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MULTIMEDIA MULTIPLEX AND SYNCHRONIZATION FOR AUDIOVISUAL COMMUNICATION IN ATM ENVIRONMENTS

ITU-T Recommendation H.222.1

(Previously "CCITT Recommendation")

FOREWORD

The ITU-T (Telecommunication Standardization Sector) is a permanent organ of the International Telecommunication Union (ITU). The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, March 1-12, 1993).

ITU-T Recommendation H.222.1 was prepared by ITU-T Study Group 15 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 19th of March 1996.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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SUMMARY

This Recommendation describes the multiplexing and synchronization of multimedia information for audiovisual communications in ATM environments. It specifies the H.222.1 Program Stream and the H.222.1 Transport Stream by choosing necessary coding elements from the generic H.222.0 specifications and by adding items for use in ATM environments. It also covers methods for accommodating ITU-T defined elementary streams.

Recommendation H.222.1

MULTIMEDIA MULTIPLEX AND SYNCHRONIZATION FOR AUDIOVISUAL COMMUNICATION IN ATM ENVIRONMENTS

(Geneva, 1996)

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 syntax, semantics and procedures, and the interactions with the AAL.

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.

- [1] CCITT Recommendation G.711 (1988), *Pulse Code Modulation (PCM) of voice frequencies.*
- [2] CCITT Recommendation G.722 (1988), *7 kHz audio-coding within 64 kbit/s.*
- [3] ITU-T Recommendation G.723.1 (1996), *Dual rate speech coder for multimedia communication transmitting at 5.3 and 6.3 kbit/s.*
- [4] CCITT Recommendation G.728 (1992), *Coding of speech at 16 kbit/s using low-delay code excited linear prediction.*
- [5] ITU-T Recommendation H.222.0 (1995) | ISO/IEC 13818-1:(1996), *Information technology – Generic coding of moving pictures and associated audio information: Systems.*
- [6] ITU-T Recommendation H.233 (1995), *Confidentiality system for audiovisual services.*
- [7] ITU-T Recommendation H.245 (1996), *Control protocol for multimedia communication.*
- [8] ITU-T Recommendation H.261 (1993), *Video codec for audiovisual services at $p \times 64$ kbit/s.*
- [9] ITU-T Recommendation H.262 (1995) | ISO/IEC 13818-2:(1995), *Information technology – Generic coding of moving pictures and associated audio information: Video.*
- [10] ITU-T Recommendation H.263 (1996), *Video coding for low bit rate communication.*
- [11] ITU-T Recommendation I.311 (1993), *B-ISDN general network aspects.*
- [12] ITU-T Recommendation I.361 (1995), *B-ISDN ATM layer specification.*
- [13] ITU-T Recommendation I.362 (1993), *B-ISDN ATM Adaptation Layer (AAL) functional description.*
- [14] ITU-T Recommendation I.363 (1993), *B-ISDN ATM Adaptation Layer (AAL) specification.*
- [15] ITU-T Recommendation T.120 (1996), *Data protocols for multimedia conferencing.*
- [16] ITU-T Recommendation Q.2931 (1995), *Broadband Integrated Services Digital Network (B-ISDN) – Digital Subscriber Signalling System No. 2 (DSS 2) – User-Network Interface (UNI) layer 3 specification for basic call connection control.*

3 Terms and definitions

For the purposes of this Recommendation, the following definition applies:

3.1 subchannel: A logical channel in Recommendation H.222.1 formed from packets having a unique multiplex identifier field value. A subchannel carries one H.222.1 elementary stream. A subchannel is unidirectional. There may be many subchannels within one ATM Virtual Channel.

4 Abbreviations

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

AAL	ATM Adaptation Layer
ACELP	Algebraic Codebook Excited Linear Prediction
ATM	Asynchronous Transfer Mode
CA	Conditional Access
CDV	Cell Delay Variation
CPCS	Common Part Convergence Sublayer
DP	Data Partitioning
DTS	Decoding Time Stamp
EOB	End_of_Block
GOP	Group of Picture
LD-CELP	Low-Delay Codebook Excited Linear Prediction
MBA	Macro Block Address
MP-MLQ	Multi-Pulse Maximum Likelihood Quantization
PCR	Program Clock Reference
PDU	Protocol Data Unit
PES	Packetized Elementary Stream
PS	Program Stream
PSI	Program Specific Information
PSM	Program Stream Map
PTS	Presentation Time Stamp
QOS	Quality of Service
RTI	Real Time Interface
SCR	System Clock Reference
SDU	Service Data Unit
STC	System Time Clock
STD	System Target Decoder
TS	Transport Stream

5 General

This Recommendation deals with the multiplexing and synchronization 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. A bi-directional connection may be symmetrical or asymmetrical.

This Recommendation addresses constant bit rate coded video. No specific support is provided for variable bit rate coded video. Variable bit rate coded video is however not precluded.

This Recommendation uses the services provided by the AAL. The AAL is specified in Recommendation I.363 [14]. The use of AAL type 1 and type 5 is specified here.

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 [5]. This Recommendation specifies the necessary coding elements in H.222.0 plus additional functionalities to form the H.222.1 Program Stream protocol and the H.222.1 Transport Stream protocol. An overview of H.222.1 and its relation to Recommendation H.222.0 is shown in Figure 1.

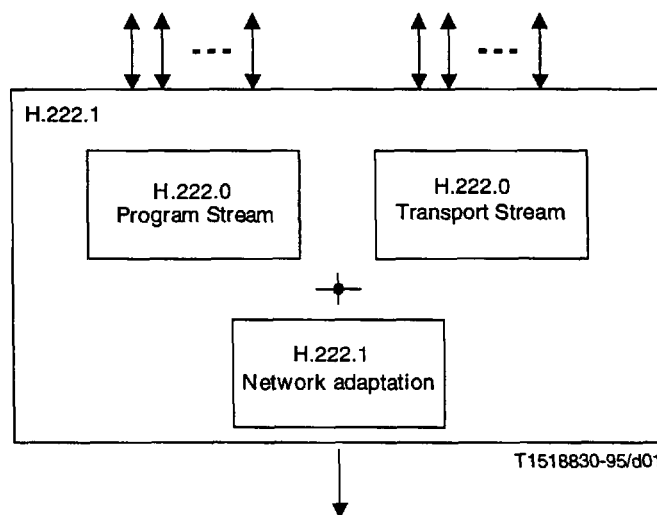


FIGURE 1/H.222.1
H.222.1 overview

6 Services provided by Recommendation H.222.1

The following services are provided by H.222.1 to the H.222.1 user:

a) *Multiplexing*

Multiplexing is based on a sequence of PDUs, each of which carry consecutive data from one and only one media source type, i.e. audio, video or other data signals. In the H.222.1 Program Stream these PDUs may be of variable length and relatively large in size. In the H.222.1 Transport Stream these PDUs are of fixed length and of relatively small size. The H.222.1 Transport Stream has a large multiplex capacity.

b) *Timebase recovery*

A program is a collection of associated media, all of which refer to a common timebase. The timebase is referred to as the System Time Clock (STC). The H.222.1 Program Stream supports one and only one program. The H.222.0 Transport Stream supports multiple programs. H.222.1, however, constrains the number of programs in the Transport Stream to be one.

The send side and receive side each have their own timebases. Time stamps attached to specific PDUs identify the intended time of arrival of the PDU at the receive side. Synchronization of the receive side timebase with the send side timebase may be achieved using these time stamps. H.222.1 provides optional additional timebase recovery information, which may be useful in jittered environments.

c) *Media presentation synchronization*

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

d) *Timing jitter removal*

Recommendation H.222.1 may offer the capabilities to remove the effects of time delay variation on the encoded bit stream at the receiver.

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 services are provided by media encryption. Support for entitlement control and management messages is also provided.

g) *In-band signalling*

The multiplexing service 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 service, which monitors channel errors, is available.

k) *Remultiplex support*

In the H.222.1 Transport Stream mechanisms to assist in the addition and removal of individual elementary streams are provided. This service only has meaning at a network element. This service is not explicitly supported in the H.222.1 Program Stream.

l) *Local program insertion*

In the H.222.1 Transport Stream mechanisms are provided to assist in the replacement of one elementary stream with another elementary stream. This service only has meaning at a network element. This service is not explicitly supported in the H.222.1 Program Stream.

m) *Priority*

In the H.222.1 Transport Stream, one of two priorities may be indicated for each PDU. This service only has meaning at a network element. This service is not explicitly supported in the H.222.1 Program Stream.

It is not stated here as to which services are mandatory. An application decides what services are appropriate.