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SERIES Q: SWITCHING AND SIGNALLING

Broadband ISDN – Signalling ATM adaptation layer (SAAL)

AAL type 2 signalling transport converter on broadband MTP

ITU-T Recommendation Q.2150.1

(Previously CCITT Recommendation)

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ITU-T RECOMMENDATION Q. 2150.1

AAL TYPE 2 SIGNALLING TRANSPORT CONVERTER ON BROADBAND MTP

Summary

This Recommendation specifies the AAL type 2 signalling transport converter on broadband MTP. This AAL type 2 signalling transport converter on broadband MTP utilizes the services offered by the message transfer part of Signalling System No. 7. The sublayer structure, the PDU structures of the signalling transport converter sublayer, and the mechanisms for the provision of the AAL type 2 generic signalling transport service are defined in depth.

The intent of this Recommendation is to provide a new protocol specification that can be used primarily in the B-ISDN ATM environment for the provision of a signalling transport service. In particular, this protocol provides a generic signalling transport service that is used by the AAL type 2 signalling protocol.

Source

ITU-T Recommendation Q.2150.1 was prepared by ITU-T Study Group 11 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on 3 December 1999.

Keywords

AAL, ATM, B-ISDN, MTP, SAAL, STC.

FOREWORD

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NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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CONTENTS

Recommendation Q.2150.1

AAL TYPE 2 SIGNALLING TRANSPORT CONVERTER ON BROADBAND MTP

(Geneva, 1999)

1 Scope

This Recommendation specifies the AAL type 2 signalling transport converter sublayer on top of the message transfer part (MTP) specified in Recommendation Q.2210 "broadband MTP" (which specifies the peer-to-peer protocol for the transfer of information and control between any pair of MTP level 3 entities). This Recommendation covers the specification of the sublayer structure, the PDU structures of the signalling transport converter sublayer, and the mechanisms for the provision of the AAL type 2 generic signalling transport service.

When this AAL type 2 signalling transport converter on MTP is applied for an AAL type 2 signalling protocol entity, that entity is liberated from considering peculiarities of the underlying signalling transport service. This is achieved by relying on a generic signalling transport service that is provided, for example, by the sublayer specified in this Recommendation.

This Recommendation describes the interactions between the AAL type 2 signalling transport converter (STC) and the next higher layer, i.e. the AAL type 2 signalling protocol entity, between the STC and the message transfer part, and between the STC and layer management, as well as STC peer-to-peer operations.

This release of the Recommendation does not support the alternative ways of MTP congestion indication that are specified as national option.

2 References

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

[1] ITU-T Recommendation Q.2140 (1995), *B-ISDN ATM Adaptation Layer – Service specific coordination function for Support of Signalling at the Network Node Interface (SSCF at NNI)*.

[2] ITU-T Recommendation Q.704 (1996), *Signalling network functions and messages*.

[3] ITU-T Recommendation Q.2210 (1996), *Message transfer part level 3 functions and messages using the services of ITU-T Recommendation Q.2140*.

[4] ITU-T Recommendation Q.2630.1 (1999), *AAL type 2 signalling protocol (Capability Set 1)*.

[5] ITU-T Recommendation X.200 (1994) | ISO/IEC 7498-1:1994, *Information technology – Open Systems Interconnection – Basic Reference Model: The Basic Model*.

[6] ITU-T Recommendation X.210 (1993) | ISO/IEC 10731:1994,– *Information technology – Open Systems Interconnection – Basic Reference Model: Conventions for the definition of OSI services*.

3 Definitions

This Recommendation is based upon the concepts developed in Recommendations X.200 [5] and X.210 [6].

4 Abbreviations

This Recommendation uses the following abbreviations:

AAL ATM Adaptation Layer

ATM Asynchronous Transfer Mode

CL Congestion Level

MTP Message Transfer Part

NNI Network Node Interface

PDU Protocol Data Unit

PICS Protocol Implementation Conformance Statement

SAP Service Access Point

SDL Specification and Description Language

SDU Service Data Unit

STC Signalling Transport Converter

5 General description of the AAL type 2 signalling transport converter on broadband MTP

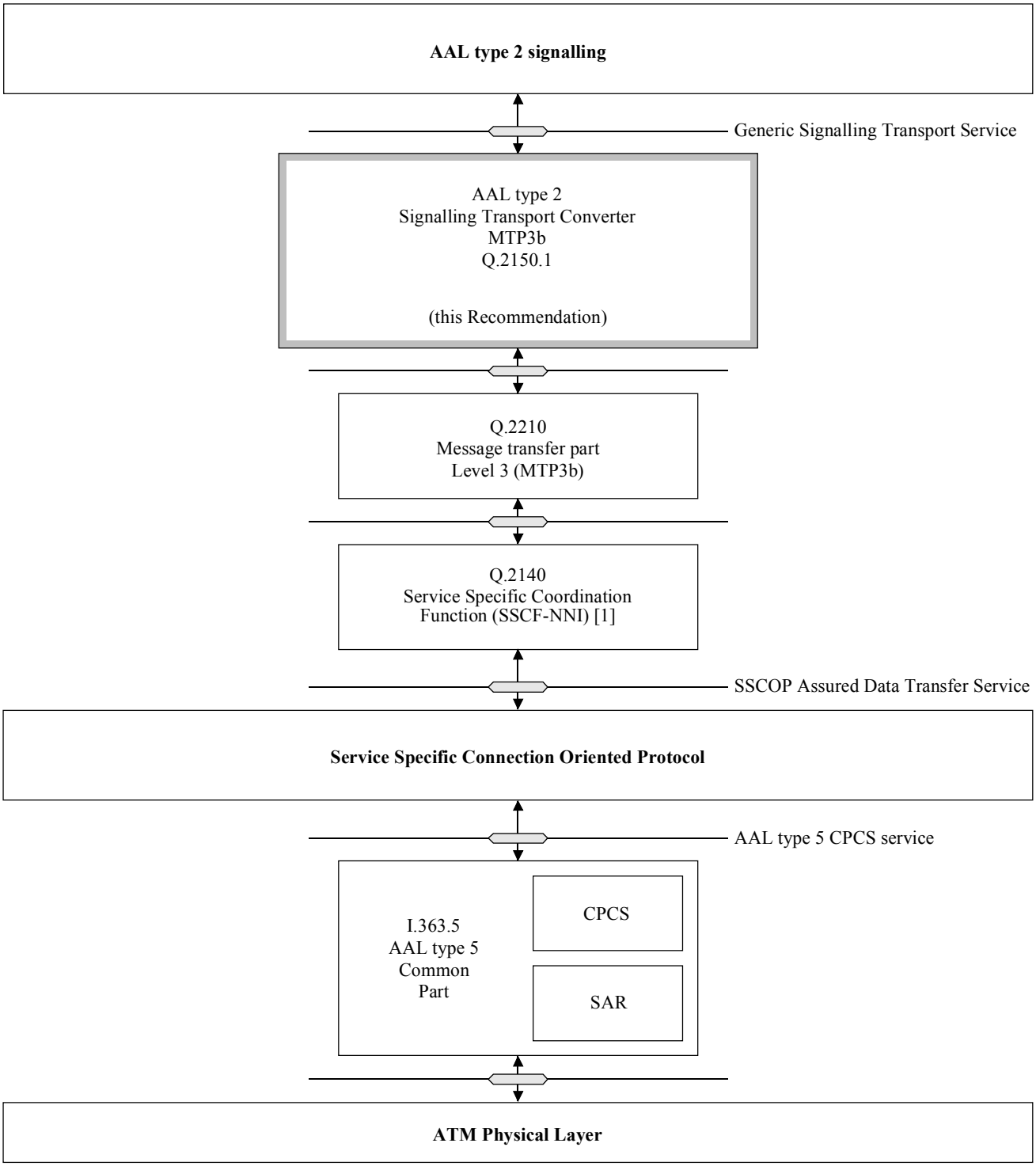
5.1 Structure of the AAL type 2 signalling transport converter on broadband MTP sublayer

The sublayer providing the AAL type 2 signalling transport converter (STC) resides on top of the message transfer part. It deploys the services provided by level 3 of the message transfer part defined in Recommendation Q.2210 [3]. It amends the services offered by the MTP with a procedure for testing the availability of the peer entity.

The STC provides for the service that is requested by the generic signalling transport service defined in Recommendation Q.2630.1 [4], where the AAL type 2 signalling protocol makes use of this service. The complete protocol stack is illustrated in Figure 5-1.

This Recommendation specifies:

- the interactions between the STC and the AAL type 2 signalling protocol;
- the interactions between the STC and the MTP level 3 sublayer;
- the interactions between the STC and layer management; and
- the peer-to-peer protocol.



NOTE – The Service Access Points shown in this diagram are for modelling purposes only. They are not necessarily visible or accessible from outside.

T11103980-99

Figure 5-1/Q.2150.1 – Structure of the AAL type 2 signalling transport converter on MTP

5.2 Services provided by the STC

The STC provides for the transparent transfer of data, i.e. STC user data between STC users. The supporting communication resources to achieve this transfer stay invisible to the STC user.

In particular, the STC service provides for:

a) Independence from the underlying transmission media:

The STC service relieves its users from all concerns of the manner in which the STC service is provided. Except for possible influences of the quality of service, the transfer of data over different underlying networks is, thus, invisible.

b) Transparency of the information transferred:

The STC service provides for the transparent transfer of octet-aligned STC user data. It does not restrict the content, format, or coding of the information nor is there ever a need to interpret its structure or meaning.

c) Service availability reporting:

As the underlying service (MTP) reports about availability/unavailability of the data transfer service, after the necessary translation, these notifications are forwarded to the STC user.

5.3 Functions of the STC

The STC performs the following functions:

a) Data transfer service availability reporting to the STC user:

This function reports the availability or unavailability of the MTP message transfer service to the user of the STC.

b) Congestion reporting to the STC user:

This function translates and forwards the congestion indications provided by the MTP to the STC user.

6 Elements for layer-to-layer communication

6.1 The generic signalling transport service

This subclause specifies the information flow across the AAL type 2 signalling transport converter – AAL type 2 signalling protocol boundary. This boundary is defined in Recommendation Q.2630.1 [4] and summarized below. In the event of any difference between the following summary and the definitions in Recommendation Q.2630.1, the definitions in Recommendation Q.2630.1 take precedence.

6.1.1 Primitive definition

The services are summarized in Table 6-1, and are defined as follows.

a) IN-SERVICE.indication:

This primitive indicates that the signalling transport is able to exchange signalling messages with the peer entity. This indication shall be provided without the AAL type 2 signalling protocol requesting any service across the SAP.

b) OUT-OF-SERVICE.indication:

This primitive indicates that the signalling transport is unable to exchange signalling messages with the peer entity. This indication shall be provided without the AAL type 2 signalling protocol requesting any service across the SAP.

c) TRANSFER.request:

This primitive is used by the AAL type 2 signalling protocol to convey a signalling message to its peer entity.

d) TRANSFER.indication:

This primitive provides a signalling message from the peer entity to the AAL type 2 signalling protocol.

e) CONGESTION.indication:

A primitive used to convey information concerning signalling network congestion.

Table 6-1/Q.2150.1 – Primitives and parameters of the Generic Signalling Transport Sublayer

Primitive Generic Name	Type			
	Request	**Indication**	**Response**	**Confirm**
IN-SERVICE	–	Level	–	–
OUT-OF-SERVICE	–	(Note)	–	–
CONGESTION	–	Level	–	–
TRANSFER	Sequence Control STC User Data	STC User Data	–	–
– This primitive is not defined. NOTE – This primitive has no parameters.				

6.1.2 Parameters

a) STC User Data:

This parameter contains a complete AAL type 2 signalling message; it represents the STC SDU.

b) Level:

This parameter indicates the level of congestion. It shall have a value between 0 and 10, where 0 indicates no congestion and 10 indicates maximum congestion.

c) Sequence Control:

This parameter, an 8-bit identifier, allows the signalling transport service to perform load sharing between several signalling links without violating sequence delivery requirements. Any signalling message accompanied by the same Sequence Control value shall be conveyed using the same signalling link.

NOTE – The mapping of the Sequence Control parameter onto a designation of the signalling link to be used is an implementation matter.

6.1.3 Establishment

On the establishment of an AAL type 2 signalling transport converter entity and the associated signalling transport converter user entity, for example at power up, the initial conditions is the same as if an OUT-OF-SERVICE.indication had been conveyed across this SAP.

6.2 The service provided by MTP

This subclause specifies the information flow across the AAL type 2 signalling transport converter – message transfer part (MTP) boundary. This boundary is defined in 6.2/Q.2210 [3] and summarized below. In the event of any difference between the following summary and the definitions in Recommendation Q.2210, the definitions in Recommendation Q.2210 take precedence.

The repertoire of primitives between STC and MTP is listed in Table 6-2.

Table 6-2/Q.2150.1 – Primitives and parameters of the message transfer part

Primitive Generic Name	Type			
	Request	Indication	Response	Confirm
MTP-RESUME	–	Affected DPC	–	–
MTP-PAUSE	–	Affected DPC	–	–
MTP-STATUS	–	Affected DPC Cause	–	–
MTP-TRANSFER	OPC, DPC, SLS, SIO, MTP-Message	OPC, DPC, SLS, SIO, MTP-Message	–	–
– This primitive is not defined.				

6.2.1 Primitive definition

a) MTP-TRANSFER:

MTP-TRANSFER primitives are used to transfer STC PDUs from one STC peer entity to the other.

b) MTP-RESUME:

MTP-RESUME primitive is sent by the MTP to indicate its ability to resume unrestricted transfer of messages to the destination specified as a parameter.

c) MTP-PAUSE:

MTP-PAUSE primitive is sent by the MTP to indicate its inability to transfer messages to the destination specified as a parameter.

d) MTP-STATUS:

MTP-STATUS primitive is sent by the MTP to indicate that the signalling route to a specific destination is congested or the STC at the destination is unavailable. The affected destination and the congestion indication are carried as parameters in the primitive.

6.2.2 Parameter definition

a) Point code of the originating exchange (OPC):

The OPC parameter indicates the originating point of the message (see 2.2.3/Q.704 [2]).

NOTE 1 – This parameter is a fixed value per STC entity.

b) Point code of the destination exchange (DPC):

The DPC parameter indicates the destination point of the message (see 2.2.3/Q.704 [2]).

NOTE 2 – This parameter is a fixed value per STC entity.

c) Signalling Link Selection Code (SLS):

Selection of the SLS parameter is based on the Sequence Control parameter received in the TRANSFER.request primitive.

d) Service Information Octet (SIO):

The service information octet of message signal units contains the service indicator and the sub service field (see 14.2/Q.704 [2]). The service indicator indicates AAL type 2 signalling.

e) MTP-Message:

MTP-Message parameter carries the PDUs constructed before transmission and interpreted upon receipt by the STC.

f) Cause:

The cause parameter can assume four values:

1) signalling network congestion level, where level is included only if national options with congestion priorities and multiple signalling states without congestion priorities (see Recommendation Q.704 [2]) are implemented;
2) user part unavailability – unequipped remote user;
3) user part unavailability – inaccessible remote user;
4) user part unavailability – unknown.

NOTE 3 – National options of MTP for indicating congestion are not supported by this version of the STC.

NOTE 4 – User part unavailability indications are ignored by the signalling transport converter because such indications are unlikely to happen. MTP would provide these indications also to Layer Management to allow any necessary actions to be taken.

g) Affected DPC:

Destination Point Code identifying the node, the state of which is reported by the corresponding primitive.

6.3 Primitives between the STC and layer management

Error indications to layer management are performed by the lower layers. No additional error indications are required from the AAL type 2 signalling transport converter, therefore no primitive needs to be defined between STC and layer management.

6.4 State transition diagram for sequences of primitives at the layer boundaries of the STC

This subclause defines the constraints on the sequences in which the primitives may occur at the layer boundaries of the STC. The sequences are related to the states at one STC endpoint between the STC and the STC user and between the STC and MTP.

The possible overall sequences of primitives at an STC connection endpoint are shown in the state transition diagram, Figure 6-1. These primitives and state transitions are defined in Recommendation Q.2630.1 [4]. If any discrepancy is detected between the representation here and the one in Recommendation Q.2630.1, the definition in Recommendation Q.2630.1 shall apply. The model assumes that the primitives are serviced immediately and in zero time.

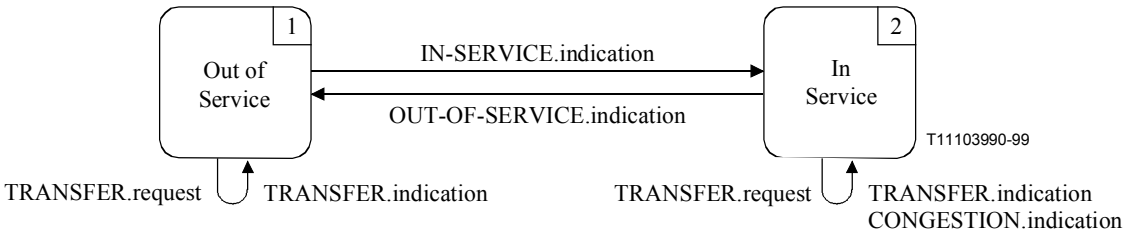


Figure 6-1/Q.2150.1 – State transition diagram for sequences of primitives between the STC and its user

The possible overall sequences of primitives at a MTP endpoint are shown in the state transition diagram in Figure 6-2. These primitives and state transitions are defined in Recommendation Q.2210 [3]. If any discrepancy is detected between the representation here and the one in Recommendation Q.2210, the definition in Recommendation Q.2210 shall apply.

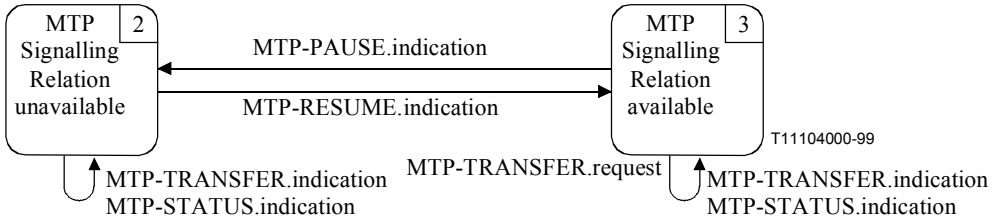


Figure 6-2/Q.2150.1 – State transition diagram for sequences of primitives between MTP and STC

The model in Figure 6-2 illustrates the behaviour of the MTP as seen by the STC. This model assumes that a request or response primitive is never issued at the same time as an indication or confirm primitive. The model also assumes that the primitives are serviced immediately and in zero time. In the diagram:

a) Any primitive that is not shown as resulting in a transition (from one state to the same state, or from one state to a different state) is not permitted in that state.

b) It is assumed that the primitives passed between STC and the STC user as well as the primitives passed between the STC and MTP are coordinated such that collisions do not occur.

NOTE – The MTP-STATUS.indication can indicate either the unavailability for a remote MTP user or MTP congestion.

7 Protocol elements for peer-to-peer communication

The peer-to-peer STC protocol utilizes the mechanisms provided by the underlying sublayer (MTP, Recommendation Q.2210 [3]). In particular:

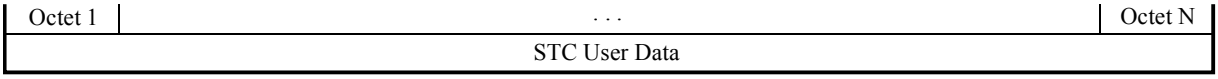
- In order to provide service availability information, it uses the information received in MTP-PAUSE.indication and MTP-RESUME.indication primitives.
- In order to provide congestion indication, it relies on the information received in MTP-STATUS.indication primitives.
- STC PDU transfer utilizes the MTP-TRANSFER.request and MTP-TRANSFER.indication primitives. MTP-TRANSFER.request is used for sending PDUs while MTP-TRANSFER.indication is used for receiving PDUs.

7.1 STC PDUs

The STC has no need of its own special PDUs; the SDUs received from the STC user are transmitted via the MTP-TRANSFER primitives without any additional protocol control information. The PDU parameter of the TRANSFER primitives at the upper boundary of the STC are mapped unchanged to the MTP-Message parameter of the MTP-TRANSFER primitives at the lower boundary and vice versa.

7.2 STC PDU formats

Figure 7-1 illustrates the format of the STC PDU.



NOTE – Transmission starts with Octet 1 and continues towards the increasing octet numbers.

Figure 7-1/Q.2150.1 – STC User Data Transfer PDU

7.3 STC PDU fields

An STC PDU contains the following field:

- STC User Data field:

  This field in the STC User Data PDU contains a complete STC-SDU.

7.4 STC state variable

The STC maintains a single state variable:

- Congestion Level (CL):

  This variable can hold the values from "0" (no congestion) through to "10" (maximum congestion) in integral increments.

7.5 STC timers

The STC entity requires the following timer:

a) Timer_Long:

   This timer is used by the congestion indication procedure. Receipt of a repeated congestion indication from MTP before the expiry of this timer is interpreted that the congestion situation has got worse in the meantime.

b) Timer_Short:

   This timer is used by the congestion indication procedure. The role of this timer is to avoid overreacting if multiple congestion indications are received from MTP in quick succession.

7.6 STC parameters

STC parameters are specified at creation of a new STC entity and they are unchanged during the lifetime of the STC entity. The following parameters are defined:

a) STC_DPC:

   Point Code corresponding to the destination point served by the STC entity.

b) STC_OPC:

Point Code corresponding to the originating point served by the STC entity.

c) STC_SIO:

The service information octet contains the service indicator and the sub service field. Service indicator must indicate AAL type 2 signalling.

8 Specification of the STC

This clause provides a set of SDL diagrams defining the procedures of the AAL type 2 signalling transport converter (STC). These SDL diagrams are the definitive description of the procedures and in case of conflict with the text, the SDL diagrams take precedence.

8.1 Overview

Figure 8-1 gives an overview about the states of STC and the major state transitions between them. The full specification of the STC state transitions can be found in 8.4.

These states are used in the specification of the peer-to-peer protocol. The states are conceptual and reflect general condition of the STC entity in the sequences of primitives and PDU exchanges with its user, peer, underlying sublayer.

8.1.1 State 1: Service Unavailable

In this state, STC is not able to transfer AAL type 2 signalling messages.

8.1.2 Sate 2: STC Service Available

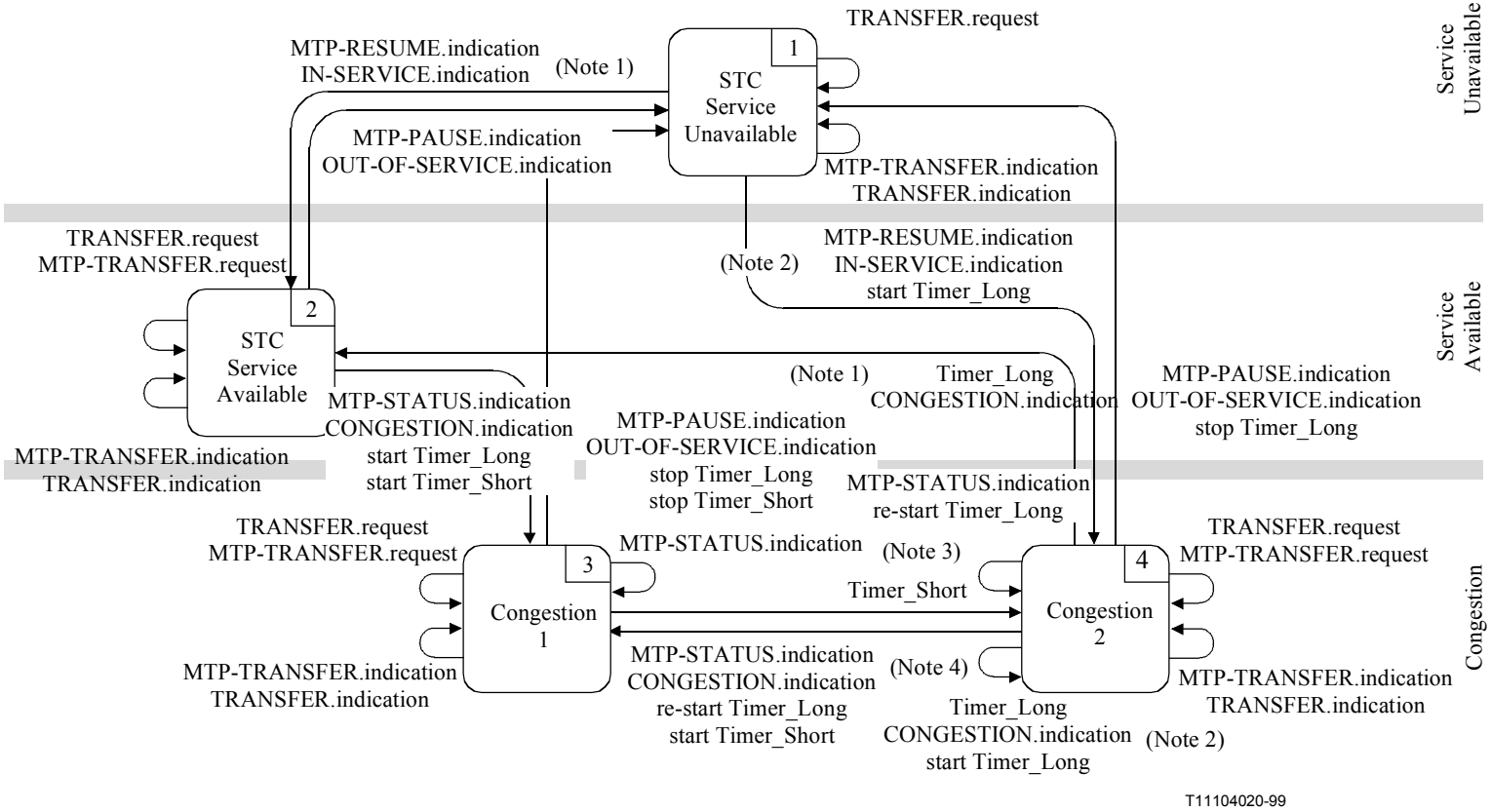
In this state, STC is able to provide unrestricted transfer of AAL2 signalling messages.

8.1.3 State 3: Congestion 1

In this state, STC is able to provide a restricted service because of congestion in the signalling network. Both Timer_Short and Timer_Long are running in this state.

8.1.4 State 4: Congestion 2

In this state, STC is able to provide a restricted service because of congestion in the signalling network. Timer_Long is running in this state.



NOTE 1 – This transition is executed if CL is zero.
NOTE 2 – This transition is executed if CL is non-zero.
NOTE 3 – This transition is executed if CL is equal to 10.
NOTE 4 – This transition is executed if CL is not equal to 10.

Figure 8-1/Q.2150.1 – Overview of STC states and major transitions between them

8.2 Procedures of the STC

8.2.1 Initial conditions

This subclause specifies how the STC operates at power-up.

If the MTP service is successfully initialised towards a peer MTP, an MTP-RESUME.indication primitive will be sent to the STC. STC then sends an IN-SERVICE.indication primitive to the AAL type 2 signalling. The primitive carries a Level parameter, the value of the parameter is network dependent. If the Level is greater then zero, then congestion indication procedure (specified in 8.2.4.) is started.

8.2.2 SDU transfer

8.2.2.1 Sending a signalling message

Upon receipt of a TRANSFER.request primitive from the STC user, a STC User Data Transfer PDU shall be composed. The PDU carries the STC User Data parameter that contains the Message parameter received in the corresponding TRANSFER.request primitive.

The PDU is transferred to the MTP by the MTP-TRANSFER.request primitive. The primitive carries the following parameters:

- MTP-Message parameter carries STC PDU;
- Point code of the originating exchange (containing the value of STC_OPC parameter);
- Point code of the destination exchange (containing the value of STC_DPC parameter);
- Service Information Octet (containing the value of STC_SIO parameter) indicating AAL type 2 signalling;
- Signalling Link Selection Code (SLS).

SLS value is derived from the Sequence Control parameter received in the TRANSFER.request primitive through a static mapping.

8.2.2.2 Receiving a signalling message

Upon receipt of an MTP-TRANSFER.indication primitive, MTP-Message parameter shall be extracted from the PDU. A TRANSFER.indication primitive shall be composed and issued towards the STC user. The Message parameter of the TRANSFER.indication primitive carries the information extracted from the incoming primitive. All the other parameters (OPC, DPC, SIO, SLS) are ignored.

8.2.3 Destination availability procedure

If an MTP-PAUSE.indication is received, an OUT-OF-SERVICE.indication primitive shall then be issued towards the STC user. Layer Management is informed.

If an MTP-RESUME.indication is received, an IN-SERVICE.indication primitive shall then be issued towards the STC user. IN-SERVICE.indication carries a network dependent value in the Level parameter.

NOTE – The Level value used here can be different from the value used at start-up.

8.2.4 Congestion indication procedure

On receipt of a MTP-STATUS.indication primitive that indicates "signalling network congestion", the STC acts as follows:

– When the first congestion indication is received by the STC, state variable Congestion Level is incremented by 1, and a CONGESTION.indication primitive is issued towards the STC user. The Level parameter carries the value of state variable Congestion Level. At the same time, two timers "Timer_Short" and "Timer_Long" are started. During period "Timer_Short" all received congestion indications for the same destination point code are ignored in order not to reduce traffic too rapidly. Reception of a congestion indication after the expiry of timer "Timer_Short", but still during period "Timer_Long", will result in a CONGESTION.indication primitive containing the Level parameter increased by 1 and restart timers "Timer_Short" and "Timer_Long". This step-wise increase of the Level parameter is continued until maximum value is obtained by arriving at the last step. If timer "Timer_Long" expires (i.e. no congestion indications having been received during the "Timer_Long" period) a CONGESTION.indication with the Level parameter decreased by 1 will be issued and timer "Timer_Long" will be restarted unless minimum value of the Level parameter has been reached.

8.3 State transition table

The state transition table for STC (see Table 8-1) describes the primitives and primitives that lead to state transitions. The table only shows the major transition paths; the SDL diagrams in 8.4 show the full transitions.

Table 8-1/Q.2150.1 – State transition table

Event	State			
	1 **STC Service Unavailable**	**2** **STC Service Available**	**3** **Congestion I**	**4** **Congestion II**
TRANSFER.request	→ 1	MTP-TRANSFER. Request → 2	MTP-TRANSFER. Request → 3	MTP-TRANSFER. Request → 4

MTP-RESUME.indication	Set CL[a)]
	IN-SERVICE. Indication (CL)
	If (CL > 0) then set Timer_Long
	→ 4
	else
	→ 2
		–	–	–

MTP-PAUSE.indication	–	OUT-OF-SERVICE. Indication → 1	OUT-OF-SERVICE. Indication reset Timer_Long reset Timer_Short → 1	OUT-OF-SERVICE. Indication reset Timer_Long → 1

Table 8-1/Q.2150.1 – State transition table *(concluded)*

Event	State			
	1 **STC Service Unavailable**	**2** **STC Service Available**	**3** **Congestion I**	**4** **Congestion II**
MTP-TRANSFER.indication	TRANSFER. Indication → 1	TRANSFER. Indication → 2	TRANSFER. Indication → 3	TRANSFER. Indication → 4

MTP-STATUS.indication[b)]	–	CL := 1
		CONGESTION. Indication (CL)
		set Timer_Long
		set Timer_Short
		→ 3
			→ 3	set Timer_Long
				if CL < 10 then
				CL := CL + 1
				CONGESTION. Indication (CL)
				set Timer_Short
				→ 3
				Else
				→ 4

MTP-STATUS.indication[c)]	→ 1	→ 2	→ 3	→ 4

Expiry of Timer_Long	–	–	–	CL := CL – 1
				CONGESTION. indication (CL)
				if CL > 0 then
				set Timer_Long
				→ 4
				else
				→ 2

Expiry of Timer_Short	–	–	→ 4	–

a) The value of CL is a network option.

b) Congestion indication without level.

c) Peer MTP User Unavailable.

8.4 SDL diagrams

The SDL diagrams are represented in Figures 8-2 to 8-4.

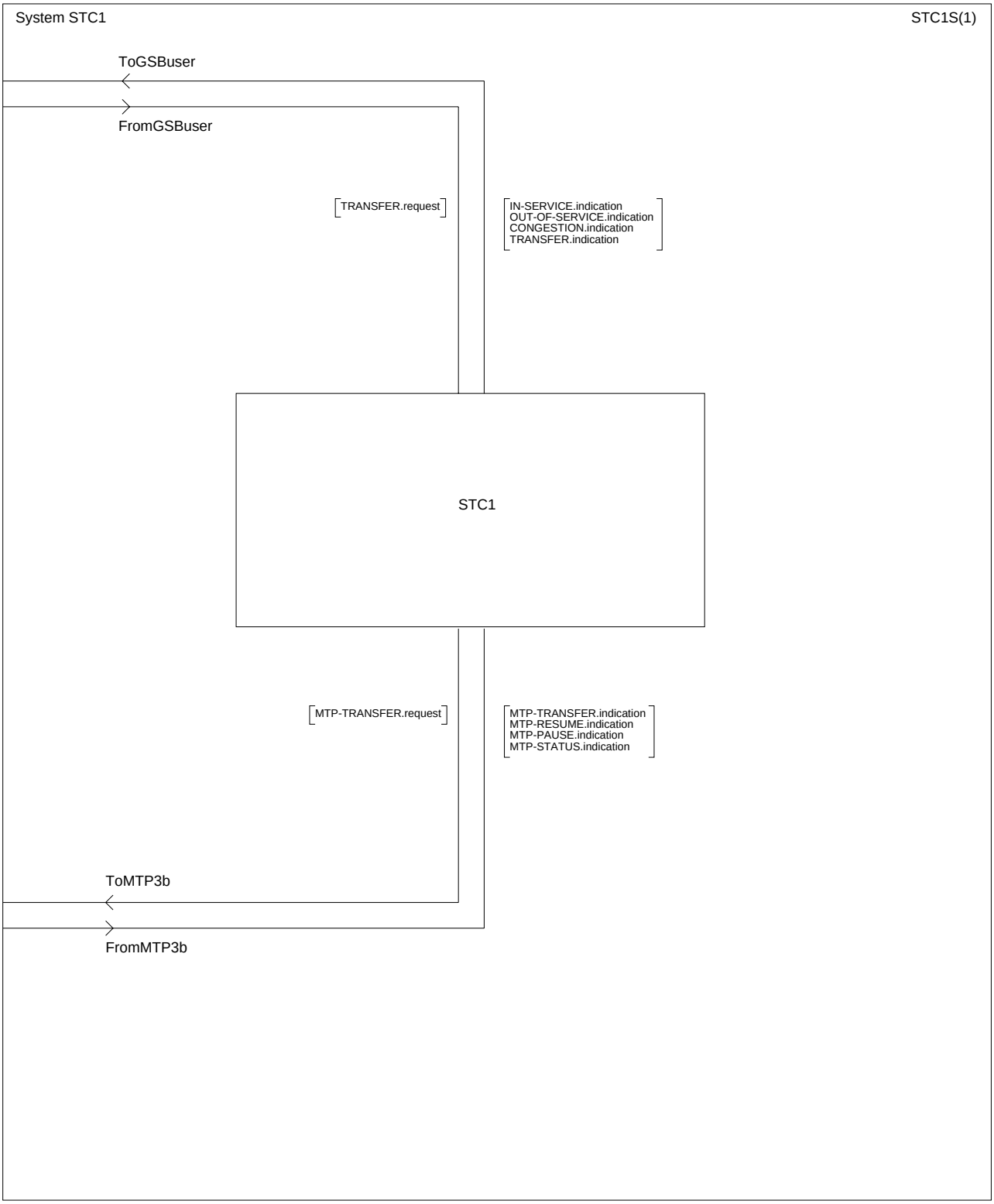


Figure 8-2/Q.2150.1 – SDL system of the AAL type 2 signalling transport converter

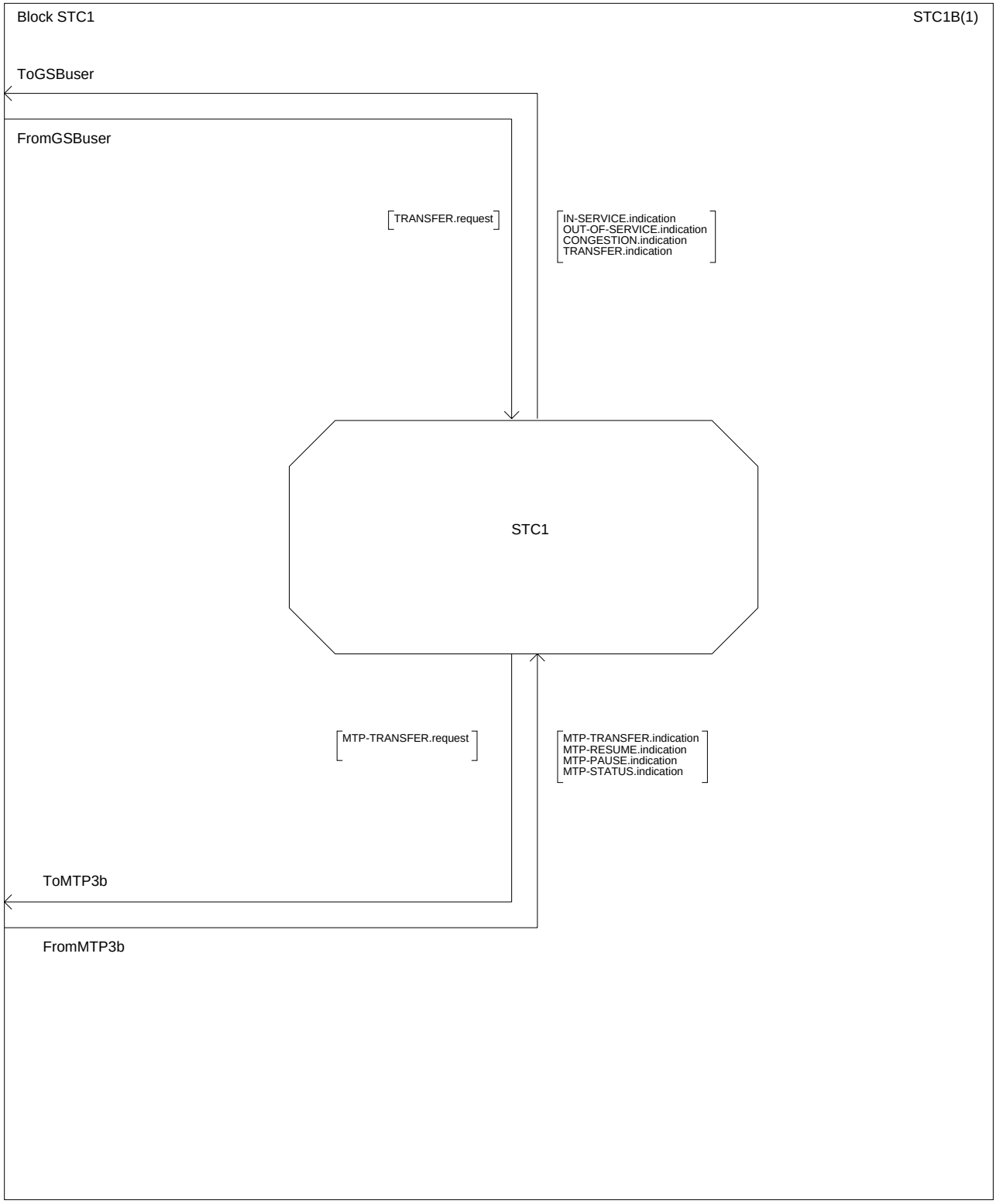


Figure 8-3/Q.2150.1 – SDL block structure of the AAL type 2 signalling transport converter

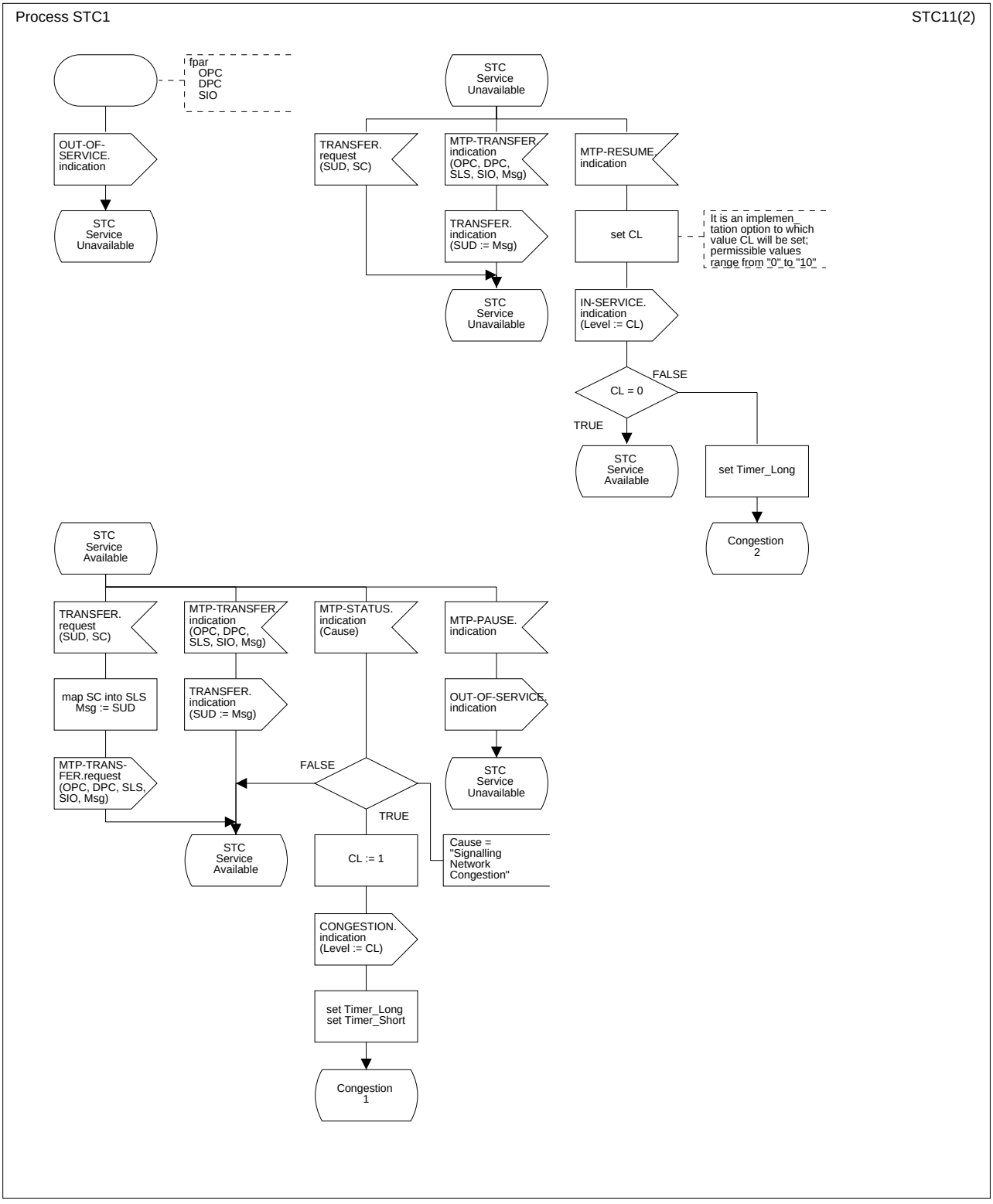


Figure 8-4/Q.2150.1 – SDL diagram for the AAL type 2 signalling transport converter *(part 1 of 2)*

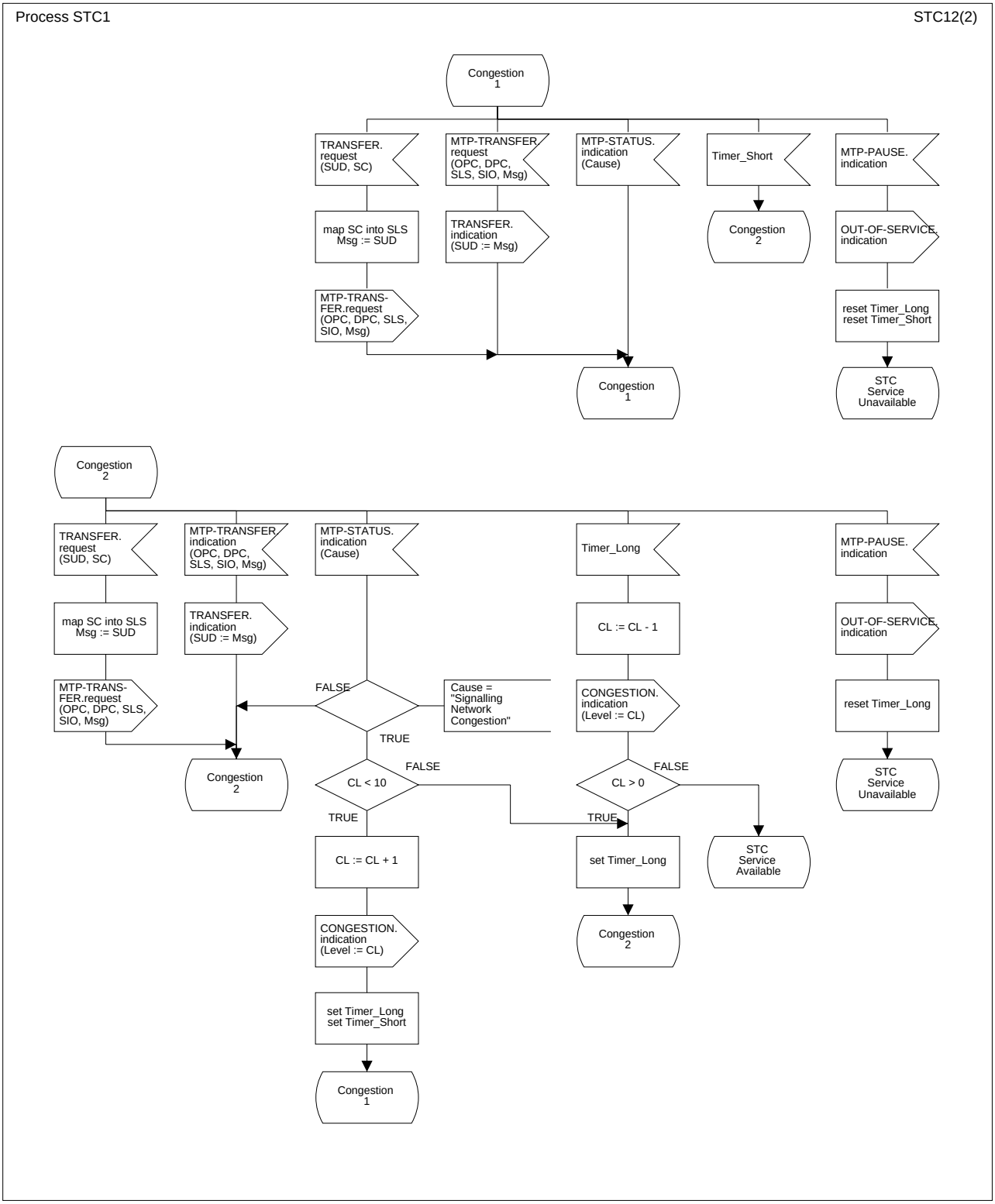


Figure 8-4/Q.2150.1 – SDL diagram for the AAL type 2 signalling transport converter *(part 2 of 2)*

APPENDIX I

Protocol Implementation Conformance Statement (PICS) Proforma

There exist no actions of the STC that are visible from outside a system; therefore, a Protocol Implementation Conformance Statement is not possible. If the generic signalling transport service is based on broadband MTP, all of clauses 7 and 8 apply.

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