TU Telecommunication Standardization Sector
Study Group 15
Experts Group for Video Coding and Systems
in ATM and Other Network Environments

Document AVC-804
July 21 1995

ITU - TSS

Extracted from Temporary Document TD.73 (P)

Study Group 13

Geneva, 10 - 21 July 1995

Questions : 6 / 13

SOURCE : Rapporteurs Q.6 (K.Yamazaki KDD Japan, A.Odedra BT UK)

TITLE : Report of the joint Q.6 meeting

The joint group met for 1/2 a day under the chairmanship of the Q.6 Rapporteurs.

1. New AAL or SSCS

1.1 AAL for supporting composite user information

Several contributions (D.677[Bezeq], D.729[Ericsson], D.899/900[AT&T]) proposed to initiate a study on new AAL which supports more than one user information stream within one ATM cell payload. Such an AAL, provisionally named AAL-CU (Composite User information) hereinafter, aims at providing;

- low cell packing/unpacking delay by supporting a short length of data (e.g., 10-30 octets), possibly of variable length, assigned for each user information stream, and
- efficient use of ATM cell payload, compared to the case of a partial cell fill method with one user information occupying portion of the cell payload and dummy octets occupying the rest of the cell payload.

Possible applications include support of mobile communications where short length of fixed or variable data and low bit-rates (e.g., 16 kbit/s and lower) are used. Delay performance is an important factor for mobile communications. The AAL-CU idea is not intended to be used between mobile terminals and the network (i.e., ATM is not terminated at the mobile terminal); instead it is akin to trunking or multiplexing to be performed within the network (e.g., the access network).

The following areas are identified as study points within Study Group 13 in conjunction with protocol work on AAL-CU:

- Network scenarios, e.g., how to accommodate mobile networks? Figures are useful.
- Example configuration, e.g., will switching functionality be provided where AAL-CU is located? Figures are useful.
- Handling of composited connections between two AAL-CUs, i.e., will some control be necessary to establish/release composited connections between two AAL-CUs?

- AAL-CU functionality, i.e., to what extent we could re-use AAL functionality already developed in I.363.1 (e.g., SDT pointer), I.363.3 and I.363.5?

In parallel with work carried out within Study Group 13, it is necessary to consult with users' groups for evaluating the value of the idea and for having experts' views and comments about applications viewpoints. Such consultation is also necessary in order to produce an AAL which will see as many as users. The following topics are identified to be asked for possible users' groups:

- Possible compressed voice coding techniques? Recommendations or standards including draft and scheduled versions?
- When such technique exists, then what bit-rate will be used? Will such technique generate fixed or variable length data? What is the range of data size?
- Any delay implications? How much will it be delay sensitive?
- Network scenarios and configurations related to these coding techniques?

A Liaison (Annex-A) was drafted to be sent to various groups which might be involved in this study.

1.2 AAL5 and SSCS for MPEG2

On a proposal to complete specification of corrupted data delivery option (new Annex E) for AAL5 , it was agreed that text should be drafted to progress this study, and prepare a corresponding Liaison to relevant SGs. The text for corrupted data delivery option and corresponding editorial instructions for AAL5 is given in TD.32[WP2]. The Liaison is contained in Annex-B. It was further agreed :

1 to FREEZE Rec. I.363.5 without the Annex E text;

2 to recognize the need for the definition of protocol and procedures to provide option of corrupted data delivery;

3 to express the intention to incorporate Annex E in the I.363.5 version (TD.40[P], TD.41[P]) to be submitted for N. 1 resolution procedure at SG 13 April '96 meeting. Produced text of Annex-E is reproduced in Annex-1;

4 to recognize the need to call an intermediate WP meeting before the end of '95 aimed to analyze the text of the Annex E, with the objective to finalize the text, to FREEZE it and to submit it at SG 13 April '96 meeting;

Considering that for taking the final decision, SG13 seeks advice from SG9, and SG15, the Chairmen of these SGs will be informed of the expected WP2/13 meeting. The meeting is scheduled for 27-29 November 1995 possibly at Geneva. The terms of reference of that meeting are given in Annex-2.

No consensus could be reached on a proposal to initiate work on SSCS for MPEG2 video transport. Concerns raised were; 1) it is not in line with current position on video studies in SG9 and 15; 2) duplicated work for video applications in SG9, 15 and 13; and 3) possible proliferation of many SSCSs for video applications.

1.3 Related topic

A proposal of initiating SSCS for LAN emulation (D.699[Korea]) was not accepted by the meeting. It was, however, felt by the meeting that management-related issues in AAL need to be studied.

2. I.362

It was agreed upon at the WP2 opening plenary that the decision on choice of an appropriate AAL and associated functions for a specific application should be left to users' groups. This consensus was obtained based on the views that 1) an application, video in particular, covers a wide variety of services with different requirements, 2) expertise for an application exist in users' groups, and 3) Study Group 13 will give them technical support from networking viewpoints.

The usefulness of I.362 was questioned. A proposal made by Rapporteurs to scratch out I.362 was not accepted by the meeting; it was, however, agreed upon to fully revise I.362 for introductory and educational propose. Description of the revised I.362 will include an introduction on AALs, implications on protocol performance related to an ATM layer and AAL, and relationship with ATM transfer capabilities.

The work for the revised I.362 will be taken through the correspondence, particularly with the following procedures: 1) Information will be sent to Rapporteur of Q.6.1 by the end of November 1995, 2) Rapporteur will attempt to produce the first draft of I.362 by the end of December 1995, 3) Such draft will be distributed to the correspondence group, 4) Experts are requested to submit contributions to the next April meeting. The revision of I.362 may be frozen at the next April 1996 meeting.

ATTACHMENT to the report:

Annex-1 : The text for corrupted data delivery and corresponding editorial instructions for AAL5

Annex-2 : Terms of reference for the interim WP2/13 meeting on corrupted data delivery for AAL5

Annex-A : Proposed Liaison on a new AAL for composite user information to ITU-T SG11, 12, 14, 15, JCG/B-ISDN, JCG/AVMMS, ICG/SAT, ICG/FPLMTS.

Annex-B : Proposed Liaison on AAL5 corrupted data delivery

Title: EDITORIAL INSTRUCTIONS FOR NEW ANNEX E IN I.363.5 - OPTIONAL CORRUPTED DATA DELIVERY

Note: These editing instructions are intended to be applied to the ITU-T Recommendation I.363.5 that is defined by the editing instructions in TD 40P and TD 41P. *Italicised text* is proposed to be added to TD.40(P) and TD.41(P) and ~~strike thru~~ text is proposed to be deleted.

Add the following new paragraph to the Summary:

In a new Annex, the optional corrupted data delivery option is specified.

The 2nd list in §7 is replaced by:

Both modes of service may offer the non-assured operation peer-to-peer operational procedures:

- Integral CPCS-SDU may be delivered, lost, or corrupted.
- Lost and corrupted CPCS-SDUs will not be corrected by retransmission. An optional feature may be provided to allow corrupted CPCS-SDUs to be delivered to the user *(the optional corrupted data delivery is specified in Annex E).*
- Flow control may be provided as an option; however, this option is for further study.

Note: If assured operations are required, they must be provided by the SSCS or by higher layers..

Within §9.2.1.1, replace the 1st paragraph in item c) with:

This function provides for the detection and handling of CPCS-PDU corruption. Corrupted CPCS-SDUs are either discarded or are optionally delivered to the SSCS. The procedures for delivery of corrupted CPCS-SDUs are ~~for further study~~ *defined in Annex E.*

In §10.2.4, replace the 1st paragraph with:

The following procedures are specified for a CPCS receiver that does not deliver corrupted data to the receiving CPCS user. Optional delivery of corrupted data is ~~for further study~~ *defined in Annex E.*

Replace the 1st paragraph of Annex D with the following:

Neither delivery of corrupted data nor Streaming Mode procedures are included in this Annex. *SDL diagrams for the optional corrupted data delivery are shown in Annex E.*

Add the new Annex E/I.363.5 and new Appendix II/I.363.5 that are contained in the following pages..

ANNEX E

(to Recommendation I.363.5)

Protocol and procedures to provide option of corrupted data delivery

E.1 Service provided by corrupted data delivery option

This annex specifies the protocol and procedures used to provide an optional service consisting of the delivery of AAL 5 CPCS-SDUsdetected as corrupted. If the corrupted data delivery option is not enabled, corrupted CPCS-SDUs are discarded in accordance with the procedures of I.363.5. If the corrupted data delivery option is enabled, corrupted CPCS SDUs are delivered to the SSCS, along with an indication of the error type, in accordance with the procedures specified in this annex.

The service delivered by CPCS AAL5 when the corrupted data delivery option is selected is such that:

- when a non corrupted PDU is received, the CPCS-SDU, as received by the peer CPCS, is delivered to the SSCS user sublayer together with an "OK" Reception Status parameter;

- when a corrupted PDU is received, the CPCS-SDU assumed to be received and delivered to the CPCS user corresponds to the reassembly buffer without the last 8 octets, which are assumed to constitute the trailer of the PDU; the assumed CPCS-SDU is delivered together with a Reception Status that lists the various types of errors detected and 3 elements including the assumed CPI, assumed Length and assumed CRC remainder;

Note - The CPCS user must recognize that if a Length error is indicated, even though no CRC error has been detected, there is no guarantee that the CRC found is actually good; that is, the CRC error detection mechanism used in AAL5 is not as reliable when a cell belonging to the PDU has been lost (or mis inserted). Conversely, the indication that no Length error has been detected cannot be relied upon if a CRC error has been detected. The actual determination of the type of error that has been encountered may be done only on the basis of an heuristic weighted by the probability of occurence of that combination of errors. The probability may be determined on the basis of the quality of the service which is expected from the particular underlying ATM connection and the characteristics of the user of this service. Appendix II/I.363.5 gives some information on the possible combinations of errors that may occur and the conclusion that may be drawn concerning the user data recovered.

- when the length of an otherwise correct CPCS-SDU exceeds the value of Max_SDU_ Deliver_Length, the corresponding CPCS-SDU is not delivered and no indication is given to the CPCS user;

- when the conditions of an aborted PDU are recognized, the corresponding CPCS-SDU is not delivered and no indication is given to the CPCS user; and

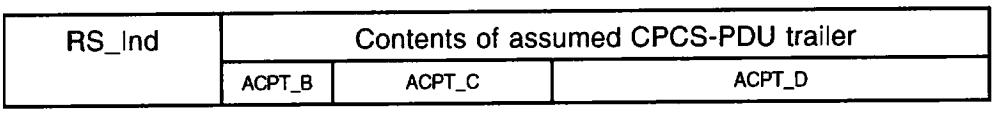
- some losses in the network may be such that some PDUs are not detected at all by the CPCS receiver; consequently, no indication is given to the CPCS user in this case.

E.2 Parameter definitions

In addition to the parameters defined in I.363.5, the following parameters are defined:

a.) Reception Status parameter

The Reception Status (RS) parameter is used at the CPCS receiver to indicate to the user of the CPCS which errors, if any, have been detected by the CPCS and to pass portions of the CPCS-PDU that may be helpful for the user of the CPCS to recover from these errors. For modeling purposes, the RS parameter may be considered to contain the elements shown in Figure E1/I.363.5.



Note: The elements of the RS parameter have the following significance for modeling purposes:

RS_Ind indicates the status of the CPCS-SDU that is being delivered. This element is modeled as a set of values representing the errors detected.

RS_Ind $\subset$ {OK, Err_A, Err_B, Err_C, Err_D, Err_E, Err_F, Err_G}
where,
OK is TRUE if no errors were detected by the CPCS in the CPCS-SDU;
Err_A is TRUE if an illegal CRC remainder was detected;
Err_B is TRUE if an illegal CPI was detected;
Err_C is TRUE if the value of the length field in the perceived CPCS-PDU trailer is 0;
Err_D is TRUE if an illegal length of a PAD field was detected;
Err_E is TRUE if the CPCS-SDU length exceeds the value of the Max_SDU_Delivery_Length parameter;
Err_F is TRUE if a reassembly buffer overflow has occurred; and
Err_G is TRUE if a reassembly timer expiry has occurred prior to completion of the CPCS-SDU assembly.

ACPT_B contains the second octet of the assumed CPCS_PDU trailer (CPI); if RS_Ind = OK, this field is "null."

ACPT_C contains the third and fourth octets of the assumed CPCS_PDU trailer (Length); if RS_Ind = OK, this field is "null."

ACPT_D contains the last four octets of the assumed CPCS_PDU trailer (CRC); if RS_Ind = OK, this field is "null."

FIGURE E1/I.363.5

Contents of Reception Status parameter

E.3 Procedures to provide corrupted data delivery

NOTE - The described procedures may copy up to 47 octets of the PAD field into the reassembly buffer before processing the CPCS-PDU trailer. When errored data is delivered to the CPCS user, the CPCS-ID parameter may contain up to 47 octets more than specified by the Max_SDU_Delivery_Length parameter.

The procedures for the SAR sublayer and for the CPCS at the sender are described in the main body of I.363.5. The procedures of the main body of I.363.5, associated with the CPCS receiver, are completely replaced by the following description.

1.) When the CPCS receiver receives a SAR-UNITDATA signal primitive from the SAR sublayer, it shall copy the interface data to the reassembly buffer. If the SAR-LP parameter is set to "1," the variable rcv_LP is also set to "1." The CPCS checks if the corrupted data delivery option is enabled. If it is not enabled, processing proceeds as described in §10.2.4/I.363.5.

2.) If the More parameter of the SAR-UNITDATA signal primitive is "1" and the received number of octets of the CPCS-SDU in the reassembly buffer is greater than the value of the parameter "Max_SDU_Delivery_Length" plus 7, the CPCS receiver shall set Err_F flag to indicate reassembly buffer overflow and proceed with item 9.) below.

3.) If the More parameter of the SAR-UNITDATA signal primitive is "0," the last eight octets of the interface data are assumed to represent the CPCS-PDU trailer. The CRC calculation, as specified in 9.2.1.2/I.363.5, is performed on the complete CPCS-PDU. If the value in the CRC field indicates the presence of errors, the CPCS sets the Err_A flag.

4.) If the value in the CPI field is not valid, the CPCS sets the Err_B flag.

5.) If the Length field of the CPCS-PDU trailer is coded as zero and neither a CRC error nor an illegal CPI field has been encountered, any information in the reassembly buffer shall be discarded. Otherwise, if the Length field is zero and other errors were detected, the CPCS receiver sets the Err_C flag and the CPCS proceeds with step 9.) below.

6.) The assumed Length field of the CPCS-PDU trailer is used to determine the length of the PAD field (length of the reassembly buffer minus eight and minus the content of the assumed Length field). If the PAD field is longer than 47 octets or if not enough data has been received, the CPCS sets the Err_D flag.

7.) If the value of the Length field is larger than the value of Max_SDU_Deliver_Length and no other errors were detected, any information in the reassembly buffer shall be discarded. Otherwise, if the value of the Length field is larger than the value of Max_SDU_Deliver_Length and other errors were detected, the CPCS receiver sets the Err_E flag and the CPCS proceeds with step 9.) below.

8.) After receipt of a SAR-UNITDATA signal primitive with the More parameter set to "0" and no errors have been detected, any CPCS-SDU data in the reassembly buffer shall be delivered to the CPCS user via a CPCS-UNITDATA signal primitive. The CPCS-LP parameter shall be set to the value of the variable rcv_LP. The CPCS-CI parameter shall be set to the value of the SAR-CI parameter received with the last SAR-UNITDATA signal primitive. The CPCS-UU parameter shall be set to the value of the CPCS-UU field of the CPCS-PDU trailer. The RS parameter is set to "OK."

Data that is delivered is removed from the reassembly buffer.

9.) If errors have been detected, all but the last eight octets of the data in the reassembly buffer shall be delivered to the CPCS user via a CPCS-UNITDATA signal primitive as a possible CPCS-SDU. The CPCS-UU parameter shall be set to the value of the CPCS-UU field of the assumed CPCS-PDU trailer. The CPCS-LP parameter shall be set to the value of the variable rcv_LP. The CPCS-CI parameter shall be set to the value of the SAR-CI parameter received with the last SAR-UNITDATA signal primitive. The RS parameter contains four items:

- an indication of all the error types detected (the inclusive OR of the ERR_x flags),
- the contents of the second octet of the assumed CPCS_PDU trailer (possible CPI),
- the contents of the third and fourth octets of the assumed CPCS_PDU trailer (possible Length), and
- the contents of the last four octets of the assumed CPCS_PDU trailer (possible CRC).

Note - effectively, the entire reassembly buffer is passed to the CPCS user. This information plus the indication of the detected error types allow the user to possibly recover from certain errors in an application specific manner.

Data that is delivered is removed from the reassembly buffer.

10.) Whenever information from the reassembly buffer is delivered or discarded, the variable rcv_LP is reset to "0."

If a reassembly timer is supported, the following procedures apply:

11.) When the CPCS receiver receives a SAR-UNITDATA signal primitive from the SAR sublayer with the More parameter set to "1," the reassembly timer shall be (re)started.

12.) When the CPCS receiver receives a SAR-UNITDATA signal primitive from the SAR sublayer with the More parameter set to "0," the reassembly timer shall be stopped.

13.) If the timer expires and the corrupted data delivery option is not enabled, the CPCS receiver shall discard any information in the reassembly buffer.

14.) If the timer expires and the corrupted data delivery option is enabled, the CPCS receiver shall set the Err_G flag to indicate timer expiry prior to completion of CPCS-SDU assembly. Processing continues with step 9.) above.

Other reassembly timer procedures are for further study.

Note - The value of the reassembly timer is not specified in this Recommendation.

E.4 SDL representation of procedures to provide corrupted data delivery

This section contains the SDL representation of the procedures, described textually in §E.3, for the CPCS receiver when the corrupted data delivery option is supported by an implementation. The SDL graphical description of the SAR procedures and those of the sending CPCS are the same as for implementations that do not support corrupted data delivery option, as shown in Annex D/I.363.5. If there are differences detected between the representation in §E.3 and in §E.4, the representation in §E.4 shall take precedence.

Process CPCS Receiver

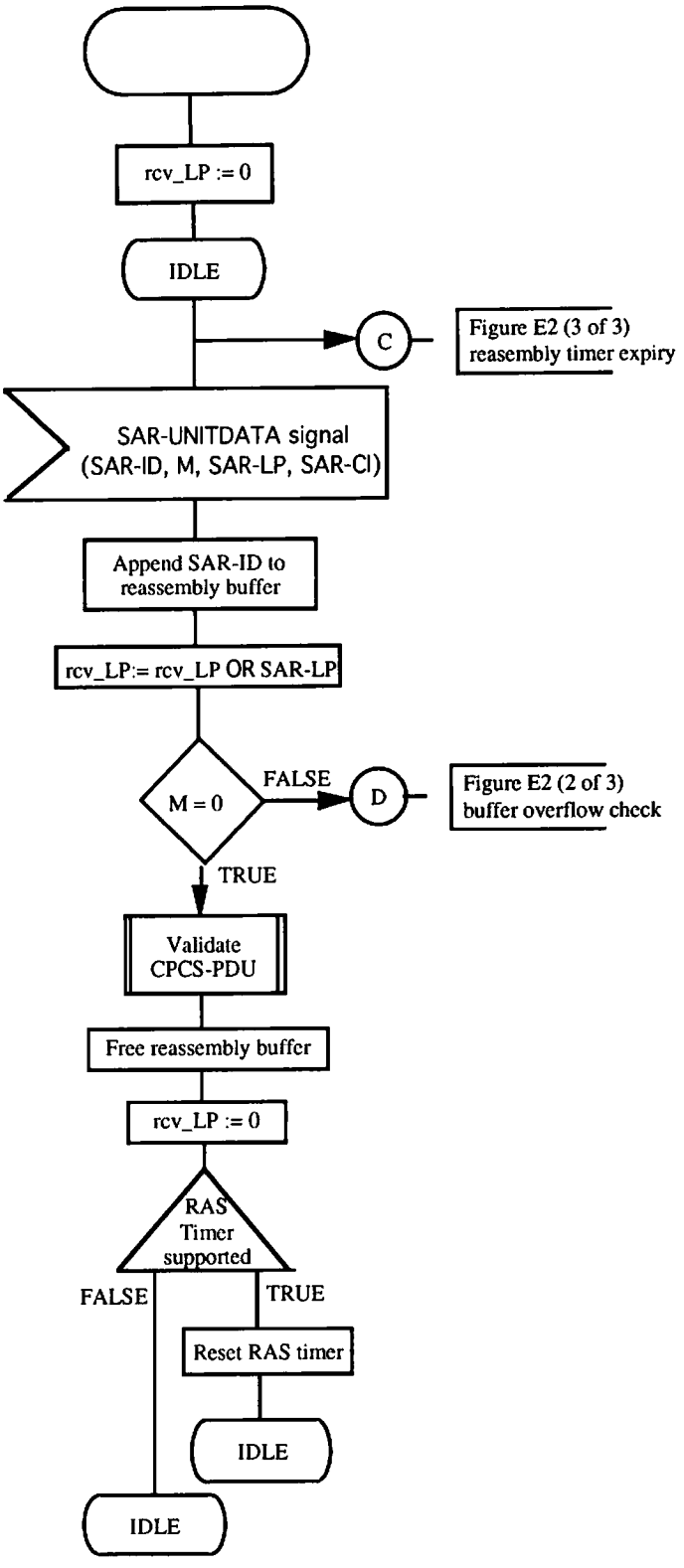


Figure E2 (1 of 3)/I.365.z

Process CPCS Receiver

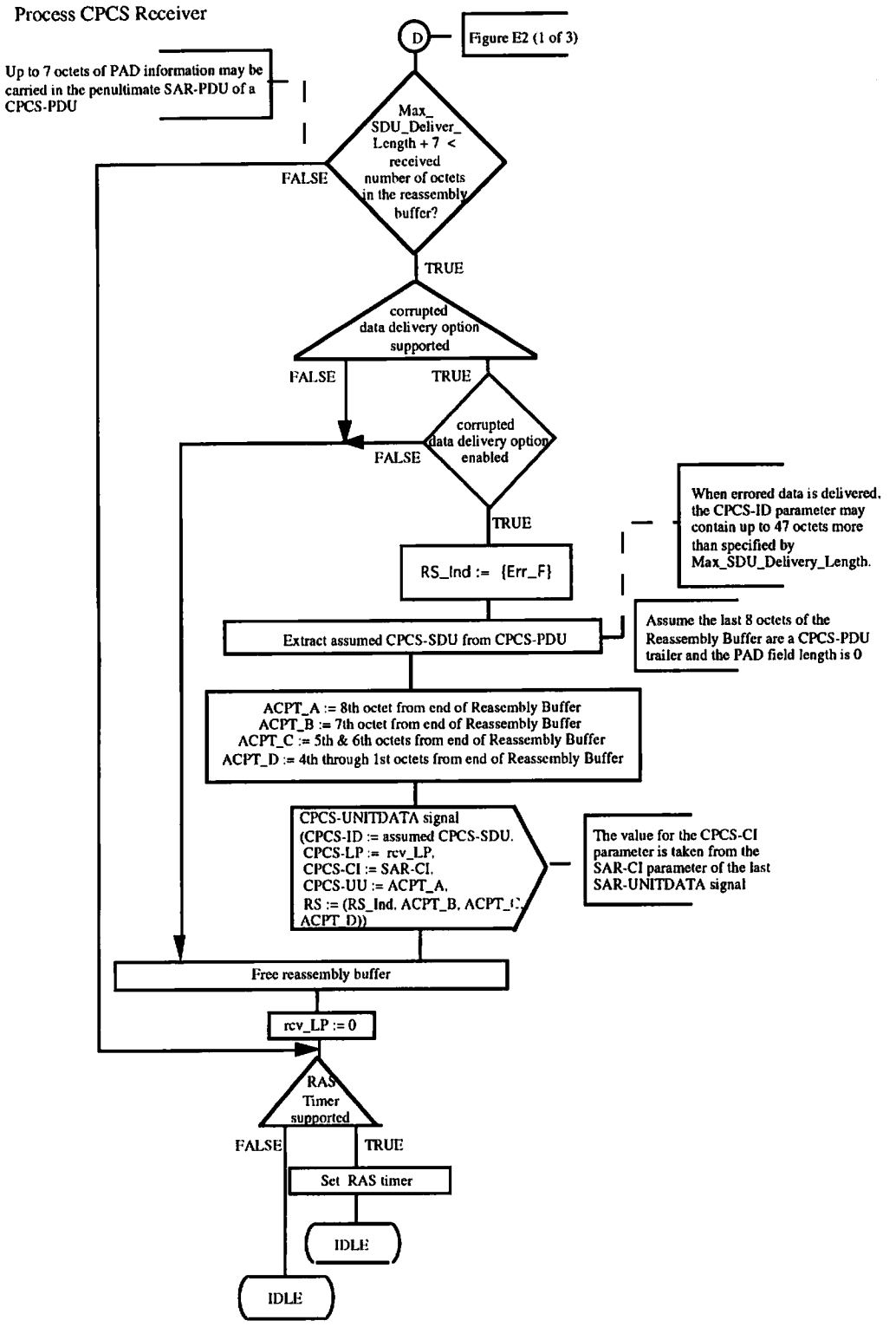


Figure E2 (2 of 3)/I.365.z

Process CPCS Receiver

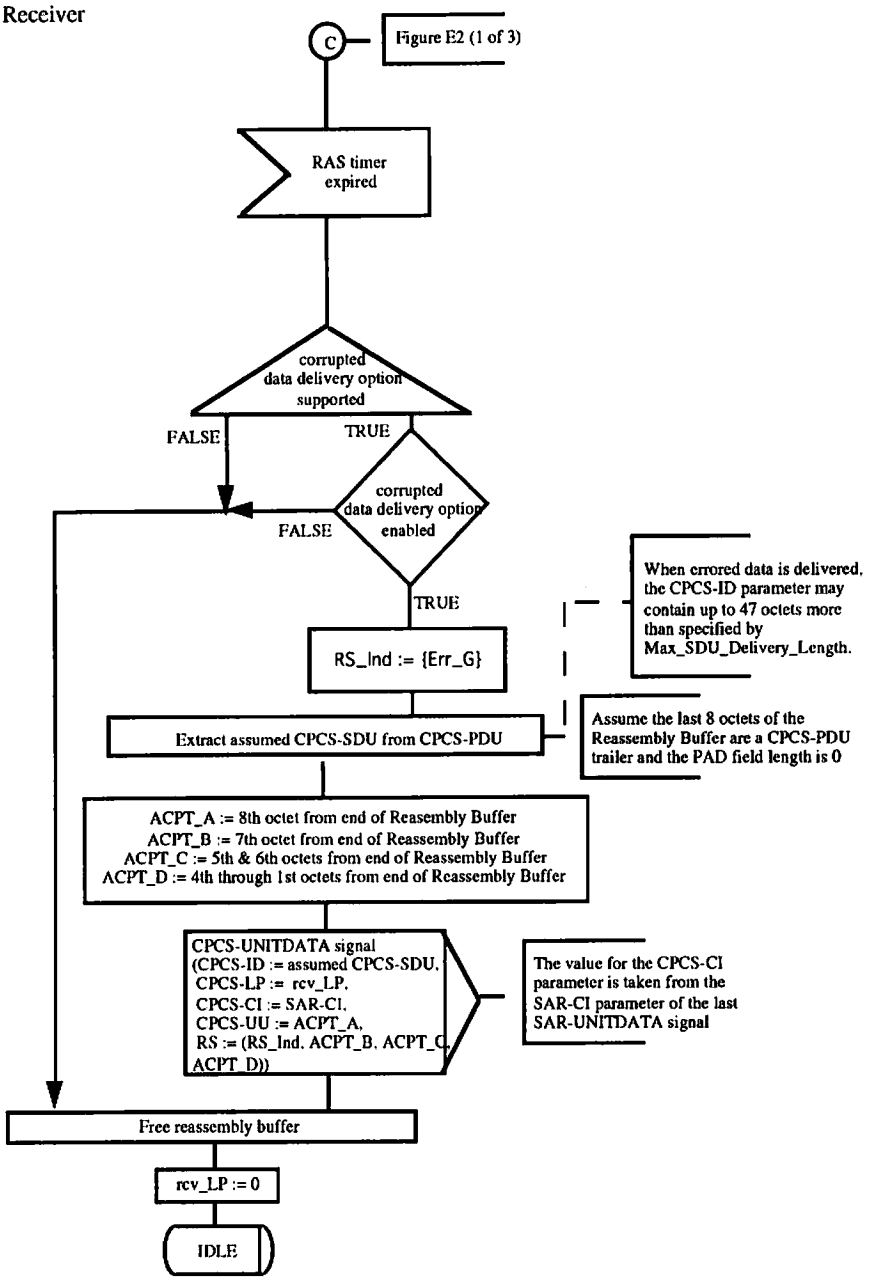


Figure E2 (3 of 3)/I.365.z

Process CPCS Receiver

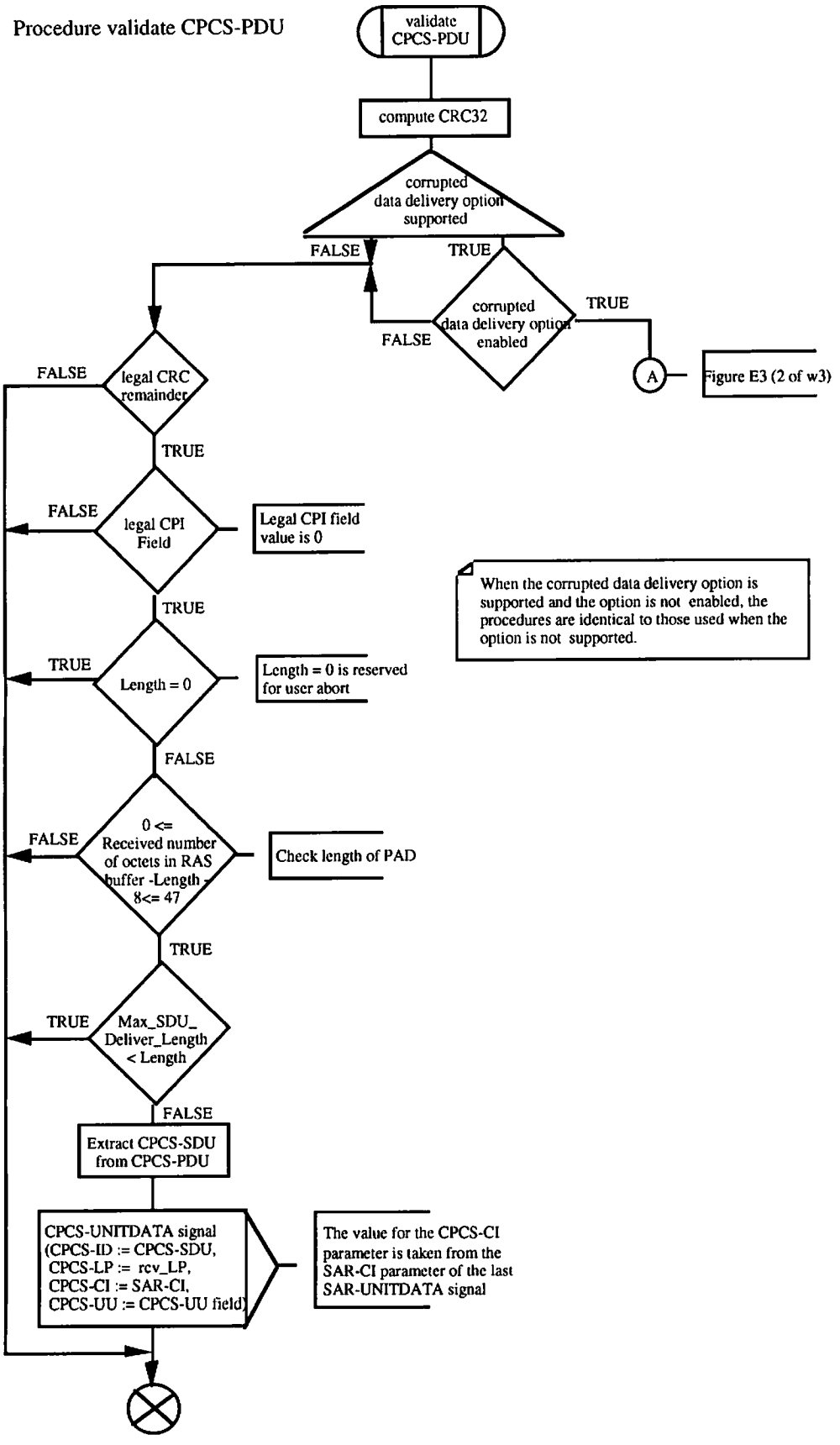


Figure E3 (1 of 3)/I.365.z

Procedure validate CPCS-PDU

Procedure validate CPCS-PDU

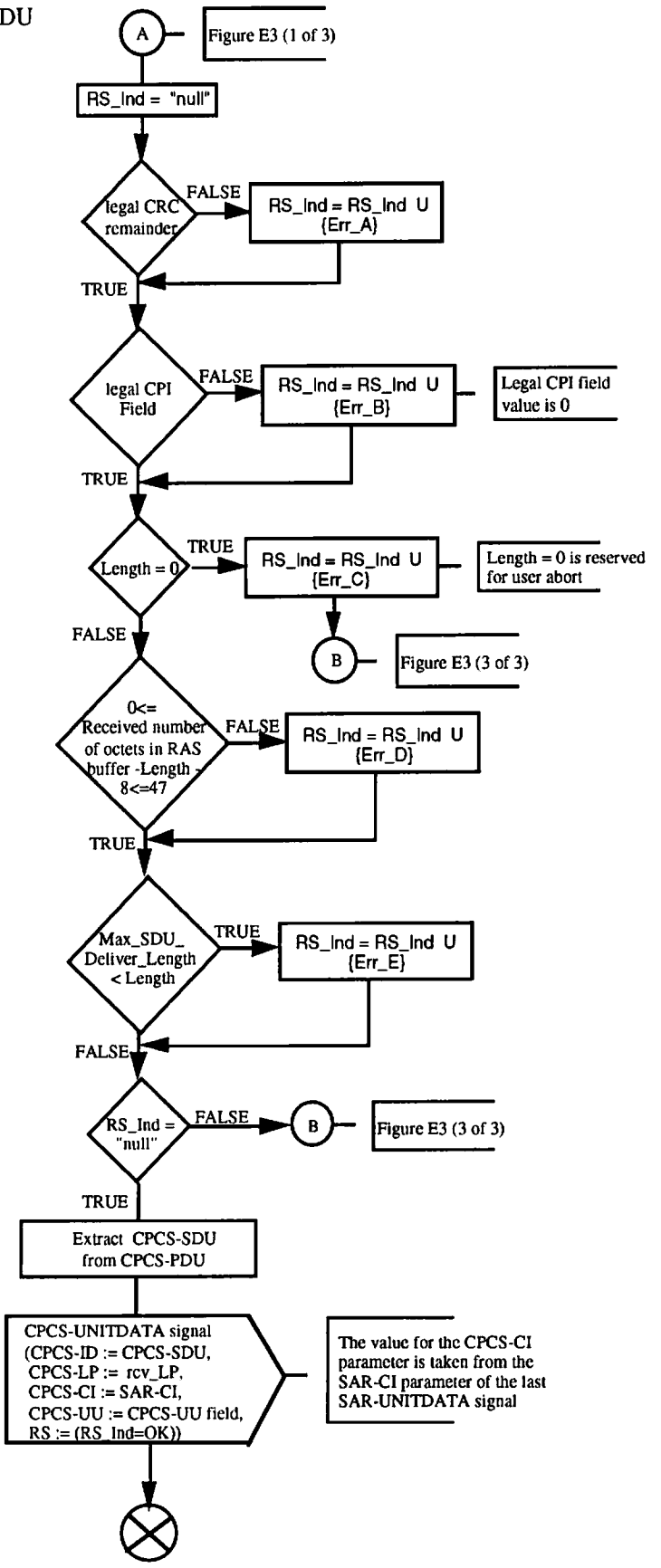


Figure E3 (2 of 3)/I.365.z

Procedure validate CPCS-PDU

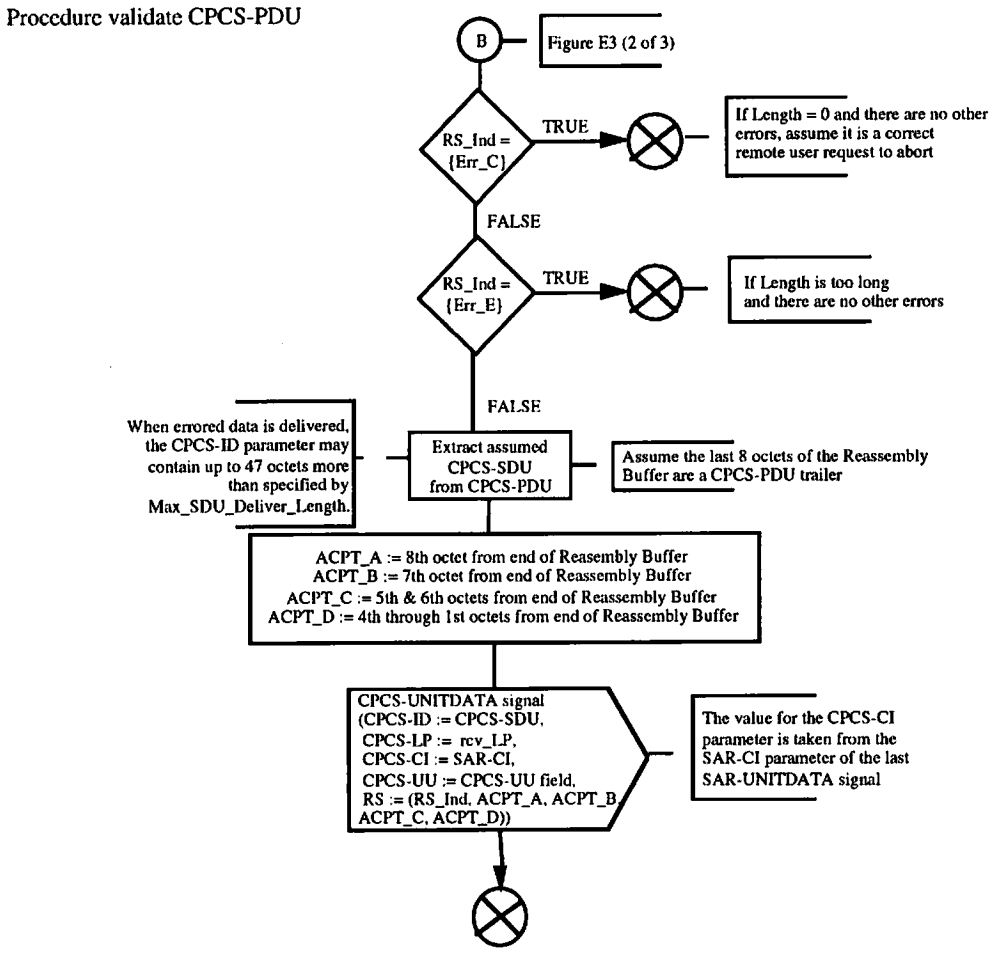


Figure E3 (3 of 3)/I.365.z

Procedure validate CPCS-PDU

Appendix II

(to Recommendation I.363.5)

Insight into service provided by the procedures of Annex E/I.363.5

Insights into the potential conclusions that may be drawn from the reception status provided by the procedures of Annex E/I.363.5 are shown in in Table II-1. In this table, each cell contains the possible situations that may cause the simultaneous conditions indicated by the corresponding row and column headings.

In addition, three other types of errors may be detected and reported. These are:

Reassembly buffer overflow: probably due to concatenation of messages . In this case, there is a high probability that no actual CPCS-SDU trailer is in the delivered information; however, for some applications it is likely that recovery of the beginning of the first message could be achieved.

Note - This type of error may be avoided with a very good probability if the reassembly buffer size and the Max_SDU_Deliver_Length is approximately 2 to 3 times the maximum expected length.

CPI field error: no real conclusion may be drawn from this error, since only a single CPI value is valid at this time.

Reassembly timer expiry: probably due to loss of the last cells of the message.

TITLE : Terms of reference for the interim WP2 meeting on corrupted data delivery of AAL Type 5

Dates of meeting: 27 to 29 November 1995.
(The meeting will start on the morning of the first day and end in the afternoon of the last day).

Venue: Geneva, Switzerland (to be confirmed)

Terms of reference:

- Objective of the WP2/13 meeting is to review and finalize the text for the corrupted data delivery option for the AAL Type 5 CPCS to a frozen state in order to seek final approval under Resolution 1 procedures at the SG13 April 1996 meeting.

- Contributions should be based on the corrupted data delivery text produced for the revised AAL Type 5 CPCS at the SG13 meeting in July 1995. Discussions at the meeting should be restricted to the corrupted data delivery option of AAL Type 5 CPCS.

Proposed draft agenda for the meeting will include:

1) Introduction
2) Address contributions providing text for sections of the corrupted data delivery service in AAL
Type 5 CPCS.
3) Seek approval of the corrupted data delivery option text for inclusion in frozen revised AAL Type
5 CPCS.

Administrative aspects:

Contributions should be sent by fax to the Rapporteurs* (Mr. K. Yamazaki and Mr. A. D. Odedra) and also copied to ITU-T** (Mr. F. Bigi) to be received six weeks before the start of the meeting. Final decision to hold the meeting will be decided on the basis of contributions received. Persons interested to attend the meeting should send their names with address and fax numbers before this six week deadline to the ITU-T**:

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Secretary of SG13, Place des Nations, CH 1211, Geneva 20, Switzerland
Fax: +41 22 730 5853
e-mail : bigi@itu.ch

SOURCE : Q.6 / SG13

TITLE : Proposed Liaison to ITU-T SG11, 12, 14, 15, and JCG/B-ISDN, JCG/AVMMS, ICG/SAT, ICG/FPLMTS. (a request for comments)

SUBJECT : A new AAL to support, e.g., mobile communications, in B-ISDN

CONTACT : Rapporteur Q.6.1 / SG13
Mr. Katsuyuki YAMAZAKI
KDD R&D Labs.
FAX : + 81 492 78 1523 (G4/G3)
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http://www.lab.kdd.co.jp/

1. Status of SG13

SG13 is considering to initiate a study on new AAL which supports more than one user information stream within one ATM cell payload. Such an AAL, provisionally named AAL-CU (Composite User information) hereinafter, aims at providing;

- low cell packing/unpacking delay by supporting a short length of data (e.g., 10-30 octets), possibly of variable length, assigned for each user information stream, and
- efficient use of ATM cell payload, compared to the case of a partial cell fill method with one user information occupying portion of the cell payload and dummy octets occupying the rest of the cell payload.

Possible applications include support of mobile communications where short length of fixed or variable data and low bit-rates (e.g., 16 kbit/s and lower) are used. Delay performance is an important factor for mobile communications. The AAL-CU idea is not intended to be used between mobile terminals and the network (i.e., ATM is not terminated at the mobile terminal); instead it is akin to trunking or multiplexing to be performed within the network (e.g., the access network).

The following areas are identified as study points within Study Group 13 in conjunction with protocol work on AAL-CU:

- Network scenarios, e.g., how to accommodate mobile networks? Figures are useful.
- Example configuration, e.g., will switching functionality be provided where AAL-C is located? Figures are useful.
- Handling of composited connections between two AAL-CUs, i.e., will some control be necessary to establish/release composited connections between two AAL-CUs?
- AAL-CU functionality, i.e., to what extent we could re-use AAL functionality already developed in I.363.1 (e.g., SDT pointer), I.363.3 and I.363.5?

2. A request for comments

In parallel with work carried out within Study Group 13, it is necessary to consult with users' groups for evaluating the value of the idea and for having experts' views and comments about applications viewpoints. Such consultation is also necessary in order to produce an AAL which will see as many as users. The following topics are identified to be asked for possible users' groups:

- Possible compressed voice coding techniques? Recommendations or standards including draft and scheduled versions?
- When such technique exists, then what bit-rate will be used? Will such technique generate fixed or variable length data? What is the range of data size?
- Any delay implications? How much will it be delay sensitive?
- Network scenarios and configurations related to these coding techniques?

SG13 would appreciate any comments on the topics mentioned above.

SOURCE : WP2 / SG13

TITLE : Proposed Liaison to ITU-T SG9(Q.37/9), 15(Q.2/15) (for action)
ISO/SC6, ITU-T SG7(Q.7/7,10/7, 23/7), ATM Forum (for information)

SUBJECT : Proposed text for corrupted data delivery option in AAL type 5 CPCS

CONTACT : Mr. Katsuyuki YAMAZAKI
KDD R&D Labs.
FAX : + 81 492 78 1523 (G4/G3)
e-mail : yamazaki@lab.kdd.co.jp

At the SG13 July meeting, a draft was produced for optional delivery of corrupted data to the user of AAL type 5 CPCS.

This covers delivery of corrupted data detected in the AAL type 5 CPCS receiver along with an appropriate error indication to the CPCS user. No change of the existing service, as perceived by an AAL type 5 CPCS user not invoking this option, is introduced.

Comments on the suitability of the proposed corrupted data delivery service to the needs of your expected applications are requested from your experts. Text for this corrupted data delivery option (as attached to this liaison) will be included in the next revision of AAL Type 5. Study Group 13 expects to initiate Resolution 1 procedures on this material at its April 1996 meeting, should the layer service be found suitable for some applications.

To meet this schedule, Study Group 13 has agreed to establish a WP 2/13 meeting from 27 to 29 of November 1995 for the purpose of finalising the text and taking final decision of proposing I.363.5 Recommendation for Resolution 1. The exact place of the meeting will be informed in due time.

Attachment-1 : Terms of reference of the meeting

Attachment-2 : Text on corrupted data delivery