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

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PURPOSE:

CONTENTS

Draft Recommendation H.222.1

MULTIMEDIA MULTIPLEX AND SYNCHRONIZATION FOR AUDIOVISUAL COMMUNICATION IN ATM ENVIRONMENTS

1. Scope

This Recommendation describes the multiplexing and synchronization of multimedia information, for audiovisual communication in ATM environments. This Recommendation specifies the peer-to-peer protocol, and the interactions with the AAL.

2. References

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

[1] ITU-T Recommendation H.222.0 - Coding of Moving Pictures and Associated Audio - ISO/IEC 13818-1.

[2] ITU-T Recommendation I.362 - BISDN Adaptation Layer (AAL) Functional Description

[3] ITU-T Recommendation I.363 - BISDN ATM Adaptation Layer (AAL) Specification

[4] CCITT Recommendation X.200 - Reference model of open systems interconnection for CCITT applications.

[5] CCITT Recommendation X.210 - OSI layer service conventions.

3. Terms and definitions

For the purpose of this Recommendation, the following definitions apply:

subchannel: a logical channel within a Recommendation H.222.1 multiplexed bitstream. A subchannel has a unique Recommendation H.222.1 packet header address field value. There may be many subchannels within one ATM Virtual Channel.

4. Abbreviations

For the purpose of this Recommendation the following abbreviations are used:

ATM	Asynchronous Transfer Mode
AAL	ATM Adaptation Layer
PDU	Protocol Data Unit

5. General

This Recommendation deals with the multiplexing and synchronisation of multiple multimedia signals, for use in audiovisual communications in ATM environments. The multimedia signals may be coded audio or video, or other data signals.

This Recommendation is suitable for various applications such as conversational services, distributive services, retrieval services, and messaging services.

This Recommendation is applicable to both unidirectional and bidirectional physical connections.

This Recommendation may also be suitable for use in environments other than ATM.

This Recommendation specifies two separate and independent protocols. They are:

- H.222.1 Program Stream
- H.222.1 Transport Stream

These two protocols are based upon the Program Stream and Transport Stream respectively, defined in Recommendation H.222.0 [1]. Selection of a particular protocol is performed using out of band signalling procedures e.g a terminal capability exchange sequence.

This Recommendation uses the services provided by the AAL. It is intended that this Recommendation be used in conjunction with AALs that support services requiring an end to end timing relationship, i.e. Service Classes A and B, as defined in ITU-T Recommendation I.363 [2].

This Recommendation specifies the protocols using OSI modelling principles [4, 5]. The coding of peer-to-peer PDUs, and their procedures, are specified, as are the interactions with the AAL Service Access Point. Figure 1/H.222.1 illustrates these principles at the send side.

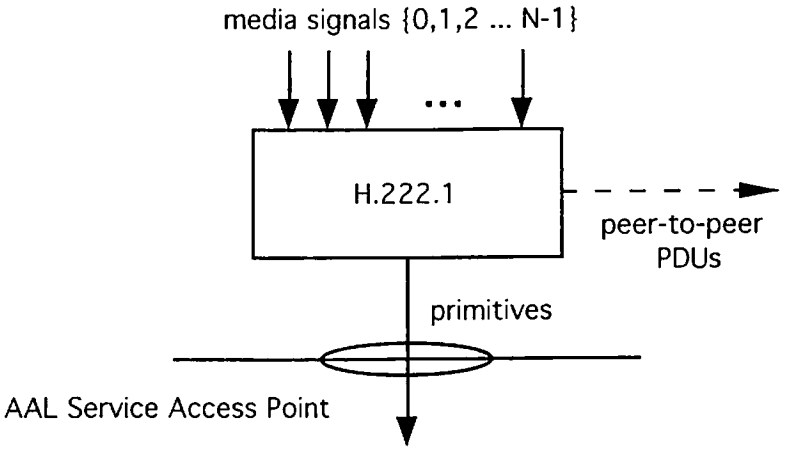


Figure 1/H.222.1. H.222.1 protocol model - send side.

{Ed: A similar figure should be included for the receive side.}

An in band signalling function is provided. Both unacknowledged and acknowledged signalling procedures are supported. Acknowledgment procedures apply only to in band signalling. User Service Data Units are never acknowledged.

Signals relating to error conditions at the receive side are also specified.

A Service Access Point is not defined at the media/H.222.1 service boundary.

{Ed: This should be for further study.}

6. Functions provided by H.222.1

6.1. Program Stream functions

The H.222.1 Program Stream protocol provides the following functions.

a) multiplexing

Multiplexing is based on a sequence of PDUs which may be of variable length and of relatively large size. Each of these PDUs carries consecutive data from only one media source type i.e audio, video, or other data signal.

b) timebase recovery

The H.222.1 Program Stream protocol supports one and only one program. A program is a collection of associated media, all of which refer to a common time base.

The send side and receive side each have their own time bases. Time stamps attached to specific PDUs identify the intended time of arrival of the PDU at the receive side. Synchronisation of the receive side time base with the send side time base is achieved using these time stamps.

c) media presentation synchronization

Additional time stamps identify times at which entities in each media are to be presented to the end user.

d) jitter removal

The H.222.1 Program Stream protocol specifies procedures for removal of timing jitter on received PDUs.

e) buffer management

Rules are specified so as to avoid underflow and overflow of receive side buffers. This is achieved by a hypothetical receive side timing model, which specifies timing relationships between outgoing PDUs at the send side.

f) security and access control

Security and access control functions are provided by media encryption. Support for entitlement control and management messages is also provided.

g) inband signalling

The multiplexing function provides multiple connection end points at the user/H.222.1 service boundary. Protocol is provided that signals to the receive side the association between a PDU and a connection end point. The nature of the information carried by the connection is also described.

h) error reporting

Protocol at the receive side reports error conditions to the H.222.1 user.

i) trick mode

Mechanisms to support video recorder like control functionality e.g. fast forward rewind etc, are included.

j) network maintenance

A network maintenance function, which monitors channel errors, is available.

{Ed: It should be determined as to whether a terminal must support all of these functions or a subset of them. It may be that H.24X lists mandatory and optional H.222.1 functions at a coder and a decoder. Optional H.222.1 functions are determined during the H.24X terminal capability exchange}.

6.2. Transport Stream functions

The H.222.1 Transport Stream protocol supports the following functions.

a) multiplexing

Multiplexing is based on a sequence of PDUs which are of fixed length and of relatively small size. The H.222.1 Transport Stream protocol has a large multiplex capacity.

b) timebase recovery

The H.222.1 Transport Stream protocol supports multiple programs. A program is a collection of associated media, all of which refer to a common time base.

The send side and receive side each have a time base, for each program. Time stamps attached to specific PDUs identify the intended time of arrival of the PDU at the receive side. For each program synchronisation of the receive side time base with the send side time base is achieved using these time stamps.

c) media timing synchronization

Additional time stamps identify times at which entities in each media are to be presented to the end user.

d) jitter removal

The H.222.1 Transport Stream protocol specifies procedures for removal of timing jitter on received PDUs.

e) buffer management

Rules are specified so as to avoid underflow and overflow of receive side buffers. This is achieved by a hypothetical receive side timing model, which specifies timing relationships between outgoing PDUs at the send side.

f) security and access control

Security and access control functions are provided by media encryption.

g) inband signalling

The multiplexing function provides multiple connection end points at the user/H.222.1 service boundary. Protocol is provided that signals to the receive side the association between a PDU and a connection end point. The nature of the information carried by the connection is also described.

h) error reporting

Protocol at the receive side reports error conditions to the H.222.1 user.

i) trick mode

Mechanisms to support video recorder like control functionality e.g. fast forward rewind etc, are included.

j) network maintenance

A network maintenance function, which monitors channel errors, is available.

k) remultiplex support

Mechanisms to assist in the addition and removal of individual elementary streams are provided. This function only has meaning at a network element.

l) priority

One of two priorities may be indicated for each PDU. This function only has meaning at a network element.

{Ed: It should be determined as to whether a terminal must support all of these functions or a subset of them. It may be that H.24X lists mandatory and optional H.222.1 functions at a coder and a decoder. Optional H.222.1 functions are determined during the H.24X terminal capability exchange}.

{Ed: In H.32X, is there such a thing as a "network element"? If not, then functions k) and l) above should not be supported}.

7. Interaction with the AAL

{Ed: The intent of this section is to specify how the primitives at the AAL-SAP will be used.}

7.1. AAL type 1

For further study

7.2. AAL type 2

For further study

7.3. AAL type 5

For further study

8. Program Stream protocol

8.1. Introduction

For further study.

8.2. Program Stream PDUs

For further study.

{Ed: This section would list and identify as a PDU, each section of MPEG-2 Systems syntax, that had a unique start code.}.

8.3. Program Stream PDU formats

For further study.

{Ed: For each PDU this section would point to the appropriate syntax and semantics section of H.222.0 (MPEG-2 Systems)}.

8.4. Timing model

For further study.

{Ed: This section should point to the respective sections in H.222.0.}

9. Transport Stream protocol

9.1. Introduction

For further study.

9.2. Transport Stream PDUs

For further study.

{Ed: This section would list and identify as a PDU, each section of MPEG-2 Systems syntax, that had a unique start code.}.

9.3. Transport Stream PDU formats

For further study.

{Ed: For each PDU this section would point to the appropriate syntax and semantics section of H.222.0 (MPEG-2 Systems)}.

9.4. Timing model

For further study.

{Ed: This section should point to the respective sections in H.222.0.}

10. In band signalling procedures

10.1. Introduction

This Recommendation supports in band signalling of user data. Both acknowledged and unacknowledged signalling procedures are supported.

A unidirectional connection may only use unacknowledged procedures. In this case in band signalling information is transmitted periodically.

A bidirectional connection may use unacknowledged or acknowledged procedures. In some applications acknowledged signalling procedures may offer the following advantages,

- error conditions can be defined e.g undefined subchannel multiplexing identifier.

- synchronisation of call phases especially in the case where the remote user is not a human i.e a computer. Transmission cannot begin on a sub channel until it has been correctly established.

10.2. Interface states

RELEASED - the sub channel is idle

AWAITING ESTABLISHMENT - a transitory state

ESTABLISHED - data may be transmitted/received in this sub channel

AWAITING RELEASE - a transitory state

10.3. Interface signals

ESTABLISH request - request to establish a sub channel

RE ESTABLISH request - request to perform mode change on an existing sub channel

ESTABLISH response - response to a sub channel establish request

ESTABLISH confirm - the remote terminal has acknowledged the establishment/re establishment request

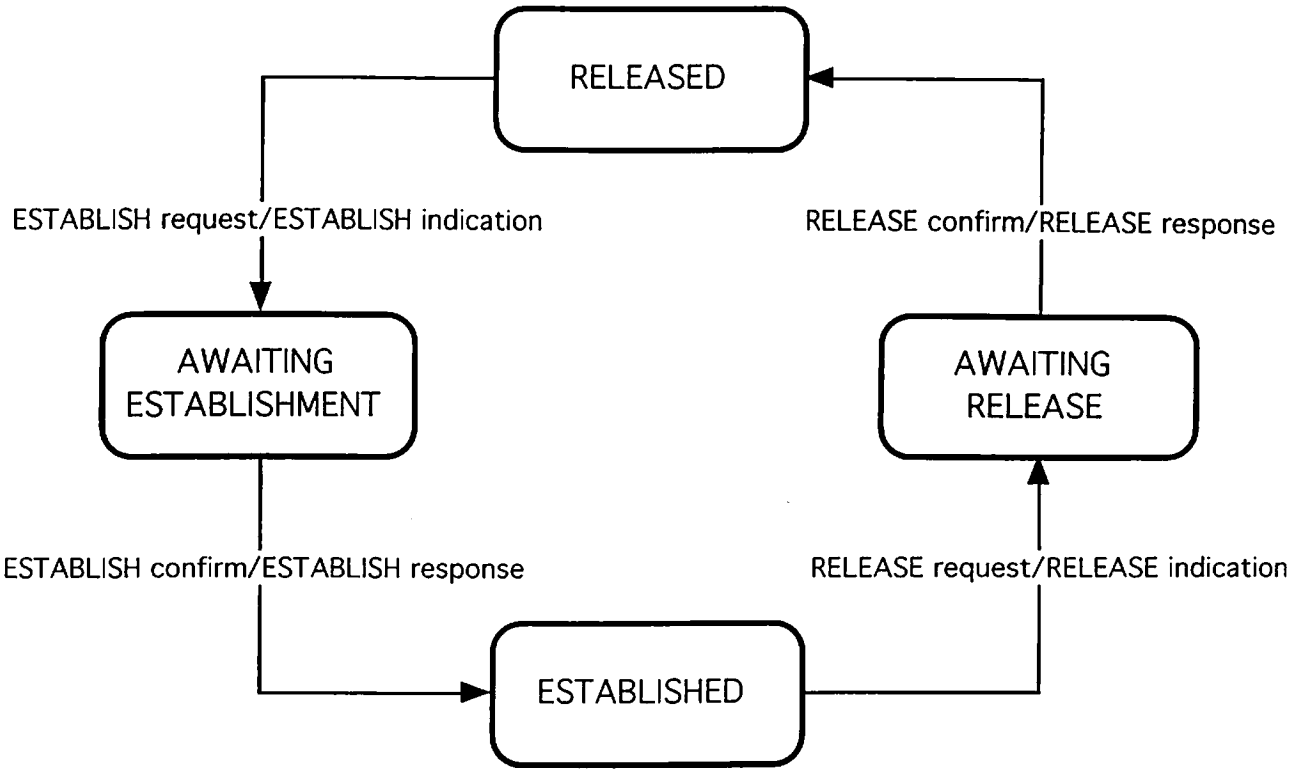
ESTABLISH indication - a remote terminal has requested establishment of a new sub channel

RELEASE request - request to release an existing sub channel

RELEASE confirm - the remote terminal has acknowledged the release request

RELEASE indication - a remote terminal has requested release of an existing sub channel

10.4. State transition diagram



Interface signal notation: send side signal/receive side signal

Figure 4. Proposed state transition diagram for H.222.1 sub channel establishment and release

10.5. Protocol Data Units

peer to peer action	Program Stream	Transport Stream
request establishment	PMT req	PSI req
confirm establishment	PMT ack	PSI ack
release connection	PMT req	PSI req
confirm release	PMT ack	PSI ack

Table 2. H.222.1 syntax to support indicated peer to peer action

10.6. SDL diagrams

For further study.

(Ed: This section describes the protocol in a formal manner).

11. Multiple ATM layer Virtual Channels

For further study.

{Ed: The H.32X terminal use of multiple connections (Virtual Channels) for one call, may be characterised as consisting of one, or multiple occurrences of H.222.1. In the former case H.222.1 must decompose the syntax into multiple channels. In the later case additional signalling may be required to associate the channels being carried by the multiple H.222.1 protocol stacks. According to the Singapore meeting the latter method is the preferred method}.

12. Descriptors

For further study.

{Ed: The descriptors in AVC-692 are to be included here}.

13. Frame synchronous signalling

For further study.

{Ed: The method is to be described here as agreed to at the Singapore meeting}.

14. Mode changing

For further study.

- end -