Avc_CI_D Avc_CI_ACS Avc_CI_SSF Avcm_TT_Sk_MI_AISreported Avcm_TT_Sk_MI_RDIreported Avcm_TT_Sk_MI_LOCreported Avcm_TT_Sk_ MI_CCActive Avcm_TT_Sk_ MI_PMActive Avcm_RI_LBtimer	Avc_AI_TSF Avcm_RI_LBresponse Avcm_TT_Sk_MI_cAIS Avcm_TT_Sk_MI_AISdata Avcm_TT_Sk_MI_cRDI Avcm_TT_Sk_MI_RDIdata Avcm_TT_Sk_MI_cLOC Avcm_TT_Sk_MI_LBdata Avcm_TT_Sk_MI_LBfail Avcm_TT_Sk_MI_LBcompleted

Processes:

This function monitors the F5 end-to-end and segment OAM cell flow. It performs VC-RDI detection, Continuity Check, VC-AIS detection, PM and CC activation/deactivation and loopback processing.

VC-RDI: The information carried in the F5 OAM RDI cell shall be monitored. The VC-RDI provides information as to the status of the remote receiver, as well as to the defect type and defect location. The information extracted from the defect type and defect location field is reported to the EMF via MI_RDIdata. The presence of an RDI cell indicates a Remote Defect Indication state, while the absence of RDI cells for longer than 2,5 ± 0,5 seconds indicates the normal, working state. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclauses 9.2.2.1.1.2 and 10.2.1).

Continuity Check: If enabled by the CC activation process (MI_CCActive), the function shall process the CC cells according to the Defects subclause below.

PM cell monitoring: If enabled by the Performance Monitoring (PM) activation process (MI_PMActive), the PM cells shall be monitored and processed according to the Performance Monitoring subclause below.

VC-AIS: The information carried in the F5 OAM AIS cell shall be monitored. The VC-AIS provides information as to the status of the VC connection, as well as to the defect type and defect location. The information extracted from the defect type and defect location field is reported to the EMF via MI_AISdata. The presence of an AIS cell indicates an Alarm Indication state, while the reception of a user cell or CC cell indicates the normal, working state. In case of Continuity Check is not activated, the absence of AIS cells for longer than 2,5 ± 0,5 seconds also indicates the normal, working state. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclauses 9.2.2.1.1.1 and 10.2.1).

NOTE 1: ETS 300 404 [8] (ITU-T Recommendation I.610 [23]) currently does not specify Continuity Check at intermediate Connection Points. Continuity Check could be useful in future for e.g. SNC protection. This issue is for further study.

Loopback processing:

If MI_LBdiscard = false, the function shall monitor the cell flow for F5 OAM end-to-end Loopback cells being inserted by the Avclb_TT_So function. On RI_LBtimer from Avclb_TT_So, a 5 seconds timer is started. If within this time period an F5 OAM end-to-end Loopback cell with Loopback Indication set to "0" is monitored, an MI_LBcompleted indication is generated and the received LLID and Source ID reported to the EMF via MI_LBdata; if no Loopback cell with Loopback Indication set to "0" is received within this time period, an MI_LBfail indication is generated. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.2.1.3, network-to-endpoint loopback).

If MI_LBdiscard = false, the function shall monitor the cell flow for F5 OAM segment Loopback cells being inserted by the Avclb_TT_So function. If an F5 OAM segment Loopback cell with Loopback Indication set to "1" and an LLID matching the CPID or an LLID = all "1"s or an LLID = all "0"s is received, this function copies and forwards the cell via RI_LBresponse to the Avclb_TT_So function for insertion of the Loopback cell in reverse direction. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.2.1.3, connecting point for single and multiple loopback technique).

Table 31 summarizes these conditions:

Table 31: Loopback conditions

Received cell (LBdiscard = false)	Loopback indication	LLID	Action
e-t-e loopback cell	0	- any value	If LBtimer < 5 seconds: - report LBcompleted - LLID/Source ID reported to LBdata
			If LBtimer > 5 seconds: - report LBfail
segment loopback cell	1	single LB: - all ONE's or - LLID = CPID multiple LB: - all ZERO's	- copy loopback cell to LBresponse

NOTE 2: In-band activation/deactivation via AD OAM cells of Avcm_TT_Sk function for CC and PM is for further study.

Defects:

If enabled by the CC activation process, the function shall declare dLOC if no user cell or continuity check cell is received within a time interval of 3,5 seconds, with a margin of ±0,5 seconds (sliding window). Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.2.1.2. dLOC shall be cleared when any user cell or CC cell is received. Also refer to ITU-T Recommendation I.732 [24], subclause 5.10.1.1.2).

The function shall declare dRDI on receipt of a VC-RDI cell. dRDI shall be cleared when no VC-RDI is received during a nominally 2,5 seconds period, with a margin of ±0,5 seconds. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.2.1.1.2).

The function shall declare dAIS on receipt of a VP-AIS cell. The dAIS shall be cleared when an user cell is received. The dAIS shall also be cleared when VP-AIS cells are absent during a nominally 2,5 seconds period within a margin of ±0,5 seconds. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.1.1).

NOTE 3: dAIS as of the present document is not identical to the AIS state of ITU-T Recommendation I.610 [23].

Consequent Actions:

aTSF ← CI_SSF or dLOC or dAIS.

Defect Correlations:

cRDI ← dRDI and RDIreported.

cAIS ← dAIS and (not CI_SSF) and AISreported.

cLOC ← dLOC and (not CI_SSF) and (not dAIS) and LOCreported.

It shall be an option to report AIS as a fault cause. This is controlled by means of the parameter AISreported. The default shall be AISreported = false.

It shall be an option to report RDI as a fault cause. This is controlled by means of the parameter RDIreported. The default shall be RDIreported = false.

It shall be an option to report LOC as a fault cause. This is controlled by means of the parameter LOCreported. The default shall be LOCreported = false.

Performance Monitoring:

If activated by the PM activation process, the forward monitoring function shall monitor blocks of user cells. If activated by the PM activation process, the backward monitoring function shall process backward reporting cells. The definition of user cells is given in ETS 300 404 [8] (table 1 ITU-T Recommendation I.610 [23]).

NOTE 4: Supported parameters (e.g. Near/Far End Defect Seconds (pN_DS, pF_DS), Cell Loss Ratio, Cell Error Ratio, Cell Misinsertion Rate) as well as the process need to be added. PM will detect errored blocks and total received user cell counts. Performances or backward report results of the received PM cell are reported to the EMF.

7.4 ATM virtual channel segment functions

7.4.1 ATM virtual channel segment trail termination source function AvcS_TT_So

Symbol:

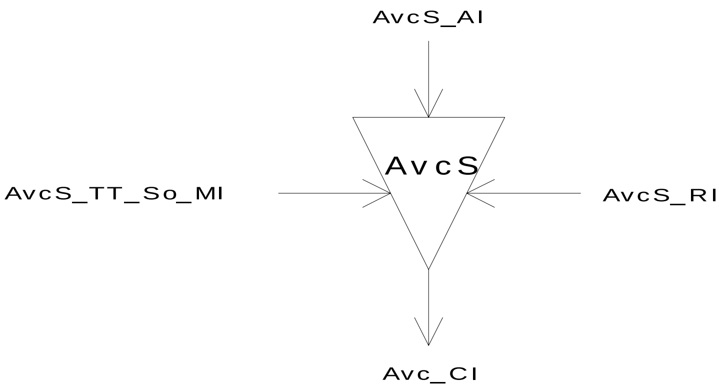


Figure 59: AvcS_TT_So symbol

Interfaces:

Table 32: AvcS_TT_So input and output signals

Input(s)	Output(s)
AvcS_AI_D AvcS_AI_ACS AvcS_RI_BRPMdata AvcS_MI_ TT_So_CCADrequest AvcS_MI_ TT_So_CCADresponse AvcS_MI_ TT_So_PMADrequest AvcS_MI_ TT_So_PMADresponse AvcS_MI_ TT_So_CCActive AvcS_MI_ TT_So_PMActive	Avc_CI_D Avc_CI_ACS

Processes:

This function performs Continuity Check, PM cell generation and PM and CC activation/deactivation on the segment level.

Segment VC-RDI: For further study.

Segment Continuity Check:

CC activation (and associated deactivation) can be initiated either by the TMN/end user by one endpoint with associated OAM flow or entirely via TMN. The corresponding Management Information for direct TMN activation/deactivation is MI_CCActive. The corresponding Management Information for AD OAM flows activation/deactivation is MI_CCAD. If enabled by the CC activation process (MI_CCActive or MI_CCAD), this function monitors the user cell stream activity at the input (AvcS_AI) and generates segment CC cells. There are two options defined in ITU-T Recommendation I.610 [23] for CC. Option 1 defines that a CC cell shall be inserted if no user cell is to be transmitted for ≥ 1 second. Option 2 defines that a CC cell shall be inserted with a periodicity of 1 cell/s. The procedure of CC is described in ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.2). In ETS 300 404 [8] only Option 1 is retained; this is for further study in TM1).

Segment PM cell generation:

PM activation (and associated deactivation) can be initiated either by the TMN/end user by one endpoint with associated OAM flow or entirely via TMN. The corresponding Management Information for direct TMN activation/deactivation is MI_PMActive. The corresponding Management Information for AD OAM flows activation/deactivation is MI_PMAD. If enabled by the PM activation process (MI_PMActive or MI_PMAD), the PM forward monitoring cells shall be generated; the BRPM cells shall be generated using the PM data from AvcS_RI_BRPMdata being collected by the AvcS_TT_Sk. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 10.3). Forced insertion of performance monitoring cells (forward monitoring) is permitted at VC segment level (ETS 300 404 [8], subclause 9.2.1.2).

AD OAM flows: On MI_CCADrequest or MI_PMADrequest, an ACTIVATE/DEACTIVATE cell for segment CC or segment PM shall be generated. Depending on the received type of CCADresponse or PMADresponse from the Management Layer, one of the following F5 OAM cells for CC or PM activation/deactivation process shall be sent:

- ACTIVATION CONFIRMED;
- ACTIVATION REQUEST DENIED;
- DEACTIVATION CONFIRMED.

Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclauses 9.2.3 and 10.4).

Defects: None.

Consequent Actions:

NOTE: Insertion of segment VP-RDI cells is for further study.

Defect Correlations: None.

Performance Monitoring: None.

7.4.2 ATM virtual channel segment trail termination sink function AvcS_TT_Sk

Symbol:

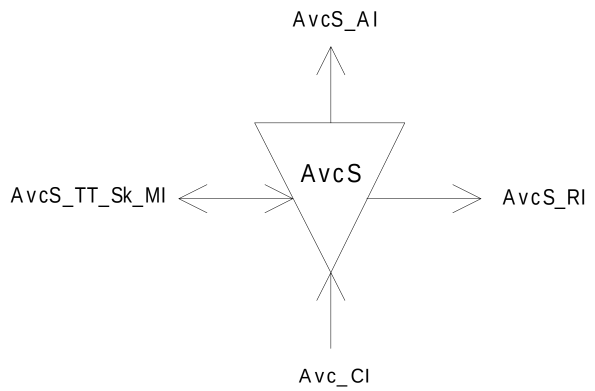


Figure 60: AvcS_TT_Sk symbol

Interfaces:

Table 33: AvcS_TT_Sk input and output signals

Input(s)	Output(s)
Avc_CI_D Avc_CI_ACS Avc_CI_SSF AvcS_TT_Sk_MI_SLOCreported AvcS_TT_Sk_MI_CCActive AvcS_TT_Sk_MI_PMActive	AvcS_AI_D AvcS_AI_ACS AvcS_AI_TSF AvcS_RI_BRPMdata AvcS_TT_Sk_MI_CCADrequest AvcS_TT_Sk_MI_CCADreport AvcS_TT_Sk_MI_PMADrequest AvcS_TT_Sk_MI_PMADreport AvcS_TT_Sk_MI_cSLOC

Processes:

This function performs Continuity Check, PM cell extraction and PM and CC activation/deactivation on the segment level. It extracts all F5 segment OAM cells from the CI:

Segment VC-RDI: For further study.

Segment VC-AIS: For further study.

Segment Continuity Check:

CC activation (and associated deactivation) can be initiated either by the TMN/end user by one endpoint with associated OAM flow or entirely via TMN. The corresponding Management Information for direct TMN activation/deactivation is MI_CCActive. The corresponding Management Information for AD OAM flows activation/deactivation is MI_CCAD. If enabled by the CC activation process (MI_CCActive or MI_CCAD), the function shall process the CC cells according to the Defects subclause below.

PM cell extraction:

PM activation (and associated deactivation) can be initiated either by the TMN/end user by one endpoint with associated OAM flow or entirely via TMN. The corresponding Management Information for direct TMN activation/deactivation is MI_PMActive. The corresponding Management Information for AD OAM flows activation/deactivation is MI_PMAD. If enabled by the Performance Monitoring (PM) activation process, the PM forward monitoring cells shall be extracted and processed according to the Performance Monitoring subclause below.

AD OAM flows: If a segment CC or segment PM ACTIVATE request cell is received, MI_CCAD request or MI_PMADrequest is generated towards the Management Layer. On receipt of ACTIVATION CONFIRMED, ACTIVATION REQUEST DENIED or DEACTIVATION CONFIRMED F5 segment OAM cell, a MI_PMADreport, resp. MI_CCADreport is sent to the Management Layer. For more detail see ETS 300 404 [8] (ITU-T Recommendation I.61, subclause 9.2.3 and annex B).

An F5 segment end point shall discard any F5 segment flow cell in outgoing direction.

Defects:

If enabled by the CC activation process, the function shall declare dSLOC if no user cell or continuity check cell is received within a time interval of 3,5 seconds, with a margin of ±0,5 seconds (sliding window). Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.1.1.2), dSLOC shall be cleared when any user cell or CC cell is received. Also refer to ITU-T Recommendation I.732 [24], subclause 5.8.2.1.2.

Consequent Actions:

aTSF ← CI_SSF or dSLOC.

aSRDI ← for further study.

Defect Correlations:

cSLOC ← dSLOC and (not CI_SSF) and (not dAIS) and SLOCreported.

It shall be an option to report SLOC as a fault cause. This is controlled by means of the parameter SLOCreported. The default shall be SLOCreported = false.

NOTE 1: cSRDI and cSAIS are for further study.

Performance Monitoring:

If activated by the PM activation process, the function shall monitor the performance derived from the comparison between received block of user cells and information in a received Forward Monitoring PM cell. The definition of user cells is given in ETS 300 404 [8] (table 1 ITU-T Recommendation I.610 [23]). The result is backward reported via RI_BRPMdata. The received backward reporting PM cell on the near end contains the performance information regarding the unidirectional connection, set up from the near end to the far end. This information is reported to the EMF.

NOTE 2: Supported parameters (e.g. Near/Far End Defect Seconds (pN_DS, pF_DS), Cell Loss Ratio, Cell Error Ratio, Cell Misinsertion Rate) as well as the process need to be added. PM will detect errored blocks and total received user cell counts. Performances or backward report results of the received PM cell are reported to the EMF.

7.4.3 ATM virtual channel segment to ATM virtual channel adaptation source function AvcS/Avc_A_So

Symbol:

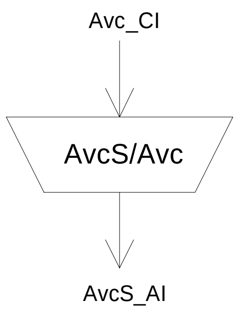


Figure 61: AvcS/Avc_A_So symbol

Interfaces:

Table 34: AvcS/Avc_A_So input and output signals

Input(s)	Output(s)
Avc_CI_D Avc_CI_ACS Avc_CI_SSF	AvcS_AI_D AvcS_AI_ACS

Processes: None.

Defects: None.

Consequent Actions: None.

Defect Correlations: None.

Performance Monitoring: None.

7.4.4 ATM virtual channel segment to ATM virtual channel adaptation sink function AvcS/Avc_A_Sk

Symbol:

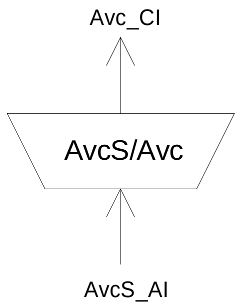


Figure 62: AvcS/Avc_A_Sk symbol

Interfaces:

Table 35: AvcS/Avc_A_Sk input and output signals

Input(s)	Output(s)
AvcS_AI_D AvcS_AI_ACS AvcS_AI_TSF	Avc_CI_D Avc_CI_ACS Avc_CI_SSF

Processes: None.

Defects: None.

Consequent Actions:

aSSF ← AI_TSF.

aAIS ← AI_TSF.

On declaration of aAIS the function shall output VC-AIS OAM cells on all active VCCs according to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.2.1.1.1); on clearing of aAIS the generation of VC-AIS cells shall be stopped. If implemented, the defect type and defect location field of the VC-AIS cell shall be inserted in the information field. The contents of these fields is for further study.

Defect Correlations: None.

Performance Monitoring: None.

7.5 ATM virtual channel traffic management functions

NOTE: The ATM VC Traffic Management Functions are, if activated, always present as a set. If active, the Avc_CI output of the AvcT/Avc_A_Sk is always connected to the Avc_CI input of the AvcT/Avc_A_So as shown in figure 61. This model allows the insertion of additional traffic management functions by not inserting an additional sub-layer in the network architecture view.

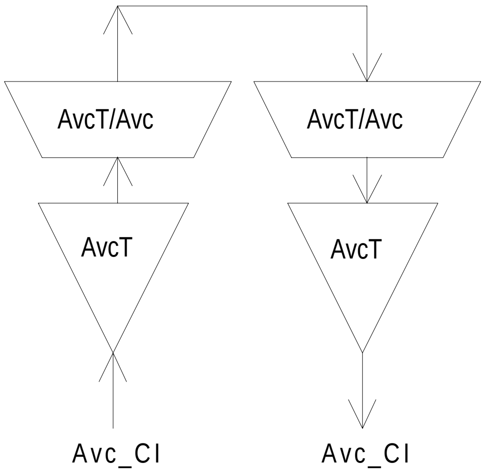


Figure 63: Model of active AvcT Traffic Management functions

7.5.1 ATM virtual channel traffic management trail termination source function AvcT_TT_So

Symbol:

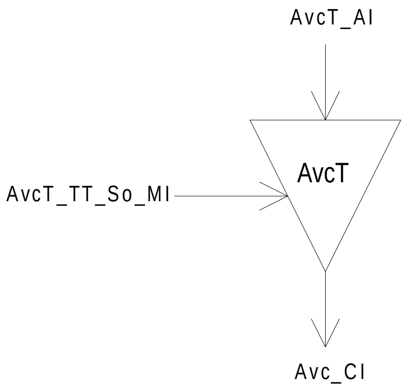


Figure 64: AvcT_TT_So symbol

Interfaces:

Table 36: AvcT_TT_So input and output signals

Input(s)	Output(s)
AvcT_AI_D AvcT_AI_ACS AvcT_AI_TSF AvcT_AI_CNGI	Avc_CI_D Avc_CI_ACS Avc_CI_SSF

Processes:

This function performs EFCI setting and RM cells insertion.

EFCI setting: This function is optional. The insertion of EFCI is driven by the input AvcT_AI_CNGI from the Avp/Avc_A_Sk. The EFCI setting is done in the PTI field of the cell header on all VCs of this CI. For the coding, refer to ETS 300 298-2 [3] (ITU-T Recommendation I.361 [18]). The PTI field shall not be changed if the NE is not congested.

RM cells insertion: This function is for further study.

Defects: None.

Consequent Actions:

aSSF ← AI_TSF.

On declaration of AI_CNGI, any congested NE, upon receiving a user data cell, may modify the PTI as follows: Cells received with PTI = 000 or PTI = 010 are transmitted with PTI = 010. Cells received with PTI = 001 or PTI = 011 are transmitted with PTI = 011. For the use of EFCI, refer to EN 300 301 [5] (ITU-T Recommendation I.371 [19]). This function is optional.

Defect Correlations: None.

Performance Monitoring: None.

7.5.2 ATM virtual channel traffic management trail termination sink function AvcT_TT_Sk

Symbol:

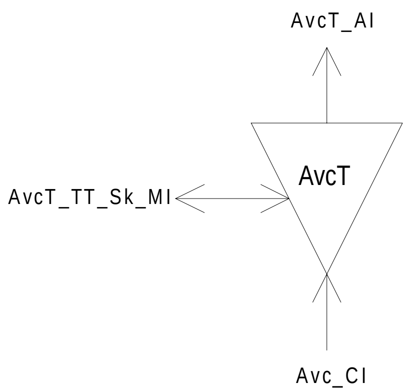


Figure 65: AvcT_TT_Sk symbol

Interfaces:

Table 37: AvcT_TT_Sk input and output signals

Input(s)	Output(s)
Avc_CI_D Avc_CI_ACS Avc_CI_SSF Avc_CI_CNGI AvcT_TT_Sk_MI_VCusgActive AvcT_TT_Sk_MI_ShapingActive AvcT_TT_Sk_MI_UPC/NPCActive	AvcT_AI_D AvcT_AI_ACS AvcT_AI_TSF AvcT_AI_CNGI

Processes:

This function performs the UPC/NPC, VC traffic shaping, VC usage measurement per VCC, and RM cells extraction.

UPC/NPC: This function is optional and can only be present at the ingress direction of the Network Element. If implemented, the UPC/NPC function can be activated/deactivated per VCC by UPC/NPCActive. If activated, it shall detect violations of negotiated traffic parameters for purpose of protecting the QoS of other VCCs. The use of UPC may be required, whereas the use of NPC is optional. Actions and requirements of UPC/NPC are described in EN 300 301 [5] (ITU-T Recommendation I.371 [19]).

NOTE 1: The use of UPC in ATM equipment on the user side of S_B and T_B reference point of optional.

VC traffic shaping: This function is optional. If implemented, the shaping function can be activated/deactivated per VCC by ShapingActive. If activated, it shall perform traffic shaping according to EN 300 301 [5] (ITU-T Recommendation I.371 [19]).

NOTE 2: The VC traffic shaping function should not be simultaneously activated on both sink and source directions of the same VCC.

VC usage measurement: This function is optional. If enabled by VCusgActive, this function shall count the incoming cells on a VCC basis.

RM cells extraction: This process is for further study.

Defects:

Consequent Actions:

aCNGI ← CI_CNGI.

aTSF ← CI_SSF.

Defect Correlations:

Performance Monitoring:

The Performance Monitoring parameters are for further study. The parameters for the following functions need to be defined:

- VC usage measurement: Count for CLP = 0 + 1; Count for CLP = 0;
- UPC/NPC (tagged cell count): Count for CLP = 0 + 1; Count for CLP = 0.

7.5.3 ATM virtual channel traffic management to ATM virtual channel adaptation source function AvcT/Avc_A_So

Symbol:

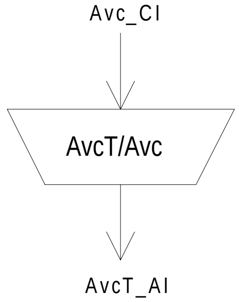


Figure 66: AvcT/Avc_A_So symbol

Interfaces:

Table 38: AvcT/Avc_A_So input and output signals

Input(s)	Output(s)
Avc_CI_D Avc_CI_ACS Avc_CI_SSF Avc_CI_CNGI AvcT/Avc_A_So_MI_Active	AvcT_AI_D AvcT_AI_ACS AvcT_AI_TSF AvcT_AI_CNGI

NOTE: If activated by MI_Active, the input of this function is always connected to the AvcT/Avc_A_Sk function.

Processes: None.

Defects: None.

Consequent Actions:

aTSF ← CI_SSF

aCNGI ← CI_CNGI

Defect Correlations: None.

Performance Monitoring: None.

7.5.4 ATM virtual channel traffic management to ATM virtual channel adaptation sink function AvcT/Avc_A_Sk

Symbol:

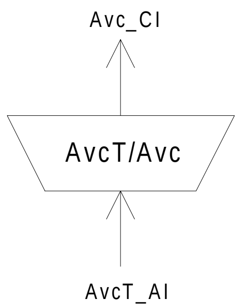


Figure 67: AvcT/Avc_A_Sk symbol

Interfaces:

Table 39: AvcT/Avc_A_Sk input and output signals

Input(s)	Output(s)
AvcT_AI_D AvcT_AI_ACS AvcT_AI_TSF AvcT_AI_CNGI AvcT/Avc_A_Sk_MI_Active	Avc_CI_D Avc_CI_ACS Avc_CI_SSF Avc_CI_CNGI

NOTE: If activated by MI_Active, the output of this function is always connected to the AvcT/Avc_A_So function.

Processes: None.

Defects: None.

Consequent Actions:

aSSF ← AI_TSF

aCNGI ← AI_CNGI

Defect Correlations: None.

Performance Monitoring: None.

7.6 ATM virtual channel loopback functions

7.6.1 ATM virtual channel loopback source function Avclb_TT_So

Symbol:

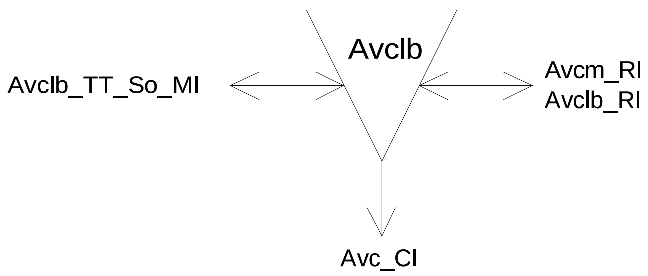


Figure 68: Avclb_TT_So symbol

Interfaces:

Table 40: Avclb_TT_So input and output signals

Input(s)	Output(s)
Avclb_RI_LBresponse Avcm_RI_LBresponse Avc_TT_So_MI_LBdiscard Avc_TT_So_MI_LBrequest	Avc_CI_D Avc_CI_ACS Avclb_RI_LBtimer Avcm_RI_LBtimer

Processes:

This function adds the following F5 loopback OAM cells to the CI:

Loopback:

On Avc_MI_LBrequest, an F5 end-to-end loopback cell shall be generated with Loopback Indication set to "1". The LLID and Source ID contain the addresses of the loopback point, resp. of the source point. The default value of the Source ID filed is the all ONE's pattern. If the LLID address field contains an all ONE's pattern, it indicates the end points of the VC connection. If LBdiscard = true, an indication Avclb_RI_LBtimer shall be generated to start the timer at Avclb_TT_Sk. If LBdiscard = false, an indication Avcm_RI_LBtimer shall be generated to start the timer at Avcm_TT_Sk. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.2.1.3, network-to-endpoint loopback).

On Avc_MI_LBrequest, an F5 segment loopback cell shall be generated with Loopback Indication set to "1". The LLID and Source ID contain the addresses of the loopback point (single loopback technique), resp. of the source point. The default value of the Source ID field is the all ONE's pattern. If the LLID field contains an all ZERO's pattern, it indicates all intermediate connecting points and the end points of the VC segment (multiple loopback technique). If LBdiscard = true, an indication Avclb_RI_LBtimer shall be generated to start the timer at Avclb_TT_Sk. If LBdiscard = false, an indication Avcm_RI_LBtimer shall be generated to start the timer at Avcm_TT_Sk. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.2.1.3, intra-domain loopback).

On Avclb_RI_LBresponse (LBdiscard = true) or Avcm_RI_LBresponse (LBdiscard = false), an F5 loopback cell identical to the cell passed through Avclb _RI_LBresponse/Avcm_RI_LBresponse shall be generated, but with Loopback Indication set to "0" and the LLID set to the CPID of the Loopback point. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclauses 9.2.2.1.3 (connecting points) and 10.2.4).

The time interval of sending consecutive segment or end-to-end Loopback cells shall be longer than 5 seconds.

7.6.2 ATM virtual channel loopback sink function Avclb_TT_Sk

Symbol:

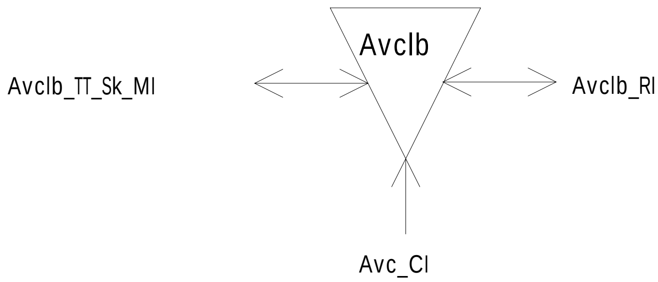


Figure 69: Avclb_TT_Sk symbol

Interfaces:

Table 41: Avclb_TT_Sk input and output signals

Input(s)	Output(s)
Avc_CI_D Avc_CI_ACS Avc_CI_SSF Avc_TT_Sk_MI_LBdiscard Avclb_RI_LBtimer	Avclb_RI_LBresponse Avclb_TT_Sk_MI_LBdata Avclb_TT_Sk_MI_LBfail Avclb_TT_Sk_MI_LBcompleted

Processes:

This function terminates the following F5 OAM Loopback cells:

Loopback processing:

If MI_LBdiscard = true, the function shall terminate the cell flow of F5 OAM end-to-end Loopback cells being inserted by the Avclb_TT_So function. On RI_LBtimer from Avclb_TT_So, a 5 seconds timer is started. If within this time period an F5 OAM end-to-end Loopback cell with Loopback Indication set to "0" is received, an MI_LBcompleted indication is generated and the received LLID and Source ID reported to the EMF via MI_LBdata; if no Loopback cell with Loopback Indication set to "0" is received within this time period, an MI_LBfail indication is generated. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.2.1.3, network-to-endpoint loopback).

If MI_LBdiscard = true, the function shall terminate the cell flow of F5 OAM end-to-end Loopback cells being inserted by the Avclb_TT_So function. If an F5 OAM end-to-end Loopback cell with Loopback Indication set to "1" and an LLID matching the CPID or an LLID = all "1"s is received, this function copies and forwards the cell via RI_LBresponse to the Avclb_TT_So function for insertion of the Loopback cell in reverse direction. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.2.1., connecting point for single loopback technique).

If MI_LBdiscard = true, the function shall terminate the cell flow of F5 OAM segment Loopback cells being inserted by the Avclb_TT_So function. If an F5 OAM segment Loopback cell with Loopback Indication set to "1" and an LLID matching the CPID or an LLID = all "1"s or an LLID = all "0"s is received, this function copies and forwards the cell via RI_LBresponse to the Avclb_TT_So function for insertion of the Loopback cell in reverse direction. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.2.1.3, connecting point for single and multiple loopback technique).

If MI_LBdiscard = true, the function shall terminate the cell flow of F5 OAM segment Loopback cells being inserted by the Avclb_TT_So function. On RI_LBtimer from Avclb_TT_So, a 5 seconds timer is started. If within this time period an F5 OAM segment Loopback cell with Loopback Indication set to "0" is received, an MI_LBcompleted indication is generated and the received LLID and Source ID reported to the EMF via MI_LBdata; if no Loopback cell with Loopback Indication set to "0" is received within this time period, an MI_LBfail indication is generated. Refer to ETS 300 404 [8] (ITU-T Recommendation I.610 [23], subclause 9.2.2.1.3, loopback termination at connecting point for single loopback technique).

Table 42 summarizes these conditions:

Table 42: Loopback conditions

Received cell (LBdiscard = true)	Loopback indication	LLID	Action
e-t-e loopback cell	1	- all ONE's or - LLID = CPID	- copy loopback cell to LBresponse
e-t-e loopback cell	0	- any value	If LBtimer < 5 seconds: - report LBcompleted - LLID/Source ID reported to LBdata
			If LBtimer > 5 seconds: - report LBfail - discard loopback cell
segment loopback cell	1	single LB: - all ONE's or - LLID = CPID multiple LB: all ZERO's	- copy loopback cell to LBresponse
segment loopback cell	0	- any value	If LBtimer < 5 seconds: - report LBcompleted - LLID/Source ID reported to LBdata
			If LBtimer > 5 seconds: - report LBfail - discard loopback cell

Defects: None.

Consequent Actions: None.

Defect Correlations: None.

Performance Monitoring: None.

8 ATM virtual channel to ATM client adaptation functions

8.1 ATM virtual channel to ATM client adaptation source function Avc/XXX_A_So

Symbol:

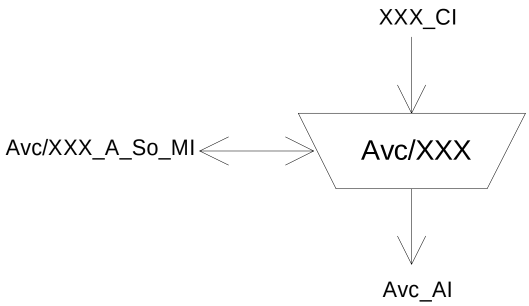


Figure 70: Avc/XXX_A_So symbol

Interfaces:

Table 43: Avc/XXX_A_So input and output signals

Input(s)	Output(s)
XXX_CI_D XXX_CI_FS XXX_CI_SSF XXX_CI_other Avc/XXX_A_So_MI_Active Avc/XXX_A_So_MI_other	Avc_AI_D Avc_AI_ACS

Processes:

This function performs an ATM Adaptation Layer (AAL) process for a given VCC in source direction. It is for further study. The following is a non-exhaustive list of possible candidates for payloads to be supported:

- CE 2 Mbit/s - 140 Mbit/s;
- CE n × 64 kbit/s;
- Frame Relay, High-level Data Link Control procedure (HDLC);
- Internet Protocol;
- Connectionless Broadband Data Service (CBDS);
- N-ISDN interworking (BA, PRA);
- Local Area Network (LAN) (IEEE 802.x).

Defects:

Consequent Actions:

Defect Correlations:

Performance Monitoring:

8.2 ATM virtual channel to ATM Client Adaptation Sink function Avc/XXX_A_Sk

Symbol:

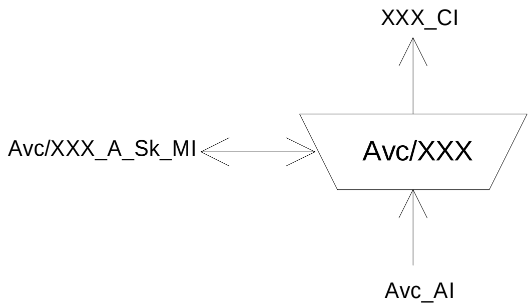


Figure 71: Avc/XXX_A_Sk symbol

Interfaces:

Table 44: Avc/XXX_A_Sk input and output signals

Input(s)	Output(s)
Avc_AI_D Avc_AI_ACS Avc_AI_TSF Avc/XXX_A_Sk_MI_Active Avc/XXX_A_Sk_MI_other	XXX_CI_D XXX_CI_FS XXX_CI_SSF XXX_CI_other

Processes:

This function performs an AAL process for a given VCC in sink direction. It is for further study. The following is a non-exhaustive list of possible candidates for payloads to be supported:

- CE 2 Mbit/s - 140 Mbit/s;
- CE n × 64 kbit/s;
- Frame Relay, HDLC;
- Internet Protocol;
- CBDS;
- N-ISDN interworking (BA, PRA);
- LAN (IEEE 802.x).

Defects:

Consequent Actions:

Defect Correlations:

Performance Monitoring:

Bibliography

The following material, though not specifically referenced in the body of the present document (or not publicly available), gives supporting information.

EN 300 417-4-1: "Transmission and Multiplexing (TM); Generic requirements of transport functionality of equipment; Part 4-1; Synchronous Digital Hierarchy (SDH) path layer functions".

EN 300 417-5-1: "Transmission and Multiplexing (TM); Generic requirements of transport functionality of equipment; Part 5-1; Plesiochronous Digital Hierarchy (PDH) path layer functions".

EN 301 163-1-1: "Transmission and Multiplexing (TM); Generic Requirements of Asynchronous Transfer Mode (ATM) transport functionality within equipment; Part 1-1; Functional characteristics and equipment performance".

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