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SERIES Q: SWITCHING AND SIGNALLING

Broadband ISDN – Signalling network protocols

Message transfer part level 3 functions and messages using the services of ITU-T Recommendation Q.2140

ITU-T Recommendation Q.2210

(Previously CCITT Recommendation)

ITU-T Q-SERIES RECOMMENDATIONS

SWITCHING AND SIGNALLING

SIGNALLING IN THE INTERNATIONAL MANUAL SERVICE	Q.1–Q.3
INTERNATIONAL AUTOMATIC AND SEMI-AUTOMATIC WORKING	Q.4–Q.59
FUNCTIONS AND INFORMATION FLOWS FOR SERVICES IN THE ISDN	Q.60–Q.99
CLAUSES APPLICABLE TO ITU-T STANDARD SYSTEMS	Q.100–Q.119
SPECIFICATION OF SIGNALLING SYSTEMS No. 4 AND No. 5	Q.120–Q.249
SPECIFICATIONS OF SIGNALLING SYSTEM No. 6	Q.250–Q.309
SPECIFICATIONS OF SIGNALLING SYSTEM R1	Q.310–Q.399
SPECIFICATIONS OF SIGNALLING SYSTEM R2	Q.400–Q.499
DIGITAL EXCHANGES	Q.500–Q.599
INTERWORKING OF SIGNALLING SYSTEMS	Q.600–Q.699
SPECIFICATIONS OF SIGNALLING SYSTEM No. 7	Q.700–Q.849
DIGITAL SUBSCRIBER SIGNALLING SYSTEM No. 1	Q.850–Q.999
PUBLIC LAND MOBILE NETWORK	Q.1000–Q.1099
INTERWORKING WITH SATELLITE MOBILE SYSTEMS	Q.1100–Q.1199
INTELLIGENT NETWORK	Q.1200–Q.1999
BROADBAND ISDN	Q.2000–Q.2999
General aspects	Q.2000–Q.2099
ATM adaptation layer	Q.2100–Q.2199
Signalling network protocols	**Q.2200–Q.2599**
Common aspects of B-ISDN application protocols for access signalling and network signalling and interworking	Q.2600–Q.2699
B-ISDN application protocols of the network	Q.2700–Q.2899
B-ISDN application protocols for access signalling	Q.2900–Q.2999

For further details, please refer to ITU-T List of Recommendations.

ITU-T RECOMMENDATION Q.2210

MESSAGE TRANSFER PART LEVEL 3 FUNCTIONS AND MESSAGES USING THE SERVICES OF ITU-T RECOMMENDATION Q.2140

Summary

This Recommendation specifies Message Transfer Part level 3 functions and messages that are suitable for the control of signalling links that provide the service of ITU-T Recommendation Q.2140.

Source

ITU-T Recommendation Q.2210 was prepared by ITU-T Study Group 11 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 9th of July 1996.

FOREWORD

ITU (International Telecommunication Union) is the United Nations Specialized Agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the ITU. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, March 1-12, 1993).

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

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

CONTENTS

Page

Recommendation Q.2210

MESSAGE TRANSFER PART LEVEL 3 FUNCTIONS AND MESSAGES USING THE SERVICES OF ITU-T RECOMMENDATION Q.2140

(Geneva, 1996)

1 Scope

This Recommendation specifies Message Transfer Part level 3 functions and messages that are suitable for the control of signalling links that provide the services of Recommendation Q.2140 [1].

These functions and messages will informally be referred to as MTP-3b within this Recommendation.

Any additional specifications for the interworking between signalling links that provide the services of Recommendation Q.2140 [1] and signalling links offering the services of Recommendation Q.703 [8] are beyond the scope of this Recommendation.

2 References

The following 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.

2.1 Normative references

[1] ITU-T Recommendation Q.2140 (1995), *B-ISDN signalling ATM Adaptation Layer – Service Specific Coordination Function for signalling at the Network Node Interface (SSCF at NNI)*.

[2] ITU-T Recommendation Q.704 (1993), *Signalling network functions and messages*.

[3] CCITT Recommendation Q.707 (1988), *Testing and maintenance*.

[4] CCITT Recommendation Q.701 (1988), *Functional description of the Message Transfer Part (MTP) of Signalling System No. 7*.

[5] *Glossary of Terms used in Signalling System No. 7*, CCITT *Blue Book*, Fascicle VI.7, 1988.

[6] ITU-T Recommendation Q.751.1 (1995), *Network element management information model for the Message Transfer Part (MTP).*

2.2 Informative references

[7] ITU-T Recommendation Q.700 (1993), *Introduction to CCITT Signalling System No. 7*.

[8] ITU-T Recommendation Q.703 (1996), *Signalling link*.

3 Abbreviations and acronyms

For the purposes of this Recommendation, the following abbreviations are used.

AAL	ATM Adaptation Layer
ATM	Asynchronous Transfer Mode
B-ISDN	Broadband ISDN
DPC	Destination Point Code
FSN	Forward Sequence Number
H0	Heading Code which identifies the message group
H1	Heading Code which identifies the signals in a message group
LSB	Least Significant Bit
LSLA	Signalling link activation function
LSLD	Signalling link deactivation function
LSLR	Signalling link restoration function
MSB	Most Significant Bit
MTP	Message Transfer Part
MTP-3b	Message Transfer Part level 3 functions and messages according to this Recommendation
NNI	Network Node Interface
OPC	Originating Point Code
SAAL	Signalling ATM Adaptation Layer
SDU	Service Data Unit
SIF	Signalling Information Field
SIO	Service Information Octet
SLC	Signalling Link Code
SLS	Signalling Link Selection
SSCF	Service Specific Coordination Function
XCA	Extended Changeover Acknowledgement
XCO	Extended Changeover Order

4 Definitions

Definitions of MTP level 3 terms are provided in the glossary of CCITT *Blue Book*, Fascicle VI.7 [5] and in Annex B/Q.751.1 [6].

5 General description

If MTP level 3 is used for the control of signalling links that provide the services of Recommendation Q.2140 [1], Recommendations Q.704 [2] and Q.707 [3] shall apply with the modifications as described in this Recommendation. Furthermore specific parts of Recommendation Q.701 [4] shall apply as specified in this Recommendation. In the case of conflicting statements between this Recommendation and Recommendations Q.701 [4], Q.704 [2] or Q.707 [3], this Recommendation takes precedence over Recommendations Q.701 [4], Q.704 [2] and Q.707 [3].

6 Boundaries of MTP level 3 using the services of Recommendation Q.2140

6.1 Definition of the lower boundary of MTP level 3 with SSCF at NNI

The primitives required by MTP level 3 (MTP-3b) at the lower boundary are specified in clause 7/Q.2140 [1].

NOTES

1 – The primitives AAL-FLUSH_BUFFERS and AAL-CONTINUE should not be issued because no remote processor outage indication is provided to MTP level 3 by the underlying SAAL. In fact, due to the SAAL behaviour, the processor outage (both local and remote) always results in Out of Service of the concerned link.

2 – The primitive AAL-LINK_CONGESTED contains the congestion parameter "level" (values from 0 through 3) if the option "multiple congestion thresholds" (3.8.2.2/Q.704 [2]) applies; the level value 0 indicates that the signalling link is uncongested.

3 – The primitive AAL-LINK_CONGESTION_CEASED will not be received if the option "multiple congestion thresholds" applies (see Note 2).

4 – According to the specification of the AAL boundary in Recommendation Q.2140 [1], the primitive AAL-BSNT_NOT_RETRIEVABLE is issued by the underlying layer rather than issued from an "unspecified implementation dependent function" as stated in Recommendation Q.704 [2] [e.g. Figure 27/Q.704 (sheet 2 of 3)].

6.2 Definition of the upper boundary of MTP level 3

The primitives supported by MTP level 3 at the upper boundary are specified in clause 8/Q.701[4].

Table 1 has been replicated from Table 1/Q.701 [4]; only the references have been updated to identify the appropriate Recommendations:

TABLE 1/Q.2210

Message Transfer Part service primitives

Primitives		Parameters
Generic name	Specific name	
MTP-TRANSFER	Request Indication	OPC (2.2.3/Q.704 [2]) DPC (2.2.3/Q.704 [2]) SLS (2.2.4/Q.704 [2]) (Note 1) SIO (14.2/Q.704) User data (subclause 9.1 of this Recommendation)
MTP-PAUSE (Stop)	Indication	Affected DPC
MTP-RESUME (Start)	Indication	Affected DPC
MTP-STATUS	Indication	Affected DPC Cause (Note 2)

NOTES

1 - The MTP users should take into account that this parameter is used for load sharing by the MTP, therefore, the SLS values should be distributed as equally as possible. The MTP guarantees (to a high degree of probability) an in-sequence delivery of messages which contain the same SLS code.

2 - The Cause parameter has, at present, four values:

i) Signalling network congested (plus optional level).

The level value is included if national options with congestion priorities or multiple signalling link states without congestion priorities as in Recommendation Q.704 are implemented.

ii) User Part Unavailability: unknown.

iii) User Part Unavailability: unequipped remote user.

iv) User Part Unavailability: inaccessible remote user.

6.3 Interactions between level 1 and MTP level 3 using the services of Recommendation Q.2140

When the services of Recommendation Q.2140 are used, there are no interactions between MTP level 3 with level 1. The signals "Connect" between LSLA/LSLR and level 1, and "Disconnect" between LSLD and level 1 are not applicable.

7 Interworking between signalling links that provide the services of Recommendation Q.2140 [1] with signalling links offering the services of Recommendation Q.703 [8]

In principle, signalling links that provide the services of Recommendation Q.2140 [1] and signalling links offering the services of Recommendation Q.703 [8] could be connected to the same signalling point. Network design or administrative means beyond the scope of this Recommendation shall prevent the routing of messages that are too long (as defined in Recommendation Q.703) to links offering the services of Recommendation Q.703 [8]. Any additional specifications for the interworking between signalling links that provide the services of Recommendation Q.2140 [1] and signalling links offering the services of ITU-T Recommendation Q.703 [8] are beyond the scope of this Recommendation.

8 Compatibility in MTP-3b

To enable forward compatibility with future implementations of MTP-3b, the requirements defined in 6.1/Q.701, 6.2/Q.701 and 6.3/Q.701 [4] apply.

Allocated values for H0/H1 codes are those defined in Recommendation Q.704 [2] and in this Recommendation. The messages received that are associated with a procedure which is not supported are discarded and no action is taken.

9 Signalling network functions and messages

This clause specifies the modifications to Recommendation Q.704 [2].

9.1 Maximum SDU size

The maximum amount of user data supported by MTP level 3 for signalling links that provide the services of Recommendation Q.2140 [1] is 4091 octets.

NOTE – The maximum size SDU [including the Service Information Octet (SIO)] supported by SSCF at NNI is 4096 octets, whereas the maximum size SIF supported by signalling links offering the services of Recommendation Q.703 [8] is 272 octets.

9.2 Changeover procedure

The requirements of clause 5/Q.704 [2] shall apply with the following exceptions and clarifications:

i) The Signalling link failure indication causes listed in 3.2.2 a)/Q.704 [2] do not apply. The criterion for initiation of changeover is the transition of a signalling link that provides the services of Recommendation Q.2140 [1] from the In Service to the Out Of Service state or when a request (automatic or manual) is obtained from a management or maintenance system as specified in 3.2.2 b)/Q.704 [2]. Moreover a signalling link that is available is recognized by level 3 as failed when an extended changeover order or an emergency changeover order is received.

ii) Subclause 5.3.1 b)/Q.704 [2] does not apply.

iii) Instead of the changeover message format according to 15.4/Q.704 [2], the format of the changeover message containing extended changeover signals is used (see 9.8.1).

iv) Subclause 5.6.2 ii)/Q.704 [2] does not apply.

NOTE – The concept of long-term and short-term processor outage is not applicable to arrangements with signalling links offering the services of Recommendation Q.2140 (see also 6.1, Note 1).

9.3 Signalling route set congestion method according to 11.2.3/Q.704 [2]

Concerning signalling links that provide the services of Recommendation Q.2140 [1], the value of N for a particular signalling link is network provider and/or implementation dependent (N = number of octets for which a congestion indication primitive or a transfer controlled message will be generated, see 11.2.3.1/Q.704 [2]).

The procedures of 11.2.3.1/Q.704 [2] shall be used, except for 11.2.3.1 ii) b)/Q.704 which is replaced by the following text:

A transfer controlled message is sent to the originating point for the initial message, or alternatively the first octet, and for every n messages (n = 8), or alternatively every N octets (where the measured length is the full message length) received from any originating point for the congested route set or for any link of the congested route set or for any link set of the congested route set or for any congested link of the congested route set.

9.4 Signalling link management

The need for any procedures for the automatic allocation of signalling data links or signalling terminals in MTP-3b to links that provide the services of Recommendation Q.2140 [1] is left for further study. Therefore 12.3/Q.704 through 12.7/Q.704 [2] do not apply.

9.5 Service indicator

The following codes of the service indicator are additionally used:

Bits	D	C	B	A	
	1	0	0	1	Broadband ISDN User Part
	1	0	1	0	Satellite ISDN User Part

9.6 Coding conventions

In Recommendation Q.704 [2], the format of the messages and the fields within the messages is based on bit transmission order. In these figures the least significant bit of each field is positioned to the right.

In this Recommendation, although the coding conventions correspond to the conventions of ITU-T Recommendation Q.704, the message format is based on octet transmission order. Therefore the following coding conventions shall be used when a message is generated for a signalling link offering the services of Recommendation Q.2140:

- When a field of a message is contained within a single octet, the lowest bit number of the field represents the least significant bit.
- When a field of a message spans more than one octet, the order of the bit values within each octet progressively increases as the octet number increases; the lowest bit number associated with the field represents the least significant bit.

9.7 General format of messages conveying peer-to-peer information of user parts

Figure 1 shows the general format and coding conventions of messages conveying peer-to-peer information of user parts.

8	7	6	5	4	3	2	1	Bit / Octet
MSB	Sub-service field		LSB	MSB	Service indicator		LSB	1
DPC							LSB	2
OPC	LSB	MSB	DPC					3
OPC								4
MSB	SLS		LSB	MSB	OPC			5
User data								6
User data								...
User data								n

FIGURE 1/Q.2210

General format and coding conventions of messages conveying peer-to-peer information of user parts

9.8 Formats and codes of signalling network management messages

Figure 2 shows the general format and coding conventions of signalling network management messages.

8	7	6	5	4	3	2	1	Bit / Octet
MSB	Sub-service field		LSB	MSB	Service indicator		LSB	1
DPC							LSB	2
OPC	LSB	MSB	DPC					3
OPC								4
MSB	SLC		LSB	MSB	OPC			5
MSB	Heading Code H1		LSB	MSB	Heading Code H0		LSB	6
							LSB	(Note) 7
								(Note) ...
MSB								(Note) m

NOTE – The octets numbered from 7 to m may not be present or consist of one or more than one octet depending on the type of signalling network management message.

FIGURE 2/Q.2210

General format and coding conventions of signalling network management messages

9.8.1 Changeover message

The heading code H0 is the same as allocated in Recommendation Q.704 [2] to the changeover message. The heading code H1 shall contain signal codes as follows:

Bit	D	C	B	A	
	0	0	1	1	Extended Changeover Order Signal (XCO)
	0	1	0	0	Extended Changeover Acknowledgement Signal (XCA)

NOTE – Signalling links that provide the services of Recommendation Q.2140 [1] use 24-bit sequence numbers. Therefore, the format of the changeover message has to be extended when used in the normal changeover procedure to refer to such signalling links.

The format of the changeover message containing extended changeover signals is shown in Figure 3.

8	7	6	5	4	3	2	1	Bit / Octet
Sub-service field				Service indicator				1
DPC								2
OPC				DPC				3
OPC								4
SLC				OPC				5
D	C	B	A	0	0	0	1	6
Heading Code H1				Heading Code H0				
FSN of last accepted message								7
FSN of last accepted message								8
FSN of last accepted message								9

FIGURE 3/Q.2210

Format of the changeover message containing extended changeover signals

9.8.2 User part unavailable message

The user part identity field within the user part unavailable message can additionally include the following codes:

Bits	D	C	B	A	
	1	0	0	1	Broadband ISDN User Part
	1	0	1	0	Satellite ISDN User Part

9.9 Timers and timer values

The timers T7, T9 and T24 of 16.8/Q.704 [2] do not apply.

Experience in the future will possibly result in changes to timer values included in 16.8/Q.704 [2].

10 Testing and maintenance

This clause specifies the modifications to Recommendation Q.707 [3].

The coding conventions given in 9.6 shall also be applied to the signalling link test message and the signalling link test acknowledgement message. With regard to the format of these messages, see Figure 2.

Appendix I

Insights into architectural aspects and boundaries of MTP-3 using the services of Recommendation Q.2140

I.1 Introduction

The purpose of this Appendix is to provide supplementary information on:

– functional architecture of MTP-3 using the services of Recommendation Q.2140 (see I.2);

– upper and lower boundary of MTP-3, and boundary between MTP-3 and management, with respect to interactions between MTP-3b and entities of adjacent layers (see I.3);
– signalling traffic flow control (see I.4.2); and
– signalling link management (see I.4.3).

I.2 Functional architecture of the MTP-3 using the services of Recommendation Q.2140

Figure I.1 depicts the functional architecture of the MTP-3 using the services of Recommendation Q.2140. In this functional architecture, different types of functional blocks are identified according to the functions they perform which could be related to one signalling link, to one signalling link set, or to the entire MTP-3. Figure I.1 also depicts the relations between the various functional blocks of the MTP-3 using the services of Recommendation Q.2140, and the primitives by which MTP-3 interacts across the boundaries between MTP-3 and lower layer, upper layer, and management. At the lower boundary, an association is to be established between signalling links and AAL-connections. At the upper boundary, signalling relations identified within the MTP by OPC/DPC are defined, within each of them, one or more than one User Part (type) can exist, identified by User Part IDentity (UPID) also known as the Service Indicator (SI).

A description of the signalling message handling function is provided in clause 2/Q.704 [2].

A description of the signalling traffic management function is provided in clause 4/Q.704 [2].

A description of the signalling link management function is provided in clause 12.1/Q.704 [2].

A description of the signalling route management function is provided in clause 13.1/Q.704 [2].

In Figure I-1 subsets of the repertoire of AAL-primitives are related to functional blocks.

The following AAL-primitives convey messages of User Parts and Signalling Network Management messages:

AAL-MESSAGE_FOR_TRANSMISSION

AAL-RECEIVED_MESSAGE

The following AAL-primitives are related to Signalling Link Management (Set A):

AAL-EMERGENCY

AAL-EMERGENCY_CEASES

AAL-STOP

AAL-START

AAL-IN_SERVICE

AAL-OUT_OF_SERVICE

The following AAL-primitives are related to Signalling Traffic Management (Set B):

AAL-LINK_CONGESTED

AAL-LINK_CONGESTION_CEASED

AAL-RETRIEVE_BSNT

AAL-RETRIEVAL_REQUEST_AND_FSNC

AAL-RETRIEVED_MESSAGES

AAL-RETRIEVAL_COMPLETE

AAL-BSNT

AAL-BSNT_NOT_RETRIEVABLE

For the control of the MTP-3b functionality, a repertoire of Signalling Network Management Messages is required. In Figure I-1 subsets of this repertoire are related to functional blocks.

The following Signalling Network Management Messages are related to Signalling Traffic Management (Set A) (see Table I.1):

TABLE I.1/Q.2210

Signalling Network Management Messages are related to Signalling Traffic Management

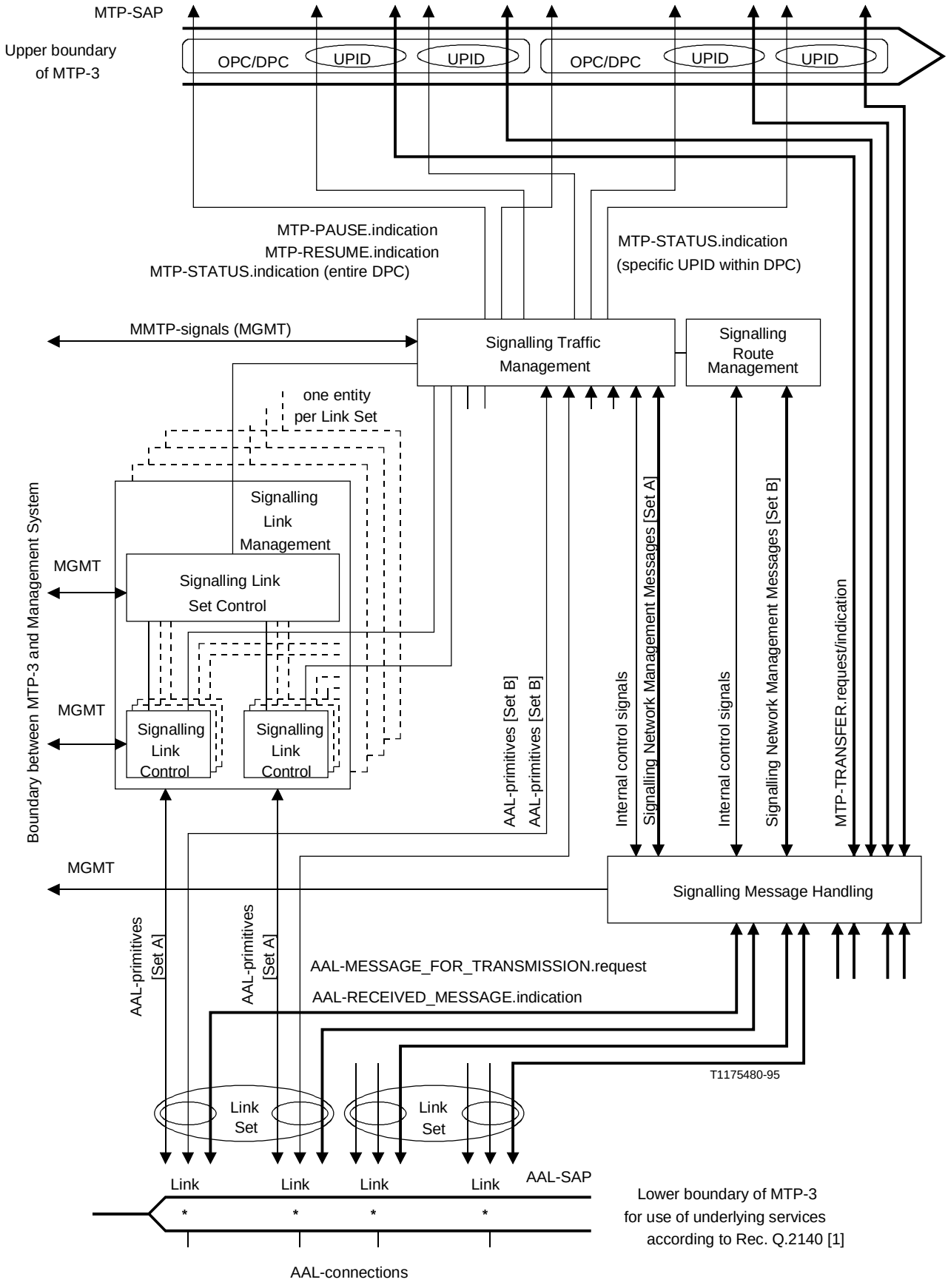
PDU	Group H0	Type H1	Procedure associated with
Emergency changeover acknowledgement	ECM	ECA	Changeover
Emergency changeover order	ECM	ECO	Changeover
Extended changeover acknowledgement	CHM	XCA	Changeover
Extended changeover order	CHM	XCO	Changeover
Changeback declaration	CHM	CBD	Changeback
Changeback acknowledgement	CHM	CBA	Changeback
Link force uninhibit	MIM	LFU	Link uninhibiting
Link inhibit	MIM	LIN	Link inhibiting
Link uninhibit	MIM	LUN	Link uninhibiting
Link inhibited acknowledgement	MIM	LIA	Link inhibiting
Link uninhibited acknowledgement	MIM	LUA	Link uninhibiting
Link inhibit denied	MIM	LID	Link inhibiting
Link local inhibit test	MIM	LLT	Link inhibit test
Link remote inhibit test	MIM	LRT	Link inhibit test
Traffic restart allowed	TRM	TRA	MTP restart
User part unavailable	UFC	UPU	User Part availability control

The following Signalling Network Management Messages are related to Signalling Route Management (Set B) (see Table I.2):

TABLE I.2/Q.2210

Signalling Network Management Messages are related to Signalling Route Management

PDU	Group H0	Type H1	Procedure associated with
Signalling-route-set-test for prohibited destination	RSM	RST	Signalling route set test
Signalling-route-set-test for restricted destination	RSM	RSR	Signalling route set test
Signalling-route-set-congestion-test	FCM	RCT	Signalling route set congestion test
Transfer-allowed	TFM	TFA	Controlled rerouting Signalling route set test
Transfer controlled	FCM	TFC	Signalling route set congestion
Transfer-prohibited	TFM	TFP	Forced rerouting MTP restart Signalling route set test
Transfer restricted	TFM	TFR	Controlled rerouting MTP restart Signalling route set test



NOTE – The MTP-SAP is used to identify the MTP. Signalling relation information is accessed through the MTP-SAP.

FIGURE I.1/Q.2210

Functional architecture of MTP-3 using the services of Recommendation Q.2140

I.3 Elements for layer-to-layer communication

I.3.1 General

Communications between layers is accomplished by means of primitives. In addition, for this Recommendation, communications between the MTP level 3 and the system management is accomplished by means of signals. The description of primitives following also applies to signals except there is no Service Access Point defined across which signals are passed.

Primitives represent, in an abstract way, the logical exchange of information and control between the MTP level 3 and adjacent layers. They do not specify or constrain implementations.

Primitives consist of commands and their respective responses associated with the services requested of a lower layer. The general syntax of a primitive is:

XX-Generic name-Type: Parameters

where XX designates the interface across which the primitive flows. For this Recommendation, XX is:

– MTP for communication between the MTP User and the MTP level 3;

– AAL for communication between the MTP level 3 and the SSCF at the NNI; or

– MMTP for communication between the layer management and the MTP level 3 (see Note).

NOTE – MMTP is defined as a signal.

I.3.1.1 Generic names

The generic name specifies the activity that should be performed. The primitive generic names that are used in this Recommendation are indicated in clause 6, and the generic name for MMTP signals are defined in Table I.3.

I.3.1.2 Primitive Types

I.3.1.2.1 Request

The request primitive type is used when a higher layer or layer management is requesting a service from the lower layer.

I.3.1.2.2 Indication

The indication primitive type is used by a layer providing a service to inform the higher layer or layer management.

I.3.1.2.3 Response

The response primitive type is used as a consequence of the indication primitive type. It is not in use in this Recommendation.

I.3.1.2.4 Confirm

The confirm primitive type is used by the layer providing the requested service to confirm that the activity has been completed.

Figure I.2 illustrates the relationship of the primitive types between the MTP level 3 and the adjacent layers.

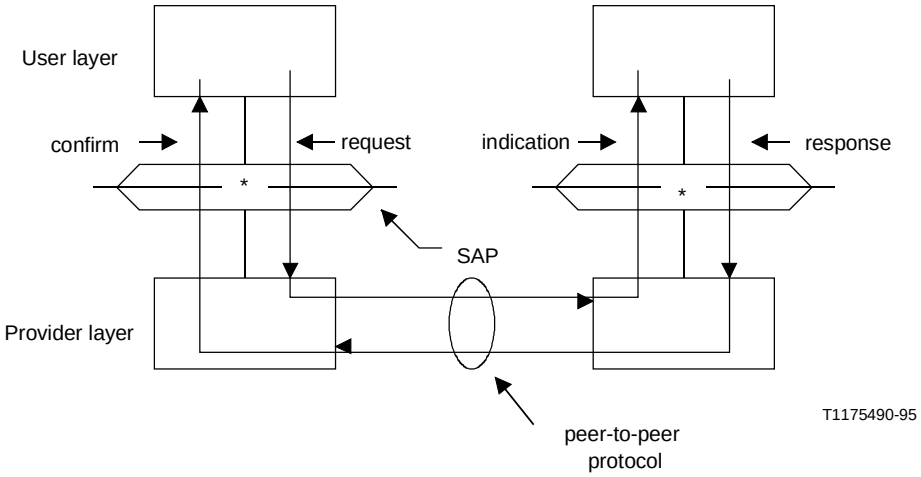


FIGURE I.2/Q.2210

Relationship of the primitive types between adjacent layers

I.3.1.3 Parameter definition

A parameter consists of information relevant to the particular action of the primitive.

I.3.1.4 Primitive procedures

Primitive procedures specify the interactions between adjacent layers to invoke and provide a service. The service primitives represent the elements of the procedures. Primitives and the procedures based upon them are an abstract description method which does not constrain implementation of functions in a real system environment, and in particular does not define any physical architecture.

In the scope of this Recommendation, the interactions between the MTP User and the MTP level 3, and those between the MTP level 3 and the SSCF at the NNI and those between the MTP level 3 and the Layer Management entity are specified.

Primitive procedures may be defined in a state transition diagram for sequences of primitives across a Service Access Point (SAP) in relation to a Connection Endpoint (CE). Primitive procedures also define constraints on the sequence in which the primitives may occur.

The states of a CE may be derived from the internal states of the functional entities supporting this type of Connection. The states of a CE provide the view of the user which utilizes the services offered by a service provider. This approach avoids the need for the user to know all the details of the provider layer.

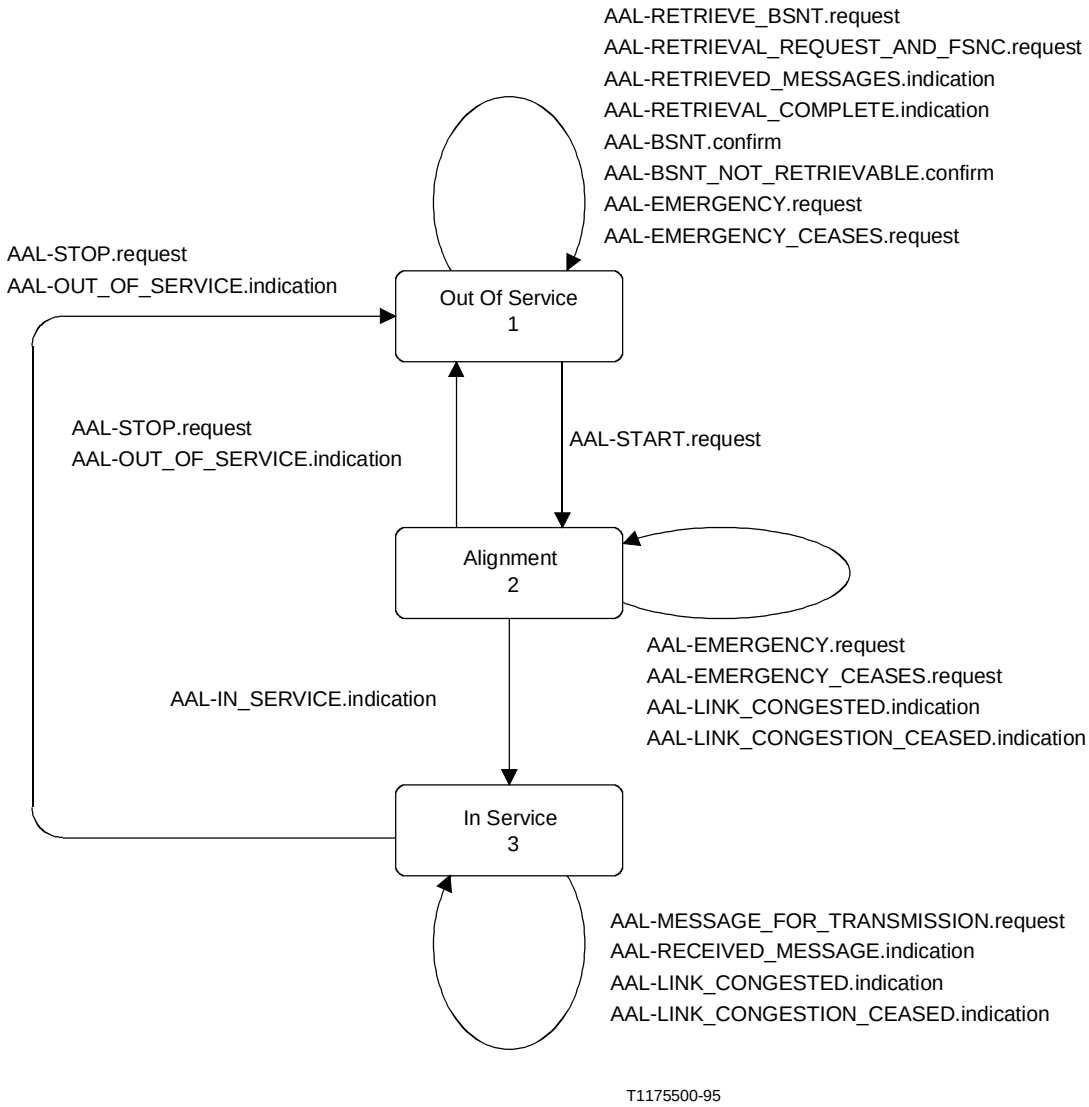
I.3.2 Definition of the lower boundary of the MTP-3 in performing MTP-3b functionality

I.3.2.1 AAL-primitives

The primitives used by the MTP-3 in performing MTP-3b functionality at the lower boundary are defined in 6.1. Their names are consistent with the names of the messages which are exchanged between MTP level 2 according to Recommendation Q.703 [8] and MTP level 3 according to Recommendation Q.704 [2].

I.3.2.2 State transition diagram

The state transition diagram, as seen by the MTP-3 in performing MTP-3b functionality is shown in Figure I.3. This state transition diagram defines how the MTP-3 is using the Q.2140 services, while the possible overall sequences of primitives at a point-to-point AAL connection endpoint are defined in the state transition diagram, Figure 3/Q.2140 [1]. The sequences are related to the states at one point-to-point AAL connection endpoint, i.e. one individual state transition diagram exists per AAL connection.



NOTE – The In Service state which applies to this state transition diagram is related to the SSCF at NNI.

FIGURE I.3/Q.2210

State transition diagram for sequence of AAL-primitives across a connection endpoint at the lower boundary of the MTP-3 in performing MTP-3b functionality

I.3.2.3 Different behaviours of the service provider SSCF at NNI and MTP-2

There are some different behaviours of a service provider SSCF at NNI and MTP-2. The two explanatory notes indicate the major differences:

NOTES

1 – Emergency during proving. While a protocol entity according to Recommendation Q.703 [8] performs the proving when an emergency is required, a protocol entity according to Recommendation Q.2140 [1] does not perform emergency proving since N1, the number of PDUs sent during proving, is set to "0" under this condition.

2 – Processor outage during proving. According to Recommendation Q.703 [8], if a processor outage condition exists after proving is completed, the MTP-2 enters the Aligned/Not ready state. Under the same circumstances, the SSCF at NNI enters the Out Of Service state.

I.3.3 Definition of the upper boundary of the MTP-3

I.3.3.1 MTP-primitives

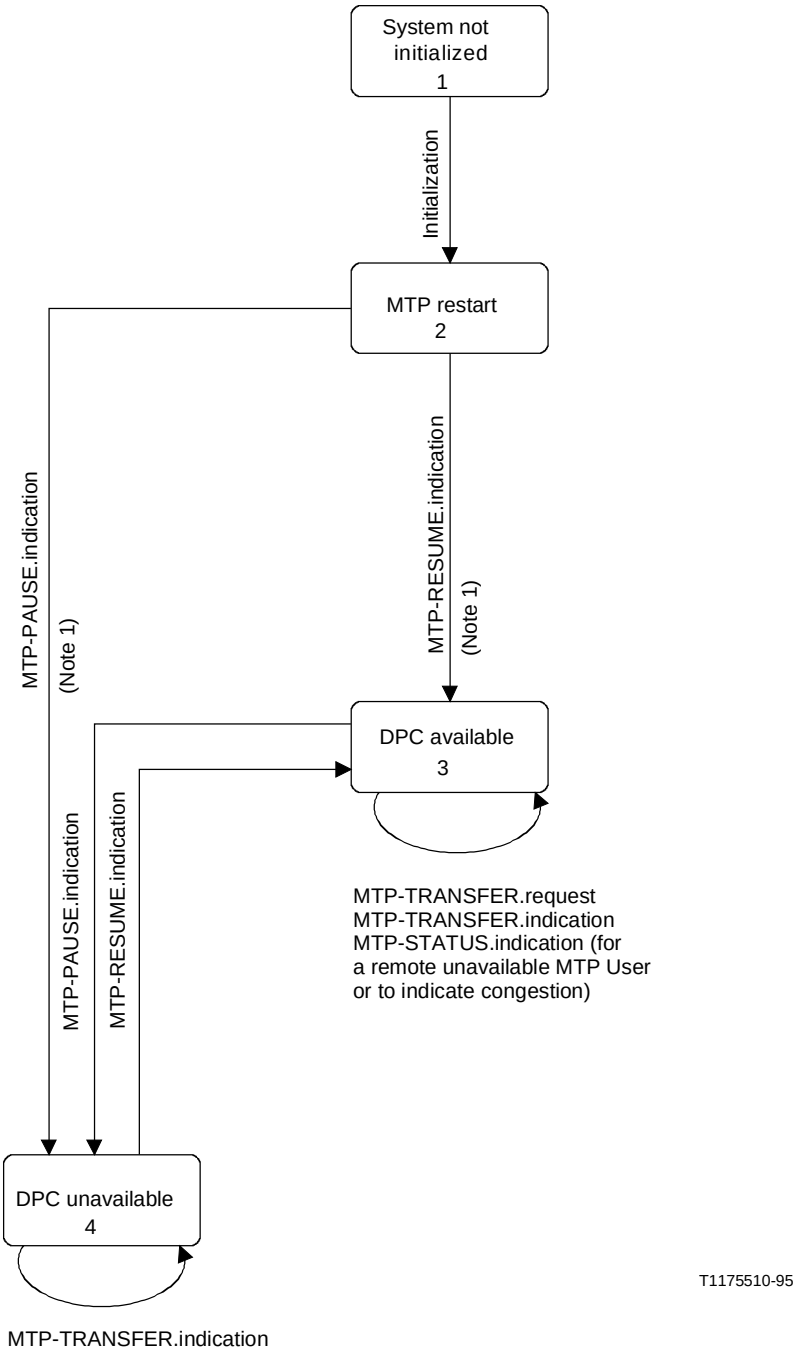
The primitives supported by the MTP-3 at the upper boundary are defined in 6.2. Their names are consistent with the names of the messages which are exchanged between MTP level 3 and MTP level 3 user according to Recommendation Q.704 [2].

I.3.3.2 State transition diagram

The state transition diagram, as seen by the MTP User is shown in Figure I.4. One individual state transition diagram exists per MTP-3 connection, which is conceptually identified by a Connection Endpoint Suffix with the identifier "OPC/DPC". Associated with each MTP-3 connection is one signalling relation.

This subclause defines the constraints on the sequences in which the primitives may occur. The sequences are related to the states at one MTP connection endpoint.

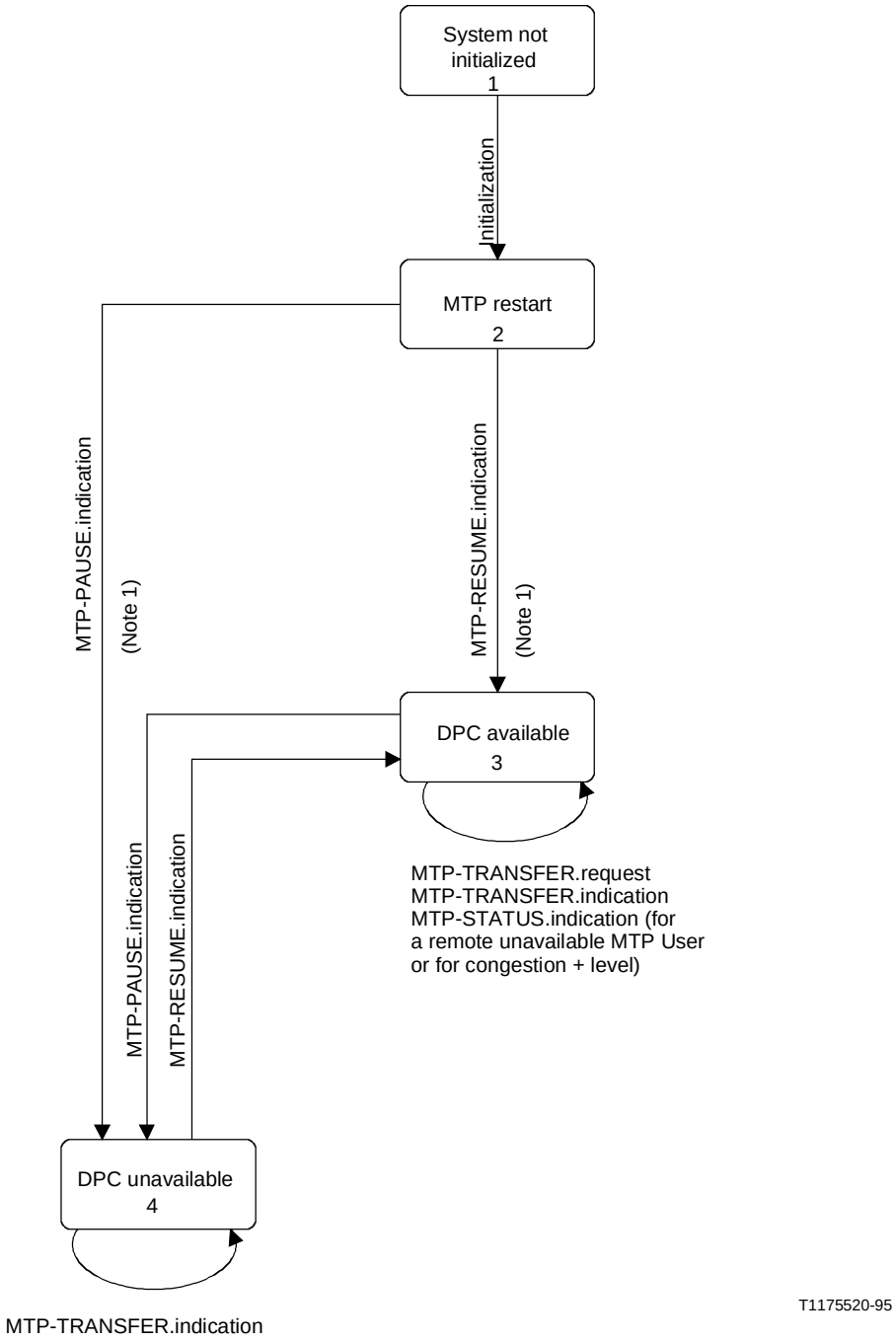
Figure I.4 Part 1 is for the international method of congestion control. Figure I.4 Part 2 shows the state transition diagram for the method of congestion control with multiple congestion levels without congestion priorities, Figure I.4 Part 3 shows the method with congestion priorities.



NOTES
1 – Within Rec. Q.704, the mechanism for leaving the MTP restart state is not modelled.
2 – MTP-TRANSFER.indication in state 4 is from a unidirectional route set. There might be MTP-STATUS.indications for User Part Unavailable or congestion just after entering state 4.

FIGURE I.4/Q.2210 (part 1 of 3)

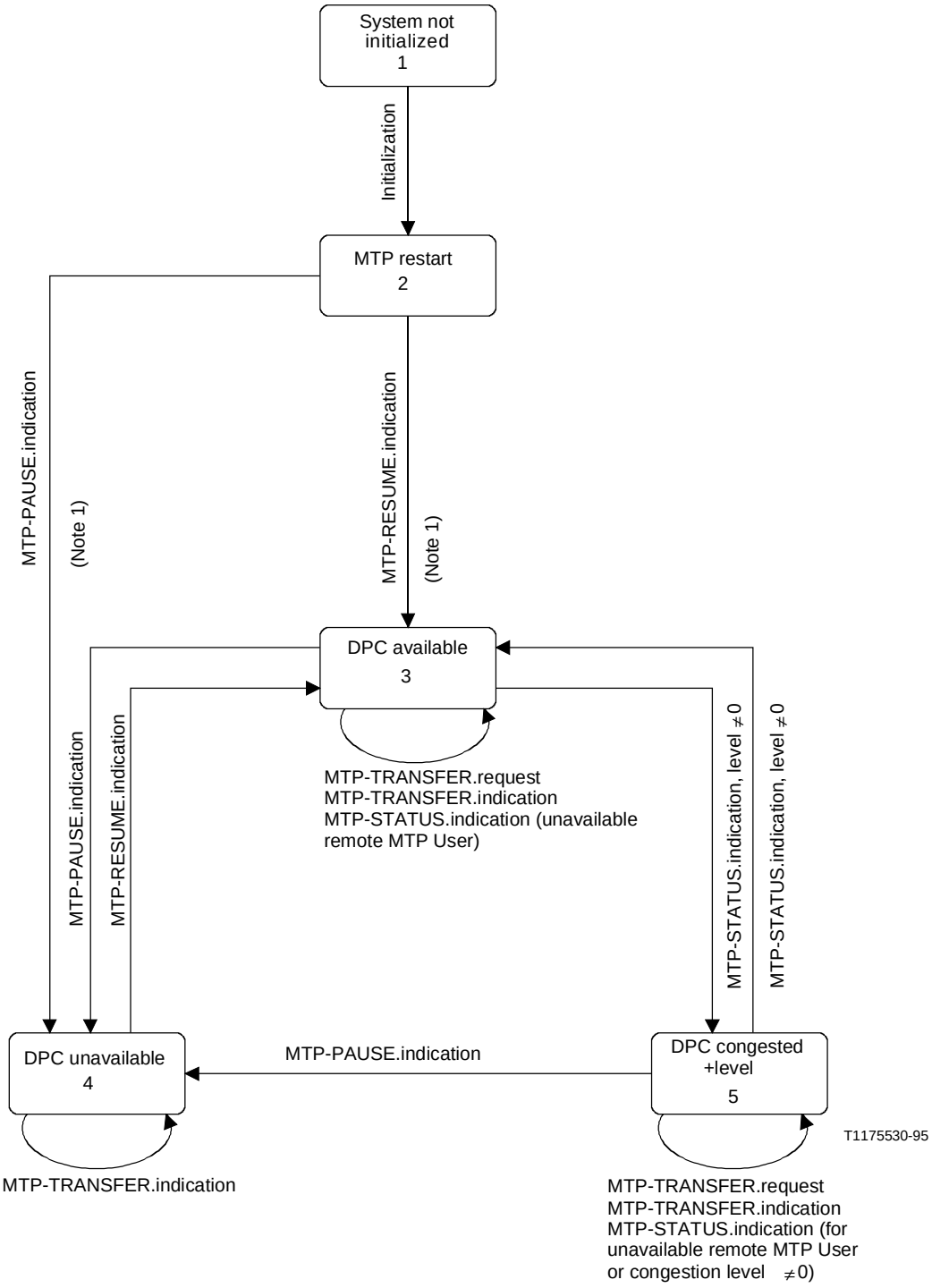
State transition diagram for sequence of MTP-primitives across the upper boundary of the MTP-3 (international method of congestion control)



NOTES
1 – Within Rec. Q.704, the mechanism for leaving the MTP restart state is not modelled.
2 – MTP-TRANSFER.indication in state 4 is from a unidirectional route set. There might be MTP-STATUS.indications for User Part Unavailable or congestion just after entering state 4.

FIGURE I.4/Q.2210 (part 2 of 3)

State transition diagram for sequence of MTP-primitives across the upper boundary of the MTP-3 (multiple congestion levels without congestion priorities)



NOTES
1 – Within Rec. Q.704, the mechanism for leaving the MTP restart state is not modelled.
2 – MTP-TRANSFER.indication in state 4 is from a unidirectional route set.
There might be MTP-STATUS.indications for User Part Unavailable or congestion just after entering state 4.

FIGURE I.4/Q.2210 (part 3 of 3)

State transition diagram for sequence of MTP-primitives across the upper boundary of the MTP-3 (multiple congestion levels with congestion priorities)

I.3.4 Definition of the boundary between the MTP-3 and Management System

I.3.4.1 Introduction

A management system may have several layer interfaces to managed entities. This subclause specifies one layer interface. Therefore, the state transition diagram contained in I.3.4.3 defines the view the management system has on the status of MTP-3 based on the use of the signals identified in I.3.4.2. It should be noted that this view may be incomplete, and the management system may rely on additional information.

I.3.4.2 Signals between the MTP-3 and Management System

The signals exchanged between Management System and MTP-3 are shown in Table I.3. Their names are consistent with the names used in Recommendation Q.704 [2].

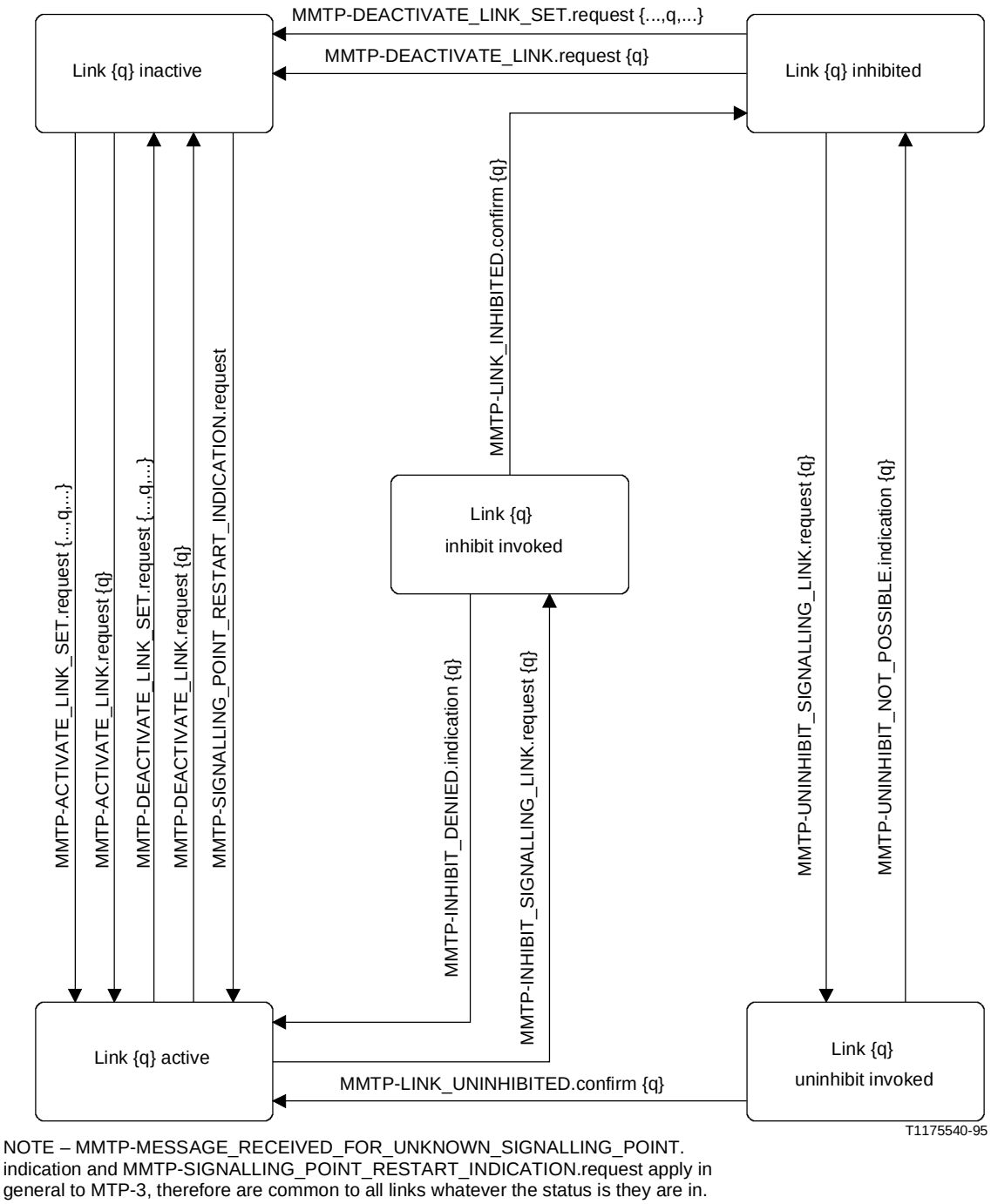
TABLE I.3/Q.2210

Signals across the boundary between the MTP-3 and Management System

Signal	Direction (functional entity within MTP-3)	Contents of Primitive Parameter Data
MMTP-MESSAGE_RECEIVED_FOR_ UNKNOWN_SIGNALLING_POINT.indication	MTP-3 (HMRT) to MS	DPC, OPC
MMTP-INHIBIT_SIGNALLING_LINK.request	MS to MTP-3 (TLAC)	Link
MMTP-LINK_INHIBITED.confirm	MTP-3 (TLAC) to MS	Link
MMTP-INHIBIT_DENIED.indication	MTP-3 (TLAC) to MS	Link
MMTP-UNINHIBIT_SIGNALLING_LINK.request	MS to MTP-3 (TLAC)	Link
MMTP-LINK_UNINHIBITED.confirm	MTP-3 (TLAC) to MS	Link
MMTP-UNINHIBIT_NOT_POSSIBLE.indication	MTP-3 (TLAC) to MS	Link
MMTP-LOCAL_PROCESSOR_OUTAGE.request	MS to MTP-3 (TLAC)	
MMTP-LOCAL_PROCESSOR_RECOVERED.request	MS to MTP-3 (TLAC)	
MMTP-SIGNALLING_POINT_RESTART_INDICATION.request	MS to MTP-3 (TPRC)	
MMTP-ACTIVATE_LINK_SET.request	MS to MTP-3 (LLSC)	LinkSet
MMTP-DEACTIVATE_LINK_SET.request	MS to MTP-3 (LLSC)	LinkSet
MMTP-ACTIVATE_LINK.request	MS to MTP-3 (LSAC)	Link
MMTP-DEACTIVATE_LINK.request	MS to MTP-3 (LSAC)	Link

I.3.4.3 State transition diagram

The state transition diagram for the boundary between Management System and MTP-3 is shown in Figure I.5. One individual state transition diagram exists per signalling link. In this Figure, the signalling link is element {q} in a set of signalling links {…,q,…}. The signals MMTP-MESSAGE_RECEIVED_FOR_UNKNOWN_SIGNALLING_POINT.indication and MMTP-SIGNALLING_POINT_RESTART_INDICATION.request are common to all signalling links.



NOTE – MMTP-MESSAGE_RECEIVED_FOR_UNKNOWN_SIGNALLING_POINT. indication and MMTP-SIGNALLING_POINT_RESTART_INDICATION.request apply in general to MTP-3, therefore are common to all links whatever the status is they are in.

FIGURE I.5/Q.2210

State transition diagram for sequence of MMTP-signals across the boundary between Management System and the MTP-3

I.4.2 Signalling traffic flow control

Subclauses I.4.2.1 and I.4.2.2 provide additional clarification on flow control indications to the local user parts and signalling route set congestion method according to 11.2.3/Q.704, respectively.

I.4.2.1 Flow control indications to the local user parts

The requirements of 11.2.1/Q.704 and 11.2.2/Q.704 [2] apply with the following clarification:

– In the case of unavailability, the appropriate primitive is MTP-PAUSE.indication with a parameter indicating the concerned DPC.

– In the case of availability, the appropriate primitive is MTP-RESUME.indication with a parameter indicating the concerned DPC.

I.4.2.2 Signalling route set congestion method according to 11.2.3/Q.704

The requirements of 11.2.3/Q.704 [2] apply with the following clarification:

– In 11.2.3.1 i) b)/Q.704, the appropriate primitive is MTP-STATUS.indication with a cause "signalling network congested" and a parameter indicating the affected DPC.

I.4.3 Signalling link management

The following provides additional clarification on signalling link management. The signalling link management addresses:

a) the allocation of protocol entities (signalling equipment such as signalling terminals) for support of a signalling link;

b) a connecting procedure which allows establishment, or release of an association between a signalling link and AAL connection endpoints at both ends. It should be noted that the identity of a signalling link referred to by the Signalling Link Code (SLC) is not the AAL-connection identity itself or any other means to identify a signalling link within provider layers such as VPI and VCI;

c) the activation, restoration and deactivation of a link set and individual links. A primitive procedure allows the request, or release of provider layer resources which are offered in form of AAL-connections.

The allocation of protocol entities (signalling equipment such as signalling terminals) for the support of a signalling link is a local matter; its realization is in the responsibility of implementers.

For the support of basic signalling link management an association between each signalling link and AAL-connection endpoints is established, or released, as appropriate, in a local procedure at each end of the signalling link. The number of active (associated AAL-connection In Service) and inactive (associated AAL-connection Out of Service) signalling links in the absence of signalling link failures at both ends, and the priority for signalling initialization of links in a link set is identical at both ends of the link set. The requirements of 12.2/Q.704 [2] apply with the following clarification:

– in order to invoke an AAL-connection, the AAL-START.request primitive is used;

– the AAL-IN_SERVICE.indication notifies MTP-3 regarding completion of the initial alignment;

– on receipt of the AAL-IN_SERVICE.indication primitive, the signalling link test as specified in 2.2/Q.707 [3] is invoked, further requirements are specified in clause 10;

– in order to release an AAL-connection, the AAL-STOP.request primitive is used.

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