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B-ISDN ATM ADAPTATION LAYER

B-ISDN SIGNALLING ATM ADAPTATION LAYER (SAAL) – LAYER MANAGEMENT FOR THE SAAL AT THE NETWORK NODE INTERFACE (NNI)

ITU-T Recommendation Q.2144

(Previously "CCITT Recommendation")

FOREWORD

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NOTE

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SUMMARY

The ATM Adaptation Layer (AAL) is defined to enhance the services provided by the ATM layer to support the functions required by the next higher layer. One particular type of AAL service is the Signalling AAL (SAAL) which comprises AAL functions necessary to support a signalling entity. The structure of the SAAL is defined in Recommendation Q.2100.

The SAAL consists of a Segmentation And Reassembly (SAR) function, and a Convergence Sublayer which is divided into two sublayers: a Common Part Convergence Sublayer (CPCS) and a Service Specific Convergence Sublayer (SSCS). The common part protocol is defined in clause 6/I.363, and is used as the underlying protocol for the service specific part for signalling. The SSCS is functionally divided into two parts. The Service Specific Connection Oriented Protocol (SSCOP), which provides an assured data transfer service and the Service Specific Coordination Function (SSCF). The SSCOP is defined in Recommendation Q.2110 and is suitable for use by various SSCFs. This Recommendation specifies the layer management functions for the SAAL at the Network Node Interface (NNI).

The layer management functions at the NNI perform error monitoring and a coordination function between the systems management function and the SAAL.

This Recommendation describes the NNI layer management functions associated with the management primitives between the SAAL sublayers and the layer management entity.

KEYWORDS

Error monitoring, Layer management, NNI, SAAL

Recommendation Q.2144

B-ISDN SIGNALLING ATM ADAPTATION LAYER (SAAL) – LAYER MANAGEMENT FOR THE SAAL AT THE NETWORK NODE INTERFACE (NNI)

(Geneva, 1995)

1 Scope

This Recommendation specifies the Layer Management functions for the Signalling ATM Adaptation Layer (SAAL) at the Network Node Interface (NNI). These include the interfaces to the Service Specific Connection Oriented Protocol (SSCOP, Recommendation Q.2110 [2]), to the Service Specific Coordination Function (SSCF) at the NNI (Recommendation Q.2140 [3]), and to systems management. Layer Management provides, or supports, the following functions for the Service Specific Convergence Sublayer (SSCS) at the NNI:

- error processing;
- measurements;
- notification of processor outage status;
- determination of link quality during proving; and
- determination of link quality during normal operation.

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 I.363 (1993), *B-ISDN ATM Adaptation Layer (AAL) specification*.
- [2] ITU-T Recommendation Q.2110 (1994), *B-ISDN ATM adaptation layer – Service Specific Connection Oriented Protocol (SSCOP)*.
- [3] ITU-T Recommendation Q.2140 (1995), *B-ISDN ATM adaptation layer – Service Specific Coordination Function for signalling at the Network Node Interface (SSCF AT NNI)*.

2.2 Informative references

- [4] ITU-T Recommendation Q.703 (1993), *Signalling System No. 7 Signalling link*.
- [5] ITU-T Recommendation Q.704 (1993), *Signalling System No. 7 Signalling network functions and messages*.
- [6] ITU-T Recommendation Q.750 (1993), *Overview of Signalling System No. 7 management*.
- [7] ITU-T Recommendation Q.752 (1993), *Monitoring and measurements for Signalling System No. 7 networks*.

3 Abbreviations and acronyms

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

AA	ATM Adaptation
AAL	ATM Adaptation Layer
ALN	Alignment
ANS	Alignment Not Successful
ATM	Asynchronous Transfer Mode
BER	Bit Error Ratio
BGAK	Begin Acknowledge (SSCOP PDU)
BGN	Begin (SSCOP PDU)
BGREJ	Begin Reject (SSCOP PDU)
B-ISDN	Broadband Integrated Services Digital Network
CC	Congestion Ceased
CD	Congestion Detected
END	End (SSCOP PDU)
ENDAK	End Acknowledge (SSCOP PDU)
ER	Error Recovery (SSCOP PDU)
ERAK	Error Recovery Acknowledge (SSCOP PDU)
INS	IN Service
LM	Layer Management
LPO	Local Processor Outage
LR	Local Release
MAA	Management ATM Adaptation
MAAL	Management ATM Adaptation Layer
MD	Management Data (SSCOP PDU)
MPS	Management Proving State
MTP	Message Transfer Part
MTP-2	Message Transfer Part Level 2
MTP-3	Message Transfer Part Level 3
MU	Message Unit
NC	NO CREDIT
NNI	Network Node Interface
NRP	Number of Retransmitted SSCOP PDUs
OOS	Out Of Service
OSI	Open Systems Interconnection
PDU	Protocol Data Unit
PDUT	SSCOP PDU Transmitted

PE	Protocol Error
PNS	Proving Not Successful
PO	Processor Outage
POLL	Poll (SSCOP PDU)
QOS	Quality of Service
RR	Remote Release
RS	Resynchronization (SSCOP PDU)
RSAC	Resynchronization Acknowledge (SSCOP PDU)
RSREC	Timer_REPEAT-SREC
SAAL	Signalling ATM Adaptation Layer
SAR	Segmentation And Reassembly
SD	Sequenced Data (SSCOP PDU)
SR	SSCOP Release
SREC	SSCOP RECover
SSCF	Service Specific Coordination Function
SSCOP	Service Specific Connection Oriented Protocol
SSCOP-UU	SSCOP User-to-User Information
SSCS	Service Specific Convergence Sublayer
STAT	Solicited STATus (SSCOP PDU)
UD	Unnumbered Data (SSCOP PDU)
UDR	UNITDATA Received
USTAT	Unsolicited STATus (SSCOP PDU)

4 Model for interactions with Layer Management

Figure 1 shows the relationship of Layer Management to other protocols and management entities. In the figure, solid lines connect Layer Management to entities with which it interacts directly. Sections 5, 6 and 7 provide more information on these interfaces.

5 Interface Between Layer Management and the SAAL at the NNI

This clause defines the signals between the Layer Management entity for the SAAL at the NNI and between the SSCF at the NNI and the SSCOP. Subclause 5.1 defines the interface to SSCOP. Subclause 5.2 defines the interface to the SSCF at the NNI. For information concerning the interface of AAL Type 5 Common Part to Layer Management, consult 6/I.363 [1].

NOTE – Currently there are no interactions between the AAL Type 5 Common Part and Layer Management specified in Recommendation I.363 [1].

5.1 Interface Between Layer Management and SSCOP

Between Layer Management and the SSCOP the signals contained in Table 1 are defined:

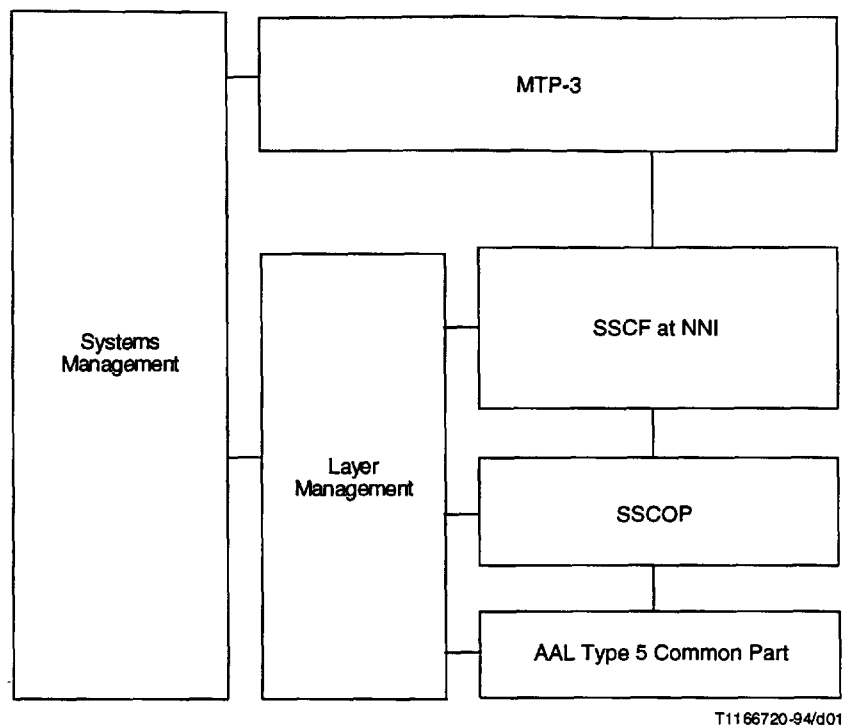


FIGURE 1/Q.2144
Relationships of Layer Management with other entities

TABLE 1/Q.2144
Signals and Parameters between SSCOP and Layer Management

Generic name	Type			
	Request	Indication	Response	Confirm
MAA-ERROR	Not Defined	Code, Count	Not Defined	Not Defined
MAA-UNITDATA	MU	MU	Not Defined	Not Defined

The definitions of these signals are found in Recommendation Q.2110 [2]. They are shown here for ease of reference.

- The MAA-ERROR signal is used by SSCOP to report the occurrence of various error events to Layer Management.
- The MAA-UNITDATA signals are used for the non-assured transfer of information between peer Layer Management entities.

NOTE – Thus far, no procedures using the MAA-UNITDATA signal have been defined for the Layer Management for the SAAL at the NNI.

The parameters in these signals are defined as follows:

- The Message Unit (MU) parameter contains the service data unit that is transferred from Layer Management to SSCOP in the MAA-UNITDATA.request and from SSCOP to Layer Management in the MAA-UNITDATA.indication.
- The Code parameter indicates the type of error that occurred. A table of errors that can be reported and the corresponding Code values are given in Recommendation Q.2110 [2] and are replicated for convenience in Appendix I.
- The Count parameter indicates the number of SD PDU retransmissions that occurred.

5.2 Interface Between Layer Management and the SSCF at the NNI

Between Layer Management and the NNI SSCF the signals contained in Table 2 are defined in Recommendation Q.2140 [3]. These definitions are repeated below for the convenience of the reader.

TABLE 2/Q.2144
Signals between SSCF at the NNI and Layer Management

Signals	Direction
MAAL-PROVING.indication	SSCF to LM
MAAL-CLEAR_FORCE_MODES.request	LM to SSCF
MAAL-FORCE_EMERGENCY.request	LM to SSCF
MAAL-FORCE_PROVING.request	LM to SSCF
MAAL-STOP_PROVING.indication	SSCF to LM
MAAL-PROVING_UNSUCCESSFUL.response	LM to SSCF
MAAL-RELEASE.request	LM to SSCF
MAAL-LOCAL_PROCESSOR_OUTAGE.request	LM to SSCF
MAAL-LOCAL_PROCESSOR_RECOVERED.request	LM to SSCF
MAAL-REPORT.indication	SSCF to LM

These signals are defined as follows:

"MAAL-PROVING.indication"

is used by SSCF to initiate the error monitoring within Layer Management for connection proving.

"MAAL-FORCE_PROVING.request"

is used to instruct SSCF to implement forced proving.

"MAAL-FORCE_EMERGENCY.request"

is used to instruct SSCF to omit proving.

"MAAL-CLEAR_FORCE_MODES.request"

is used to notify SSCF that Layer Management is indifferent to which proving mode is used.

"MAAL-RELEASE.request"

is used to instruct SSCF to release the connection.

"MAAL-STOP_PROVING.indication"

is used to indicate that the proving procedure has terminated.

"MAAL-PROVING_UNSUCCESSFUL.response"

is used to notify SSCF that the proving was not successful.

"MAAL-LOCAL_PROCESSOR_OUTAGE.request"

is used to notify SSCF of local processor outage.

"MAAL_LOCAL_PROCESSOR-RECOVERED.request"

is used to notify SSCF that the local processor has recovered.

"MAAL-REPORT.indication"

is used to notify Layer Management of events detected by SSCF.

The generic structure for the MAAL-REPORT.indication is:

MAAL-REPORT.indication ("lower boundary conditions," "upper boundary conditions," "reasons in case of exceptional situations")

The "lower boundary conditions" parameter reports whether the SSCOP connection was released by the remote or local SSCF or by SSCOP itself if the event being reported involves release of the SSCOP connection; it can take values RR, LR, SR, or -.

The "upper boundary conditions" parameter reports the interface state at the upper boundary of the SSCF into which a transition was made if the event being reported involves a transition at this boundary; it can take values OOS, INS, ALN, or -.

The "reasons in case of exceptional situations" parameter reports the reason for transitions reported in the lower boundary conditions or upper boundary conditions parameters or the type of event being reported when the boundary conditions parameters are empty; it can take values ANS, SREC, SSCOP-UU, PE, CD, CC, PDUT, UDR, or -.

Key

ALN	Alignment
ANS	Alignment Not Successful
CC	Congestion Ceased
CD	Congestion Detected
INS	IN Service
LR	Local Release
OOS	Out Of Service
PDUT	SSCOP PDU Transmitted
PE	Protocol Error
RR	Remote Release
SR	SSCOP Release
SREC	SSCOP RECover
SSCOP-UU	SSCOP User-to-User Information
UDR	UNITDATA Received
-	empty

These parameter values of the MAAL-REPORT.indication and other MAAL-signals provide the Layer Management with an unambiguous view of the status of SSCF (see Table 6/Q.2140 [3] for applicability of notifications).

In the state transition diagram Figure 2:

- the signal MAAL-REPORT.indication (-,-,UDR) is possible in any state. This is not shown;
- any other signal which 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;

- c) it is assumed that the signals passed between LM and an SSCF are coordinated so that collisions do not occur;
- d) the following abbreviations are used:

MAAL-PROVING_UN = MAAL-PROVING_UNSUCCESSFUL,
 MAAL-LOC_PROC_OUT = MAAL-LOCAL_PROCESSOR_OUTAGE,
 MAAL-LOC_PROC_REC = MAAL-LOCAL_PROCESSOR_RECOVERED.

6 State Transition Table of LM for the management of SAAL at NNI

This clause contains the state transition table, Table 3, of the LM for the management of SAAL at NNI in support of an SAAL service which is provided at an AAL connection endpoint. It makes use of sequences of MAA-, and MAAL-signals as defined in 5.1 and 5.2.

The events shown in Table 3 are signals at the boundary between LM and SSCF or SSCOP, LM-internal events, management status information, e.g. Local Management Proving Status. Some of the events identified in Table 3 as illegal and associated with a state are the result of collisions at the boundary between LM and SSCF or SSCOP which, as assumed here, do not occur.

The state of Layer Management is determined by its perception of the state of the SSCF. The following states are defined:

- 1) Out Of Service: In this state no signalling connection exists and SSCF waits for an AAL-START.request from the SSCF user.
- 2) Alignment: In this state the SSCF has received an AAL-START.request and is either in the process of establishing an SSCOP connection or waiting between connection establishment attempts.
- 3) Proving: In this state the SSCF has established an SSCOP connection. Layer Management has been notified of the establishment and conducts alignment error rate monitoring.
- 4) Aligned Ready: In this state the SSCF has completed proving and awaits an indication from its peer that the signalling link can be put into service. Layer Management conducts in-service error rate monitoring.
- 5) In-Service: In this state, the signalling connection may be used by the SSCF user to transfer messages. Layer Management conducts In-Service error rate monitoring.

The LM has an internal state variable Number of Retransmitted PDUs (NRP) which keeps track of SSCOP retransmission of SD PDUs during proving, based on MAA-ERROR.indication (V,Count). The LM parameter Max_NRP determines such maximum permissible retransmissions.

The LM has an internal Timer_NO-CREDIT (NC) which supervises the unavailability of credit, if PDUs are available to be transmitted. The value of this timer is an LM parameter. On expiry of this timer, LM issues an MAAL-RELEASE.request signal which causes the release of the signalling connection.

The LM has an internal Timer_REPEAT-SREC which is set whenever a report of an SSCOP recovery is received from the SSCF. If the timer is already active when the report of recovery is received, LM issues an MAAL-RELEASE.request signal which causes release of the signalling connection.

Some of the events result in an Error logging. The accumulation of these error reports and comparison with thresholds is beyond the scope of this Recommendation.