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in ATM and Other Network Environments

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CONTENTS

1. Scope 1
2. References 1
3. Definitions 1
4. General 1
5. Functions provided by H.222.1 2
   5.1. H.222.1 Program Stream functions 2
   5.2. H.222.1 Transport Stream functions 3
6. Interaction with the AAL 4
   6.1. AAL type 1 4
   6.2. AAL type 2 5
   6.3. AAL type 5 5
7. Timing model 5
8. H.222.1 Program Stream protocol for peer-to-peer communications 5
   8.1. H.222.1 Program Stream PDUs 5
   8.2. H.222.1 Program Stream PDU formats 5
   8.3. H.222.1 Program Stream PDU sequence 5
   8.4. H.222.1 Program Stream states 5
   8.5. H.222.1 Program Stream state diagram 5
9. H.222.1 Transport Stream protocol for peer-to-peer communications 6
   9.1. H.222.1 Transport Stream PDUs 6
   9.2. H.222.1 Transport Stream PDU formats 6
   9.3. H.222.1 Transport Stream PDU sequence 6
   9.4. H.222.1 Transport Stream states 6
   9.5. H.222.1 Transport Stream state diagram 6
10. Multiple ATM layer Virtual Channels 6

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

[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. Definitions

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

4. 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.

Separate procedures are specified for the case of interactive services where the physical connection is bi directional, and for the case of broadcast services, where the connection is unidirectional.

{Ed: It is assumed that for interactive services, that there are distinct call phases, just as in H.320. H.222.1 will need to maintain a map of active connections within a Virtual Channel. As connections are changed, acknowledgment, from the far H.222.1 layer and hence a return channel, will be required, to ensure that the maps at each end agree. In the broadcast case the connection information would be broadcast continuously, and no return channel is required.}

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 during 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.

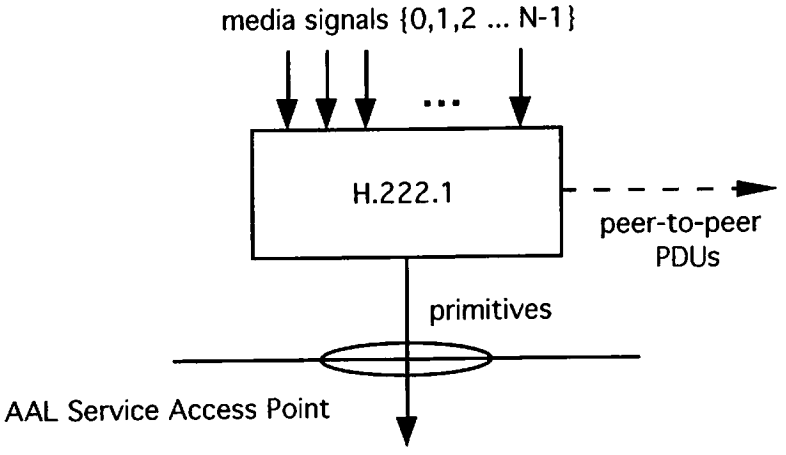

Figure 1/H.222.1. H.222.1 protocol model - send side.

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

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. It would not be difficult to formalise the service boundary for H.24X data for example.}

5. Functions provided by H.222.1

5.1. H.222.1 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.

{Ed: It should be determined as to whether a terminal must support all of these functions or a subset of them}.

5.2. H.222.1 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.

{Ed: It should be determined as to whether a terminal must support all of these functions or a subset of them}.

6. Interaction with the AAL

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

6.1. AAL type 1

For further study

6.2. AAL type 2

For further study

6.3. AAL type 5

For further study

7. Timing model

For further study.

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

8. H.222.1 Program Stream protocol for peer-to-peer communications

8.1. H.222.1 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.}.

8.2. H.222.1 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)}.

8.3. H.222.1 Program Stream PDU sequence

For further study.

{Ed: This section details the allowed sequence of PDUs. This gives a high level description of allowed syntax}.

8.4. H.222.1 Program Stream states

For further study.

{Ed: This and the following section, detail connection set up and release, and what happens in the case of errors at the receiver e.g. arrival of a PDU with an unassigned multiplex identifier (stream_id value). In addition error events reported from the AAL are dealt with here}.

8.5. H.222.1 Program Stream state diagram

For further study.

{Ed: See above}.

9. H.222.1 Transport Stream protocol for peer-to-peer communications

9.1. H.222.1 Transport Stream PDUs

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9.5. H.222.1 Transport Stream state diagram

For further study.

{Ed: See above}.

10. 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 mutliple 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. The exact method is for further study}.

- end -