International Telecommunication Union

ITU-T

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H.222.0

Amendment 1
Corrigendum 2
(07/2016)

SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Transmission multiplexing and synchronization

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Information technology – Generic coding of moving pictures and associated audio information: Systems

Amendment 1: Delivery of timeline for external data

Technical Corrigendum 2: Clarifications and corrections on pause flag, URL construction and adaptation field syntax

Recommendation ITU-T H.222.0 (2015) – Amendment 1 – Technical Corrigendum 2

International Telecommunication Union

ITU-T H-SERIES RECOMMENDATIONS

AUDIOVISUAL AND MULTIMEDIA SYSTEMS

CHARACTERISTICS OF VISUAL TELEPHONE SYSTEMS	H.100–H.199
INFRASTRUCTURE OF AUDIOVISUAL SERVICES	
General	H.200–H.219
Transmission multiplexing and synchronization	**H.220–H.229**
Systems aspects	H.230–H.239
Communication procedures	H.240–H.259
Coding of moving video	H.260–H.279
Related systems aspects	H.280–H.299
Systems and terminal equipment for audiovisual services	H.300–H.349
Directory services architecture for audiovisual and multimedia services	H.350–H.359
Quality of service architecture for audiovisual and multimedia services	H.360–H.369
Telepresence	H.420–H.429
Supplementary services for multimedia	H.450–H.499
MOBILITY AND COLLABORATION PROCEDURES	
Overview of Mobility and Collaboration, definitions, protocols and procedures	H.500–H.509
Mobility for H-Series multimedia systems and services	H.510–H.519
Mobile multimedia collaboration applications and services	H.520–H.529
Security for mobile multimedia systems and services	H.530–H.539
Security for mobile multimedia collaboration applications and services	H.540–H.549
Mobility interworking procedures	H.550–H.559
Mobile multimedia collaboration inter-working procedures	H.560–H.569
BROADBAND, TRIPLE-PLAY AND ADVANCED MULTIMEDIA SERVICES	
Broadband multimedia services over VDSL	H.610–H.619
Advanced multimedia services and applications	H.620–H.629
Ubiquitous sensor network applications and Internet of Things	H.640–H.649
IPTV MULTIMEDIA SERVICES AND APPLICATIONS FOR IPTV	
General aspects	H.700–H.719
IPTV terminal devices	H.720–H.729
IPTV middleware	H.730–H.739
IPTV application event handling	H.740–H.749
IPTV metadata	H.750–H.759
IPTV multimedia application frameworks	H.760–H.769
IPTV service discovery up to consumption	H.770–H.779
Digital Signage	H.780–H.789
E-HEALTH MULTIMEDIA SERVICES AND APPLICATIONS	
Personal health systems	H.810–H.819
Interoperability compliance testing of personal health systems (HRN, PAN, LAN, TAN and WAN)	H.820–H.859
Multimedia e-health data exchange services	H.860–H.869

For further details, please refer to the list of ITU-T Recommendations.

INTERNATIONAL STANDARD ISO/IEC 13818-1
RECOMMENDATION ITU-T H.222.0

Generic coding of moving pictures and associated audio information: Systems

Amendment 1

Delivery of timeline for external data

Technical Corrigendum 2

Clarifications and corrections on pause flag, URL construction and adaptation field syntax

Summary

Corrigendum 2 to Amendment 1 of ITU-T H.222 (2014) | ISO/IEC 13818-1:2015 clarifies the use of the paused flag in the timeline descriptor, corrects the URL construction, provides if url_scheme, and restores the extensibility of the adaptation field syntax.

History

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FOREWORD

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INTERNATIONAL STANDARD
ITU-T RECOMMENDATION

Information technology – Generic coding of moving pictures and associated audio information: Systems

Amendment 1

Delivery of timeline for external data

Corrigendum 2

Clarifications and corrections on pause flag, URL construction and adaptation field syntax

Replace Annex U with the following modified text:

Annex U

Carriage of timeline and external media information over MPEG-2 transport streams

(This annex forms an integral part of this Recommendation | International Standard.)

U.1 Introduction

This annex specifies a format for carriage of timeline and location of external media resource that may be used as a synchronized enhancement of an MPEG-2 transport stream. The possible resolving, consumption and rendering of external media indicated in the stream are out of scope of this Recommendation | International Standard.

The format specifies the mapping of the transport stream program clock to an embedded timeline, the signalling of associated external resources, hereafter called add-on(s), and the signalling of prefetching events. The format is designed to be compact in order to fit within one TS packet for common use cases. The mapping of the embedded timeline indicated in the PES packet payload or in the adaptation field descriptor with the PTS value of the PES header of the PES packet provides a stable timeline for media streams in the program, regardless of PCR discontinuities or other timestamps rewriting that may happen in the network.

In the context of this annex, the "timeline and external media information" ~~stream~~ is called TEMI ~~stream~~.

TEMI data may be carried directly in the adaptation field of a media component or carried in a dedicated PES, called TEMI stream.

The TEMI stream describes external data and associated timing for the program in the MPEG-2 Transport Stream with which the TEMI stream is associated through the Program Map Table.

TEMI data carried in adaptation field of a media component describes external data and associated timing for the program in the MPEG-2 Transport Stream carrying this media component.

U.2 TEMI access unit and TEMI elementary stream

The format of the TEMI access unit is defined in Table U.1. TEMI access units shall be carried as PES packets using private_stream_1 streamID and identified in the program map table by the stream type 0x26. There shall be at most one TEMI elementary stream declared in the program map table.

The payload of a TEMI PES packet is a single complete TEMI_AU, i.e., there shall be one and only one complete TEMI access unit in a TEMI PES packet.

The TEMI PES packet header shall contain a PTS timestamp, whose value is used to match the current system time clock with the timeline value embedded in the TEMI packet payload, as defined in Table U.1.

A TEMI_AU is made of one or several AF descriptors. These AF descriptors may be sent in different access units and at different rates, and are independently decodable. All TEMI access units are therefore random access points.

NOTE 1 – In order to avoid interpolation issues when frame-accurate synchronization is required, the indicated PTS should be the same as the PTS of the associated video or audio stream for which frame accurate sync is needed.

NOTE 2 – It is possible to perform timeline interpolation in-between TEMI access units, for example if multiple audio frames are packed in a single PES packet, or when the TEMI AU frequency is less than the media AU frequency. However, receivers detecting PCR discontinuities in-between TEMI AUs should be careful when performing interpolation.

Table U.1 – TEMI access unit

Syntax	No. of bits	Mnemonic
TEMI_AU {		
CRC_flag	1	bslbf
reserved	7	bslbf
for (i=0; i<N; i++) {		
af_descriptor();		
}		
if (CRC_flag) {		
CRC_32	32	rpchof
}		
}		

Each TEMI AU is composed of an entire number of AF descriptors.

CRC_flag – A 1-bit flag, which when set to '1' indicates that a CRC field is present in the packet.

CRC_32 – This is a 32-bit field that contains the CRC value that gives a zero output of the registers in the decoder defined in Annex A after processing the entire payload of the TEMI access unit.

U.3 AF descriptors

U.3.1 Introduction

AF descriptors are structures used to carry various features of the timeline or other information. All AF descriptors have a format that begins with an 8-bit tag value. The tag value is followed by an 8-bit AF descriptor length and data fields. The following semantics apply to the descriptors defined throughout Annex U.

af_descr_tag – The af_descr_tag is an 8-bit field that identifies each AF descriptor.

Table U.2 provides the Rec. ITU-T H.222.0 | ISO/IEC 13818-1 defined, Rec. ITU-T H.222.0 | ISO/IEC 13818-1 reserved, and user available AF descriptor tag values.

af_descr_length – The af_descr_length is an 8-bit field specifying the number of bytes of the AF descriptor immediately following af_descr_length field.

Table U.2 – AF descriptor tags

AF descriptor tag	Identification
0x00-0x03	Rec. ITU-T H.222.0 | ISO/IEC 13818-1 Reserved
0x04	Timeline descriptor
0x05	Location descriptor
0x06	BaseURL descriptor
0x07	Cets_byte_range_descriptor (see Note)
0x08-0x7F	Rec. ITU-T H.222.0 | ISO/IEC 13818-1 reserved
0x80-0xFF	User private
NOTE – See clause 6.4 in ISO/IEC 23001-9 (Common encryption of MPEG-2 transport streams) for description and usage.	

AF descriptors may be carried in the adaptation field of TS packets of a media elementary stream, as defined in 2.4.3.5.

U.3.2 Location descriptor

The location descriptor is used to signal the location of external data that can be synchronized with the program. It conveys several locations and their type (optionally including MIME types), along with the ability to signal upcoming external data association though a countdown until activation of the external data. It is possible to signal splicing of external data, by signalling that the newly associated data is temporary and the previous association will be re-used later on.

Table U.3 – TEMI location descriptor

Syntax	No. of bits	Mnemonic
temi_location_descriptor {		
af_descr_tag	8	uimsbf
af_descr_length	8	uimsbf
force_reload	1	bslbf
is_announcement	1	bslbf
splicing_flag	1	bslbf
use_base_temi_url	1	bslbf
reserved	5	bslbf
timeline_id	7	uimsbf
if (is_announcement) {		
timescale	32	uimsbf
time_before_activation	32	uimsbf
}		
if (!use_base_temi_url) {		
url_scheme	8	uimsbf
url_path_length	8	uimsbf
for (i=0;i< url_path_length;i++) {		
url_path	8	bslbf
}		
}		
nb_addons	8	uimsbf
for (i=0;i < nb_addons ;i++) {		
service_type	8	uimsbf
if (service_type==0) {		
mime_length	8	uimsbf
for (j=0;j<mime_length;j++) {		
mime_type	8	bslbf
}		
}		
url_subpath_len	8	uimsbf
for (j=0;j< url_subpath_len;j++) {		
addon_location	8	bslbf
}		
}		
}		

U.3.3 Semantic definition of fields in the location descriptor

`force_reload`: When set to 1, indicates that the add-on description shall be reloaded before attempting to map media times or locate media components. Reloading may typically happen for manifest-based add-on such as MPEG-DASH or MPEG-MMT.

`is_announcement`: When set to 1, indicates that the add-on described by this descriptor is not yet active.

`splicing_flag`: When set to 1, indicates that the new add-on indicated by this descriptor temporarily interrupts the last defined add-on for which `splicing_flag` was not set. It is possible to have a sequence of add-ons with `splicing_flag` set. This allows terminal to optimize loading of the add-on when splicing period ends. There shall not be two `temi_location_descriptor` pointing to the same add-on with different values for `splicing_flag`, unless another `temi_location_descriptor` pointing to different add-ons is sent in-between with a `splicing_flag` set to 0.

`url_scheme`: Indicates the URL scheme to use for the URL. The scheme identified shall be appended to the `url_path`, according to Table U.4.

Table U.4 – TEMI URL scheme types

TEMI URL scheme type	Scheme value
0	Scheme URL is Included in url_path
1	"http://"
2	"https://"
3-0x7F	Rec. ITU-T H.222.0 | ISO/IEC 13818-1 Reserved
0x80-0xFF	User private

timeline_id: A unique identifier for this content location. If force_reload is set to '0' and another temi_location_descriptor with the same timeline_id and splicing_flag has already been received, the associated descriptions of the two descriptors shall be the same. If the splicing_flag differs for the same timeline_id, the timeline_id is reassigned to the new URL defined in the descriptor (i.e., redefinition of timeline_id).

timescale: Indicates the timescale used to express the time_before_activation field in this message.

use_base_temi_url: When set to 1, indicates that the URL defined in the last received temi_base_url_descriptor shall be used as a base URL; when set to 0, a base URL is provided in the payload of this descriptor for the location described in this descriptor and only this descriptor.

time_before_activation: Indicates the time in timescale units until the resource identified by addon_location becomes active; the ratio time_before_activation/timescale indicates a duration in seconds. An implementation may use this information to start prefetching content.

url_path_length: Indicates the length in bytes of the base URL path; when set to 0, indicates an empty URL path.

url_path: Base URL common to the different add-ons, if any; it shall be encoded without trailing zero character. This URL shall be a valid URL, as defined in clause 3 of IETF RFC 3986, and may contain a Fragment and or a Query part.

nb_addons: Indicates the number of add-ons that share this timeline. If 0, only one add-on is present at the location indicated by url_path, if this string is not empty. If url_path is empty and nb_addons is 0, this means that no service is associated with the current broadcast. If url_path is empty and nb_addons is not 0, url_subpath_len must be greater than 0.

service_type: Indicates the type of add-on present at the given URL, as described in Table U.5. An implementation can decide to fetch or not the add-on based on this service type indication.

Table U.5 – TEMI service types

TEMI service type	Add-on type
0	Specified with MimeType
1	MPEG-DASH
2	ISO/IEC 14496-12 file
3	Rec. ITU-T H.222.0 | ISO/IEC 13818-1 transport stream
0x04-0x7E	Rec. ITU-T H.222.0 | ISO/IEC 13818-1 reserved
0x7F	Unknown service type
0x80 – 0xFF	User private

mime_type: Indicates the mime type of the add-on available at the indicated location, as defined in IETF RFC 2046. An implementation can decide to fetch or not the add-on based on this mime type indication.

url_subpath_length: Indicates the length in bytes of the URL sub path; when set to 0, indicates an empty URL subpath.

url_subpath: Indicates the URL sub path, without trailing zero character; this URL shall be a valid URL, as defined in clause 3 of IETF RFC 3986. The URL for this add-on is obtained by merging url_subpath with the base URL path, as defined in clause 5 of IETF RFC 3986.

U.3.4 Base URL descriptor

The base URL descriptor is used to assign a default base URL to all location descriptors.

Table U.6 – TEMI base URL descriptor

Syntax	No. of bits	Mnemonic

temi_base_url_descriptor {
af_descr_tag
af_descr_length
 	
url_scheme
for (i=0;i< N;i++) {
base_url_path
}
}
	
	8
	8
	
	8
	
	8
		
		uimsbf
		uimsbf
		
		uimsbf
		
		bslbf

U.3.5 Semantic definition of fields in ~~location~~ base URL descriptor

`url_scheme`: Indicates the URL scheme to use for the URL. The scheme identified shall be appended to the `base_url_path`~~h~~, according to Table U.4.

`base_url_path`~~h~~: Base URL common to all following location descriptors, if any; it shall be encoded without trailing zero character. This URL shall be a valid path, as defined in clause 3 of IETF RFC 3986, and may contain a Fragment and or a Query part.

U.3.6 Timeline descriptor

The Timeline descriptor is used to carry timing information that can be used to synchronize external data. When the descriptor is carried within a TEMI access unit, the included timing information is given for the PTS value of the TEMI access unit carrying the descriptor. When the descriptor is carried in the adaptation field of a media component, the included timing information is given for the PTS found in the PES header starting in the payload of this transport stream packet or in the first subsequent transport stream packet with `payload_unit_start_indicator` set to 1 on this component (same PID). This PES header shall have a PTS declared. For a given ~~media access unit~~PES, there shall be at most one `temi_timeline_descriptor` with a `timeline_id` in the range [0, 0x7F], a `paused` flag set to 0 and for which the last `temi_location_descriptor` received had an `is_announcement` flag set to 0. A `temi_timeline_descriptor`~~,~~ with a `timeline_id` in the range [0, 0x7F], for which the last `temi_location_descriptor` received had an `is_announcement` flag set to 1, indicates the media time at which the timeline will start upon activation. This Recommendation | International Standard does not define any restrictions on the number of `temi_timeline_descriptor` using `timeline_id` values in the range [0x80, 0xFF] associated with a given PES.

In this section, this media PES packet is called the associated PES packet and the media PTS value is called the associated PTS.

Table U.7 – TEMI timeline descriptor

Syntax	No. of bits	Mnemonic
temi_timeline_descriptor {		
af_descr_tag	8	uimsbf
af_descr_length	8	uimsbf
has_timestamp	2	uimsbf
has_ntp	1	bslbf
has_ptp	1	bslbf
has_timecode	2	uimsbf
force_reload	1	bslbf
paused	1	bslbf
discontinuity	1	bslbf
reserved	7	bslbf
timeline_id	8	uimsbf
if (has_timestamp != 0) {		
timescale	32	uimsbf
if (has_timestamp==1) {		
media_timestamp	32	uimsbf
} else if (has_timestamp==2) {		
media_timestamp	64	uimsbf
}		
}		
if (has_ntp) {		
ntp_timestamp	64	uimsbf
}		
if (has_ptp) {		
ptp_timestamp	80	uimsbf
}		
if (has_timecode != 0) {		
drop	1	bslbf
frames_per_tc_seconds	15	uimsbf
duration	16	uimsbf
if (has_timecode==1) {		
short_time_code	24	uimsbf
} else if (has_timecode==2) {		
long_time_code	64	uimsbf
}		
}		
}		

U.3.7 Semantic definition of fields in ~~location~~ the timeline descriptor

has_timestamp: Indicates a media timestamp will be carried in this descriptor, and indicates its type. Value 0 means no media timestamp is present, value 1 means a 32 bit media timestamp is present, value 2 means a 64 bit media timestamp is present, value 3 is reserved.

has_ntp: When set to 1, indicates that a NTP timestamp will be carried in this descriptor.

has_ptp: When set to 1, indicates that a PTP timestamp will be carried in this descriptor.

has_timecode: ~~when set to 1,~~ Indicates that a frame timecode will be carried in this descriptor, and indicate its type. Value 0 means no frame timecode is present, value 1 means a ~~short~~ compact frame timecode is present, value 2 means a ~~long~~ full frame timecode is present, value 3 is reserved.

force_reload: When set to 1, indicates that the add-on description shall be reloaded before attempting to map media times or locate media components. Reloading typically happens for manifest-based add-on such as MPEG-DASH or MPEG-MMT.

paused: When set to 1, indicates that the timeline identified by timeline_id is currently paused; this typically happens when a timeline has to be paused but no splicing timeline is to be inserted during the pause. When a timeline whose timeline_id is in the range [0, 0x7F] is running, all other timelines defined whose timeline_id are in the range [0, 0x7F] are implicitly in pause mode. For timelines whose timeline_id are in the range [0x80, 0xFF], this flag only indicates the running status of the timeline. ~~When a timeline is running, all other timelines defined are implicitly in pause mode.~~

discontinuity: When set to 1, indicates that a discontinuity has happened in the timeline. If set to 0, no discontinuity happened since the last received temi_timeline_descriptor with the same value of timeline_id and same value of splicing_flag, if defined.

NOTE – An implementation may use this information to optimize playback of add-on content.

timeline_id: Indicates the active timeline. timeline_id values in the range [0, 0x7F] are identified in a temi_location_descriptor; for such values of timeline_id, the content of this temi_timeline_descriptor shall be ignored if no temi_location_descriptor with the same timeline_id has been received. timeline_id values in the range [0x80, 0xFF] identify timelines defined by means beyond the scope of this Specification.

timescale: Indicates the timescale used to express the media_timestamp field in this message; it indicates the amount by which the media time, as indicated by the media_timestamp field, increases within a 1-second interval when the timeline is not paused.

media_timestamp: Indicates the media time in timescale units corresponding to the PES PTS value of this packet for the timeline identified by ~~the last temi_location_descriptor received~~timeline_id. The value in this field is the media time modulo 2^N where N is the number of bits used to represent this field. The timeline may be interpolated between two temi_timeline_descriptor: let PTS_0 be the associated PTS of the temi_timeline_descriptor carrying media time $MT~~A~~_0$; until a new temi_timeline_descriptor~~media timeline packet~~ with the same timeline_id is received, the PTS of subsequent PES packets of other PIDs in this program is mapped to th~~e~~ise TEMI timeline as follows:

$$MT_i = timescale * (PTS_i - PTS_0) / 90000 + MT~~A~~_0 ~~/timescale~~$$

ntp_timestamp: A time value in ~~full~~ 64-bit NTP timestamp format as defined in clause 6 of IETF RFC 5905. The timeline may be interpolated between two temi_timeline_descriptor: let PTS_0 be the associated PTS of the temi_timeline_descriptor carrying NTP timestamp NTP_0; until a new temi_timeline_descriptor with the same timeline_id~~media timeline packet~~ is received, the PTS of subsequent PES packets of other PIDs in this program is mapped to the NTP time NTP_i as follows (where NTP_0 and NTP_i are in units of seconds and fractions of a second):

$$NTP_i = (PTS_i - PTS_0) / 90000.0 + NTP_0$$

ptp_timestamp: A full 80 bits PTP timestamp as defined in IEEE 1588v2. The timeline may be interpolated between two temi_timeline_descriptor: let PTS_0 be the associated PTS of the temi_timeline_descriptor carrying PTP timestamp PTP_0; until a new temi_timeline_descriptor with the same timeline_id~~media timeline packet~~ is received, the PTS of subsequent PES packets of other PIDs in this program is mapped to the PTP time PTP_i as follows (where PTP_0 and PTP_i are in units of seconds and fractions of a second):

$$PTP_i = (PTS_i - PTS_0) / 90000.0 + PTP_0$$

drop: Drop-frame indication, as defined in clause 5 of IETF RFC 5484.

frames_per_tc_second: The number of those frames that make a time-code second, as defined in clause 5 of IETF RFC 5484.

duration: The duration in ticks of a frame expressed in the timescale of 90000 ticks per seconds, as defined in clause 5 of IETF RFC 5484.

short_time_code: A ~~short~~ compact ~~32~~ 24-bit time code as defined clause 6.~~2~~ 1 of IETF RFC 5484.

long_time_code: A full 64-bit time code as defined clause 6.2 of IETF RFC 5484.

short_time_code and long_time_code indicate the media time of the first access unit starting in the payload of the associated PES. Using the information of drop, duration and frames_per_tc_seconds, it is possible to interpolate the timing between two temi_timeline_descriptor.

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Series A	Organization of the work of ITU-T
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Series F	Non-telephone telecommunication services
Series G	Transmission systems and media, digital systems and networks
Series H	**Audiovisual and multimedia systems**
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Series R	Telegraph transmission
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