Telecommunication Standardization Sector
Study Group 15
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TITLE : Proposed description of communication protocol in draft Rec. H.310
PURPOSE : Proposal

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1. Introduction

Draft Rec. H.310 should define upper layer communication protocol, which include the usage of necessary H.245 signaling procedures. However, the communication protocol section is still open in the current draft Rec. H.310.

This document proposes the specification of H.310 communication protocol using H.245 procedures, which is intended to be incorporated into the draft Recommendation.

2. Discussion

The proposed text is given in Annex to this document. Some texts are taken from appropriate section of draft Rec. H.324. The detailed procedures, which apply primitives defined in H.245, are specified for error conditions as well as normal case. The specification of error handling procedure is kept minimum, according to an agreement in Yokosuka meeting. The followings are comments on protocol definition which need clarification for finalizing the draft Rec. H.310.

(1) The value of timers are defined as 5 sec. in the proposed text. Is it satisfactory for H.310?

(2) Is master slave determination procedure necessary for H.310 terminal? In the editor's note in the current draft, it is suggested that other mechanism can be used for the determination of the master, such that calling terminal becomes master.

(3) H.310 terminal can retry the H.245 procedure, when error occurred or the procedure is failed. Is it necessary to clearly define the value of retry counter in the H.310 specification?

3. Conclusions

This document has been proposed the specification of H.310 communication protocol to be included in the draft Rec. H.310.

Reference

[1] AVC-868 v1.0 "Draft Rec. H.310", Dec. 21, 1995.
[2] AVC-837 "Considerations on H.310 communication protocol", October, 1995.
[3] Draft Rec. H.245 (approved by ITU-T SG15), 27 November, 1995.
[4] Draft Rec. H.324 (approved by ITU-T SG15), 22 November, 1995.

END

5.6 Communication protocol

The control channel carries end-to-end control messages governing operation of the H.310 system, including capabilities exchange, opening and closing of logical channels, mode preference requests, round trip delay and maintenance loop.
There shall be exactly one control channel in each direction within H.310, which shall use the messages and procedures of Recommendation H.245. The H.245 control channel shall be setup at the beginning of communication, before the transmission of audio-visual information with the exception of the default audio-visual channel.
H.245 messages fall into four categories: Request, Response, Command, and Indication. Request messages require a specific action by the receiver, including an immediate response. Response messages respond to a corresponding request. Command messages require a specific action, but do not require a response. Indication messages are informative only, and do not require any action or response. H.310 terminals shall respond to all supported H.245 commands and requests as specified in H.245, and shall transmit accurate indications reflecting the state of the terminal.
All H.245 messages are conveyed by the underlying protocol stack shown in Fig.2/H.310, which can provide a reliable end-to-end transmission of H.245 messages using acknowledgment of correct receipt within each layer protocol.
H.310 terminals shall be capable of identifying all H.245 **MultimediaSystemControlPDU** messages, and shall respond to all messages needed to realize required H.310 functions. H.310 terminals shall send the **FunctionNotSupported** message in response to unrecognized request, response, command or the H.245 message which is not supported by the H.310 terminal.
Non-standard capabilities and control messages may be issued using the **NonStandardParameter** structure defined in H.245. Note that while the meaning of non-standard messages is defined by individual organizations, equipment built by any manufacturer may signal any non-standard message, if the meaning is known.
H.310 terminal shall support the following messages and procedures of Recommendation H.245.

- Capabilities Exchange
- Opening and closing of Logical Channel (uni-directional and bi-directional)
- Mode Request
- Round trip delay
- Maintenance Loop
- Master Slave Determination ???

5.6.1 Capabilities exchange

Capabilities exchange shall follow the procedures of H.245, which provides for separate receive and transmit capabilities.
Receive capabilities describe the terminal's ability to receive and process incoming information streams. Transmitters shall limit the content of their transmitted information to that which the receiver has indicated it is capable of receiving. The absence of a receive capability indicates that the terminal cannot receive (is a transmitter only).
Transmit capabilities describe the terminal's ability to transmit information streams. Transmit capabilities serve to offer receivers a choice of possible modes of operation, so that the receiver may request the mode which it prefers to receive.

There shall be exactly one out-going CESE and in-coming CESE in one H.310 terminal. H.310

terminal can start the capability exchange procedure by issuing TRANSFER.request primitive to its out-going CESE with proper parameters. The value of PROTOID parameter shall be '1' for terminals conforming to this Recommendation. MUXCAP and CAPTABLE parameters with at least one capability set is mandatory for H.310 terminal. The use of CAPDESCRIPTORS parameter is optional.

When TRANSFER.response primitive is received from out-going CESE after TRANSFER.request was issued, capability message has been successfully transmitted to the peer terminal. If REJECT.indication primitive is received instead, previously sent capability message is not accepted by the peer terminal (SOURCE=USER), or timer is expired before receiving response from peer terminal (SOURCE=PROTOCOL). H.310 terminal may reissue TRANSFER.request for re-trying capability message transmission in these cases. TRANSFER.request shall not be issued until TRANSFER.confirm or REJECT.indication primitive is received, after TRANSFER.request is issued.

H.310 shall respond to TRANSFER.indication received from in-coming CESE, by TRANSFER.response if capabilities can be accepted successfully, or by REJECT.request if capabilities are not acceptable. H.310 terminal may receive REJECT.indication, before responding to TRANSFER.indication. In this case, H.310 shall discard and ignore the contents of previously received TRANSFER.indication and shall not respond to that indication until new TRANSFER.indication will be received.

At the start of the communication, H.310 terminal shall recognize that own transmit capability declared to remote terminal and receive capability of remote terminal are the default mandatory mode of H.310 terminal. H.310 terminal can update its knowledge about own declared and remote capabilities , only after the capability exchange procedure has been successfully completed.

Terminals may reinvoke capability exchange procedure at any time, according to the procedures described above. The value of timer T101 is 5 sec. for H.310 terminal.

5.6.2 Logical channel signaling

Each logical channel carries information from a transmitter to a receiver, and is identified by a logical channel number unique for each direction of transmission.
Logical channels are opened and closed using the **OpenLogicalChannel** and **CloseLogicalChannel** messages and procedures of H.245.

When a logical channel is opened, the **OpenLogicalChannel** message fully describes the content of the logical channel, including media type, algorithm in use and any options, and all other information needed for the receiver to interpret the content of the logical channel. Logical channels may be closed when no longer needed.
Logical channels in H.310 are unidirectional, so asymmetrical operation, in which the number and type of information streams is different in each direction of transmission, is allowed.
Certain media types, including data protocols such as T.120, inherently require a bi-directional channel for their operation. In such cases a pair of unidirectional logical channels, one in each direction, may be opened and associated together to form a bi-directional channel using the bi-directional channel opening procedures of H.245. Such pairs of associated channels need not share the same logical channel number, since logical channel numbers are independent in each direction of transmission.

There shall be several out-going LCSEs and in-coming LCSEs in one H.310 terminal, each of which corresponds to manage exactly one logical channel. There shall also be one out-going CLCSE and one in-coming CLCSE managing the same logical channel as an in-coming LCSE and an out-going LCSE, respectively. H.310 terminal can start open logical channel procedure by issuing ESTABLISH.request primitive to its out-going LCSE of the required logical channel with proper parameters. FORWARD_PARAM parameter describes the content of the logical channel, which will be transferred by **OpenLogicalChannel** message to peer terminal.

When ESTABLISH.response primitive is received from out-going LCSE after ESTABLISH.request was issued, the logical channel is successfully opened and H.310 terminal can start audio-visual information transmission through this logical channel. If REJECT.indication primitive is received instead, open logical channel is not accepted by the peer terminal (SOURCE=USER), or timer is expired before receiving response from peer terminal (SOURCE=LCSE). H.310 terminal may reissue ESTABLISH.request for retrying open logical channel in these cases.

When ERROR.indication primitive is received, mismatch of state between local LCSE and remote LCSE may be occurred. It is preferable that H.310 terminal issues RELEASE.request primitive to local LCSE to force both local and remote LCSE state to RELEASED. It should be noted that RELEASE.indication will follow ERROR.indication in some error situation. The mismatch recovery procedure described above should be invoked after RELEASE.indication is received.

H.310 terminal shall respond to ESTABLISH.indication received from in-coming CESE, by ESTABLISH.response if the opening of the logical channel can be accepted, or by RELEASE.request if the logical channel cannot be opened.
H.310 may receive RELEASE.indication, before responding to ESTABLISH.indication. It is no more necessary to respond the previous ESTABLISH.request and the logical channel shall be kept closed. Whenever RELEASE.indication is received, H.310 shall regard that the logical channel is now closed and unavailable. If RELEASE.indication is followed by ESTABLISH.indication, the logical channel immediately becomes unavailable and H.310 shall decide whether new logical channel with parameters conveyed by ESTABLISH.indication is acceptable.

In-coming side of H.310 terminal can request to close logical channel using close logical channel procedure by issuing CLOSE.request primitive to out-going CLCSE. The logical channel is kept opened unless CLOSE.confirm is received. If REJECT.indication is received, H.310 may reinvoke close logical channel procedure.

If H.310 receives audio-visual information through not opened logical channel, the receiving H.310 should close that logical channel by invoking close logical channel procedure to recover the mismatch state of local and remote LCSE.

When contention occurs between open logical channel procedure and close logical channel procedure for the same channel, close logical channel always has a priority than open logical channel. Therefore, if H.310 wants to re-open the logical channel, open logical channel procedure can be invoked only after close logical channel procedure has been successfully completed.

The open bi-directional logical channel procedure is very similar to the procedure for uni-directional logical channel. The only difference is that in-coming side H.310 shall wait for ESTABLISH.confirm from in-coming B-LCSE, after H.310 responds to ESTABLISH.indication by

ESTABLISH.response. Though uni-directional channel can become active by issuing ESTABLISH.response, bi-directional channel can not become active until ESTABLISH.confirm is received.

The value of timer T103 is 5 sec. and T108 is 5 sec. for H.310 terminal.

5.6.3 Mode request

H.310 terminal is able to request a remote terminal its transmit mode of operation by using mode request procedure of H.245.
The terminal shall select the requesting mode of operation from the valid transmission capabilities of peer terminal previously received by successfully completed capability exchange procedure. If peer terminal is receive only, which does not have any transmission capabilities, mode request procedure shall not be invoked.

There shall be exactly one out-going MRSE and in-coming MRSE in one H.310 terminal. H.310 terminal can start the mode request procedure by issuing TRANSFER.request primitive to its out-going MRSE with proper parameters. MODE-ELEMENT parameter describes the requesting mode of operation for a remote terminal.

When TRANSFER.response primitive is received from out-going MRSE after TRANSFER.request was issued, requested mode has been accepted by the peer terminal. Contents of logical channels in receiving direction will soon be changed according to the requested communication mode by the remote terminal. If REJECT.indication primitive is received instead, requested mode is not accepted by the peer terminal (SOURCE=USER), or timer is expired before receiving response from peer terminal (SOURCE=PROTOCOL). H.310 terminal may reissue TRANSFER.request for re-trying mode request procedure with the same parameter in the latter case, or with different parameter in the former case. TRANSFER.request shall not be issued until TRANSFER.confirm or REJECT.indication primitive is received, after TRANSFER.request is issued.

H.310 shall respond to TRANSFER.indication received from in-coming MRSE, by TRANSFER.response if requested mode can be accepted, or by REJECT.request if the requested mode is not acceptable. H.310 terminal may receive REJECT.indication, before responding to TRANSFER.indication. In this case, H.310 shall discard and ignore the previously received TRANSFER.indication and shall not respond to that indication until new TRANSFER.indication will be received.

Terminals may invoke mode request procedure at any time, according to the procedures described above. The value of timer T109 is 5 sec. for H.310 terminal.

5.6.4 Round trip delay

Round trip delay procedure of H.245 enables H.310 terminal to measure the round trip delay of H.245 message transmission between a local and a remote terminal. This delay includes all the processing delay of underlying protocol layers for H.245 message transmission and H.245 message processing time of H.245 entities as well as delay in physical transmission line. This round trip delay procedure can be used to determine if the peer H.245 entity is still alive (i.e. keep alive function)

There shall be exactly one RTDSE in one H.310 terminal. H.310 terminal can start the round trip

delay procedure by issuing TRANSFER.request primitive to its RTDSE.

When TRANSFER.confirm primitive is received from RTDSE after TRANSFER.request was issued, the peer terminal could respond to the **RoundTripDelayRequest** message. DELAY parameter in TRANSFER.confirm primitive indicates the value of measured round trip delay. If EXPIRY.indication primitive is received instead, the peer H.245 entity was not responded until the local timer is expired. In this case, the remote H.245 entity may be not alive and H.245 procedures may not be usable. The local H.310 terminal may take appropriate action, such as release the call or indicates to human user, in this error situation.

H.310 is not necessary to respond to any in-coming messages concerning round trip delay procedure, because the **RoundTripDelayResponse** message is automatically issued with in RTDSE in response to the **RoundTripDelayRequest** message.

Terminals may invoke round trip delay procedure at any time, according to the procedures described above. The value of timer T105 is 5 sec. for H.310 terminal.

5.6.5 Maintenance loop

The maintenance loop procedure of H.245 provides a maintenance loop function for H.310 terminal.

There shall be exactly one out-going MLSE and in-coming MLSE in one H.310 terminal. H.310 terminal can start the maintenance loop procedure by issuing LOOP.request primitive to its out-going MLSE with proper parameters. LOOP_TYPE parameter indicates the type of loop operation to a remote terminal.

When LOOP.confirm primitive is received from out-going MLSE after LOOP.request was issued, maintenance loop operation has been established by the peer terminal. Data received from logical channels will be looped data transmitted by the local terminal. If RELEASE.indication primitive is received instead, maintenance loop is not accepted by the peer terminal. If ERROR.indication(B) primitive is received, timer is expired before receiving response from peer terminal. LOOP.request shall not be issued until LOOP.confirm or RELEASE.indication primitive is received, after LOOP.request is issued.

When ERROR.indication primitive is received, mismatch of state between local MLSE and remote MLSE may be occurred. In these error cases, RELEASE.indication will follow ERROR.indication, the maintenance loop procedure is failed and the state of local out-going MLSE shall kept not looped.

H.310 shall respond to LOOP.indication received from in-coming MLSE, by LOOP.response if requested maintenance loop operation can be accepted, or by RELEASE.request if maintenance loop is not acceptable. Whenever H.310 terminal receive RELEASE.indicationin, H.310 shall regard that the loop operation is released and the state of in-coming MLSE immediately become not looped.

The H.310 terminal which invoked the maintenance loop procedure shall be responsible for releasing looped operation, when maintenance loop becomes unnecessary. Terminals may invoke maintenance loop procedure at any time, according to the procedures described above. The value of timer T102 is 5 sec. for H.310 terminal.