International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

H.741.4

(06/2012)

SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

IPTV multimedia services and applications for IPTV – IPTV application event handling

IPTV application event handling: Transport mechanisms for audience measurement

Recommendation ITU-T H.741.4

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
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

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

Recommendation ITU-T H.741.4

IPTV application event handling: Transport mechanisms for audience measurement

Summary

The ITU-T H.741.x series of Recommendations defines a foundational platform for audience measurement (AM) of IPTV services. They focus on the interface between terminal devices and an audience measurement aggregation function.

The AM platform integrates a method for end users to report personal information, and is designed to easily add time-shifted and interactive services, and non-terminal device measurement points. While the ITU-T H.741.x series allows the implementation of audience measurement for IPTV services, its mechanism may be equally applicable to non-IPTV services.

The design philosophy in the ITU-T H.741.x series is focused on scalability, minimizing the use of resources, security, flexibility to support a variety of service-provider deployments, and rich privacy support to meet emerging regulations and legislation.

Recommendation ITU-T H.741.4 specifies the data elements and structures of the transport delivery-dependent XML and binary headers, used in audience measurement messages. Appendix I provides an analysis of AM to understand its transport protocol requirements.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T H.741.4	2012-06-29	16

Keywords

Audience measurement, audience rating service, audience viewership, contents rating, data structures, distributed content service, elements, engagement metrics, end-user permission, interactive services, IPTV application event handling, linear TV, metadata, monitoring, personalized service, transport.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. 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 Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

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

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure, e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

Table of Contents

Recommendation ITU-T H.741.4

IPTV application event handling: Transport mechanisms for audience measurement

1 Scope

This Recommendation describes transport mechanisms for audience measurement (AM). It specifies how the data structures defined in [ITU-T H.741.2] and [ITU-T H.741.3] are exchanged over different transport protocols. The term 'transport protocol' as used in this Recommendation refers to the protocol in which AM messages are encapsulated for delivery to a remote device.

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; 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. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T H.741.0] Recommendation ITU-T H.741.0 (2012), *IPTV application event handling: Overall aspects of audience measurement for IPTV services.*

[ITU-T H.741.1] Recommendation ITU-T H.741.1 (2012), *IPTV application event handling: Audience measurement operations for IPTV services.*

[ITU-T H.741.2] Recommendation ITU-T H.741.2 (2012), *IPTV application event handling: Data structures of audience measurement for IPTV services.*

[ITU-T H.741.3] Recommendation ITU-T H.741.3 (2012), *IPTV application event handling: Audience measurement for IPTV distributed content services.*

[ITU-T X.1191] Recommendation ITU-T X.1191 (2009), *Functional requirements and architecture for IPTV security aspects*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 aggregation functions [ITU-T H.741.0]: The function that configures audience measurement functions (AMFs), then receives processed events, sample values and end-user information from AMFs. It may participate in the communication of end-user permissions.

3.1.2 application [b-ITU-T Y.101]: A structured set of capabilities, which provide value-added functionality supported by one or more services.

3.1.3 application event [b-ITU-T H.740]: An application event is every end-user interaction or occurrence related to multimedia contents in IPTV applications. It includes an emergency event from event-notification services.

3.1.4 audience measurement [ITU-T H.741.0]: The measurement of people's engagement with IPTV services.

3.1.5 audience measurement function (AMF) [ITU-T H.741.0]: The function that, if given permission, measures the end-user behaviour by processing events or samples from IPTV services. AMFs may request and collect end-user information. AMFs transfer processed events, samples and end-user information to aggregation functions.

3.1.6 audience measurement system [ITU-T H.741.0]: The system which, with end-user permission, measures end-user behaviour by detecting application events within the IPTV service and collecting their data within the IPTV service.

3.1.7 configuration package [ITU-T H.741.0]: A configuration package is the data structure which specifies the target services to be measured, content filtering, measurement schedule, events and samples to be measured, and measurement report delivery.

3.1.8 controlled information [ITU-T H.741.0]: A classification of end-user information that can be used alone or easily in combination with other information to uniquely identify, contact, or locate an end user or subscriber. Following [ITU-T X.1191] Annex A.

3.1.9 end user [b-ITU-T Y.1910]: The actual user of the products or services.

NOTE – The end user consumes the product or service. An end user can optionally be a subscriber.

3.1.10 Internet Protocol Television (IPTV) [b-ITU-T Y.1901]: Multimedia services such as television/video/audio/text/graphics/data delivered over IP-based networks managed to support the required level of QoS/QoE, security, interactivity and reliability.

3.1.11 measurement report [ITU-T H.741.0]: The data that the audience measurement function (AMF) generates from an end-user behaviour event or sample.

3.1.12 multicast sub-addressing [ITU-T H.741.1]: The use of elements in a multicast message to determine if the message is intended for the receiving TD-AMF.

3.1.13 service [b-ITU-T Y.101]: A structure set of capabilities intended to support applications.

3.1.14 service navigation [b-ITU-T H.720]: A process of presenting information that allows the end user to discover, select and consume services.

3.1.15 service provider [b-ITU-T M.1400]: A general reference to an operator that provides telecommunication services to customers and other end users either on a tariff or contract basis. A service provider may or may not operate a network. A service provider may or may not be a customer of another service provider.

3.1.16 set-top box (STB) [b-ITU-T J.183]: A hardware box that contains digital signal demodulator, de-multiplexer, MPEG-2 decoder, and other functionalities and interfaces related to digital signal reception and presentation of the distributed programme at the subscriber's site.

3.1.17 terminal device (TD) [b-ITU-T Y.1901]: An end-user device which typically presents and/or processes the content, such as a personal computer, a computer peripheral, a mobile device, a TV set, a monitor, a VoIP Terminal or an audio-visual media player.

3.2 Terms defined in this Recommendation

This Recommendation does not define any particular term.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AM Audience Measurement

AMF Audience Measurement Function

BiM Binary MPEG format for XML

EXI	Efficient XML Interchange
GZIP	GNU Zip
ID	Identifier
MPEG	Moving Picture Experts Group
PC	Personal Computer
SP	Service Provider
STB	Set-Top Box
TD-AMF	Terminal Device Audience Measurement Function
TV	Television
UTC	Coordinated Universal Time
XML	Extensible Markup Language
ZLIB	Z LIBrary – A data compression library

5 Conventions

In this Recommendation, the following conventions apply.

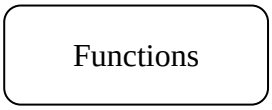
The keywords "is required to" indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this Recommendation is to be claimed.

The keywords "is recommended" indicate a requirement which is recommended but which is not absolutely required. Thus this requirement need not be present to claim conformance.

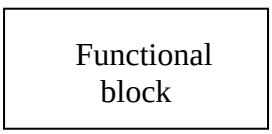
The keyword "is not recommended" indicate a requirement which is not recommended but which is not specifically prohibited. Thus, conformance with this specification can still be claimed even if this requirement is present.

The keywords "can optionally" indicate an optional requirement which is permissible, without implying any sense of being recommended. This term is not intended to imply that the vendor's implementation must provide the option and the feature can be optionally enabled by the network operator/service provider. Rather, it means that the vendor may optionally provide the feature and still claim conformance with the specification.

The keyword "functions" is defined as a collection of functionalities. It is represented by the following symbol in the context of IPTV architecture:



The keywords "functional block" is defined as a group of functionalities that has not been further subdivided at the level of detail described in this Recommendation. It is represented by the following symbol in the context of IPTV architecture:



NOTE – In the future, other groups or other Recommendations may possibly further subdivide these functional blocks.

In order to facilitate the specification of the corresponding schema, the notation used in tables defining elements and data structures is:

– *Support*: 1 = mandatory (one instance), 0-1 = optional (maximum one instance), 0-* = (optional and multiple instances possible), 1-* = mandatory and multiple instances possible).

– *Type*: string, integer, float, etc.

– *Container* elements are defined to group associated elements.

Following tables containing data structures, an alternative representation may be shown which illustrates the data structure. In the event of discrepancy between an alternative representation and the table, the correct information is to be found in the table.

6 Messages for data structure delivery

The data structures defined in [ITU-T H.741.2] may be delivered by one of multiple transport protocols; they may all be delivered by unicast, and some may be delivered by multicast, as indicated in Table 1.

Each of the three messages may be either unicast or multicast:

– configuration request response message

– configuration message

– measurement report request message.

When the message name is to be distinguished, the word unicast or multicast is prefixed to the above message names, e.g., multicast configuration message.

Table 1 – Delivery mechanisms for each data structure

Data structure	Unicast	Multicast
Configuration package request	X	
Configuration package request response	X	X
Configuration package	X	X
Measurement report request	X	X
AM report package	X	
Ack	X	
Error	X	

This clause focuses on the differences between unicast and multicast for delivery over transport protocols that can carry only XML. It distinguishes between elements to be used for delivery over transport protocols which can carry only XML and those which can carry binary.

All unicast and multicast messages have delivery elements which may be included in XML or a binary header, as depicted in Figure 1.

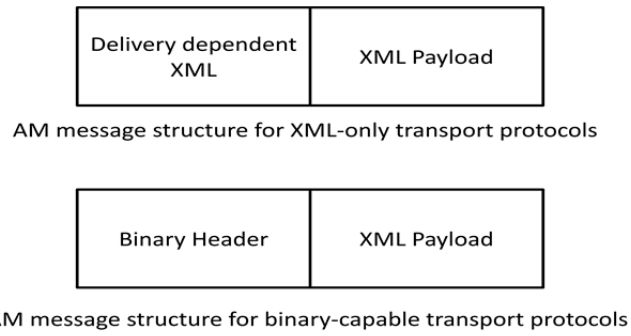


Figure 1 – Structure of an AM message

Unicast and multicast delivery elements include:

– A message type identifier to distinguish among AM messages.

– A message expiration time after which the message is not accepted.

– AM protocol version numbers to indicate interoperability and incompatibility.

– A message identifier to support correlation among messages.

In addition, multicast delivery elements include:

– A message integrity check and signature for authentication.

– An element to control acknowledge or error responses, so that problem AM messages may be reported.

– Sub-addressing elements to qualify the intended target sub-set of TD-AMFs.

The delivery elements of the uncompressed binary header may be used to determine if the XML payload is to be uncompressed and parsed.

See clause 7.1.1 of [ITU-T H.741.1] for descriptions of the capabilities provided by these elements.

6.1 Elements used in delivery

The details of delivery elements are specified in Table 2. The applicability of each element to XML-only or binary-capable transport protocols is indicated.

Table 2 – Elements used in delivery

Element	Description	Support/type	Notes or value domain	XML	Binary
MessageType	Indicates the AM message type	xs:hexBinary enumeration length = 1 octet (8 bits)	Values: 0 = configuration request message, 1 = unicast configuration request response message, 2 = multicast configuration request response message, 3 = unicast configuration message, 4 = multicast configuration message, 5 = unicast measurement report request message, 6 = multicast measurement report request message, 7 = measurement report message, 8 = configuration ack message, 9 = error message	X	X
Protocol Version MajorID	Indicates the major protocol version of this message. Differences in major protocol versions indicate incompatibility where mandatory functions have changed so that an older version receiver would not be able to interoperate with a newer version source if it simply ignored the elements and attributes it did not understand and took the actions defined in the older recommendation.	xs:hexBinary length = 1 octet (8 bits)	NOTE 1 – The source sets the value of the protocol version to the highest version it supports. The version of this AM recommendation is 1.0. NOTE 2 – When the sourced major version is not equal to the receiver's version, the message is not to be further processed by the receiver, and an error is to be returned. NOTE 3 – When the major version identifier is equal to the receiver supported version it is to be processed. The receiver sets the value of the protocol version in the response message header to either the value supplied by the sender or the highest protocol version supported by the receiver, whichever is lower.	X	X

Table 2 – Elements used in delivery

Element	Description	Support/type	Notes or value domain	XML	Binary
Protocol Version MinorID	Indicates the minor protocol version of this message, generated by the source of the message. Differences in minor protocol versions indicate compatibility. The minor version number is incremented only if significant new capabilities have been added to the AM protocol (e.g., new message).	xs:hexBinary length = 1 octet (8 bits)	NOTE – The sourced minor version is ignored by a receiver with a smaller minor version, but may be used to constrain use of certain capabilities by the entity with the larger minor version number (e.g., do not send new message).	X	X
MessageID	Message identifier.	xs:hexBinary length = 8 octets (64 bits)	Value: AM service provider unique. Uniquely generated by either TD-AMF or aggregation functions. Supports correlation of response to message being responded to.	X	X
Expiration Time	Security element indicating the message expiration time.	xs:dateTime	NOTE – This is the time of message transmission plus recommended ten minutes. Specify an offset from the UTC time. Used to protect against replay attacks, see [ITU-T H.741.1] clause 9.	X	
Expiration Time	Security element indicating the message expiration time.	NTP 64-bit timestamp format [b-IETF RFC 5905]	NOTE – This is the time of message transmission plus recommended 10 minutes. Specify an offset from the UTC time. Used to protect against replay attacks, see [ITU-T H.741.1] clause 9.		X
Digest	Integrity check element covering all XML elements in a message.	xs:hexBinary length = 32 octets (256 bits)	NOTE – The cryptographic hash function is SHA-256. See [b-FIPS PUB 180-3].	X	X
Signature	Security element indication of authentication.	xs:hexBinary length = 128 octets (1024 bits)	NOTE – The public-key cryptographic algorithm is RSA-1024. See [b-FIPS PUB 186-3].	X	X

Table 2 – Elements used in delivery

Element	Description	Support/type	Notes or value domain	XML	Binary
Response Qualifier	Qualifies which type(s) of special responses are requested.	xs:hexBinary enumeration length = 1 octet (8 bits)	Values: 0 = no acknowledge or error response requested, 1 = error message response requested only, 2 = both acknowledge and error messages requested, 3 = acknowledge requested only.	X	X
Terminal DeviceTarget ListSize	Specifies the total size in octets of the following TerminalDeviceTarget fields.	1 xs:hexBinary length = 4 octet (32 bits)			X
Terminal DeviceTarget	Identifies a terminal device, target of this message, uniquely identifies an end user's terminal device based on hashing of the device's MAC address.	xs:hexBinary length = 16 octets (128 bits)	Using MD5 algorithm. See [b-IETF RFC 6151].	X	X
Lower Threshold	It indicates the threshold to be used with the generation of a random number between 0 and 10000 by the TD-AMF to decide if the receiving terminal device accepts the configuration message (random number above lower threshold) or not (random number below lower threshold).	xs:hexBinary length = 2 octet (16 bits) Default: 0		X	X

Table 2 – Elements used in delivery

Element	Description	Support/type	Notes or value domain	XML	Binary
Upper Threshold	It indicates the threshold to be used with the generation of a random number between 0 and 10000 by the TD-AMF to decide if the receiving terminal device is to accept the configuration message (random number below upper threshold) or not (random number above upper threshold).	xs:hexBinary length = 2 octet (16 bits) Default: 10000		X	X
Terminal DeviceType Target	This element identifies a terminal device type, target of this message.	nonEmptyString Enumeration Default: qualification by terminal device type is not used.	Values: STB, TV, mobile, PC, tablet, other.	X	
Terminal DeviceType Target	This element identifies a terminal device type, target of this message.	1 8 bits	Device types indicated by bit flag = 1. Bit 7 = STB, Bit 6 = TV, Bit 5 = Mobile, Bit 4 = PC, Bit 3 = Tablet, Bit 2 = Other Value = 0 indicates that qualification by terminal device type is not used.		X
UserInfo TargetListSize	Specifies the total size in octets of the following UserInfoTypeSize, UserInfoTypeString, IgnoreIfUnavailable, EndUserValueSize and UserInfoValueString fields.	1 xs:hexBinary length = 4 octet (32 bits)			X
UserInfoType Size	Specifies the total size in octets of the following UserInfoTypeString field.	xs:hexBinary length = 1 octet (8 bits)			X
IgnoreIf Unavailable	Element to indicate how to handle UserInfoTypeString when information about the specified type is unavailable.	xs:hexBinary length = 1 octet (8 bits) default Bit 7=0	Values: Bit 7 = 1 indicates ignore if unavailable.		X

Table 2 – Elements used in delivery

Element	Description	Support/type	Notes or value domain	XML	Binary
EndUser ValueSize	Specifies the total size in octets of the following UserInfoValueString field.	xs:hexBinary length = 1 octet (8 bits)			X
UserInfo Target	Container for elements specifying user info to be used for targeting TD-AMFs.			X	
UserInfoType String	Element of UserInfoTarget Element to match to ControlledUserInfo TypeString or GenericUserInfoType A match indicates that User Info is used to identify a target of this message.	1 nonEmptyString	ControlledUserInfoTypeString and GenericUserInfoType are defined in Table 3 of [ITU-T H.741.2]. NOTE 1 – ControlledUserInfoTypeString is used only for permission level 3. NOTE 2 – GenericUserInfoType is used only for permission level 2 or 3.	X	
IgnoreIf Unavailable	Element of UserInfoTarget Element to indicate how to handle UserInfo TypeString when information about the specified type is unavailable	0-1 xs:Boolean default = False	NOTE – If true, then the associated value of UserInfoTypeString is ignored if information about the specified type is unavailable.	X	
UserInfoValue String	Element of UserInfoTarget Element to match to ControlledUserInfoValue String or GenericUserInfoValue A match indicates that this TD-AMF is a target of this message	1 nonEmptyString	ControlledUserInfoValueString and Generic UserInfoValue are defined in [ITU-T H.741.2] Table 3 NOTE 1 – ControlledUserInfoValueString is used only for permission level 3. NOTE 2 – GenericUserInfoValue is used only for permission level 2 or 3.	X	
Compression	Indicates the compression/decompression algorithm used for the XML payload.		Defined in [ITU-T H.741.2]	X	

Table 2 – Elements used in delivery

Element	Description	Support/type	Notes or value domain	XML	Binary
Compression	Indicates the compression/decompression algorithm used for the XML payload.	xs:hexBinary enumeration length = 1 octet (8 bits)	Values: 0=None, 1=BiM, 2=ZLIB, 3=Infoset, or 4=EXI. See NOTE.		X
NOTE – For BiM see [b-ISO/IEC 23001-1], for ZLIB (including GZIP) see [b-ETSI TS 102 472], for (Fast) Infoset see [b-ITU-T X.891], and for EXI see [b-W3C EXI].					

Figure 2 contains the alternative representation of the delivery-dependent XML UserInfoTarget data structure defined in Table 2:

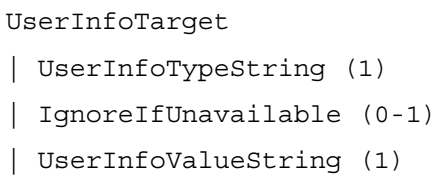


Figure 2 – Alternative representation of the delivery-dependent XML UserInfoTarget data structure

A similar representation can be made for binary headers. The inclusion of elements which indicate the total sizes of other elements or groups of elements (i.e., TerminalDeviceTargetListSize and UserInfoTargetListSize) is recommended, independent of whether any elements are quantified. In the representation shown in Figures 3 and 4, the sets of elements under the total size elements are similar to (0-*) for the XML representations.

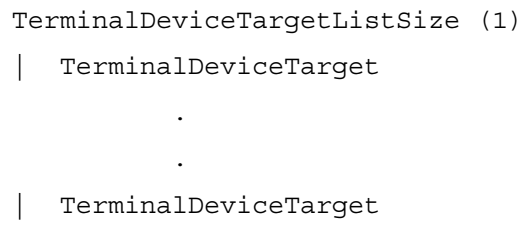


Figure 3 – Alternative representation of the binary TerminalDeviceTargetListSize data structure

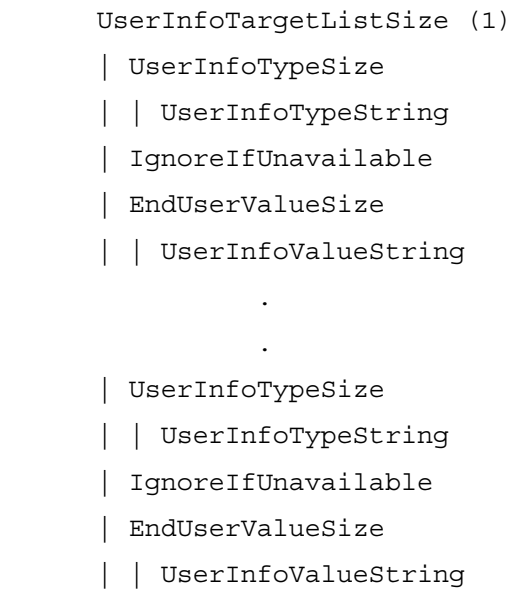


Figure 4 – Alternative representation of the binary UserInfoTargetListSize data structure

The following clauses define the data structures of AM messages for delivery using unicast or multicast transport delivery mechanisms. In the following tables, the partition between the delivery-dependent XML and the XML payload are indicated by a double line.

In cases where multicast is supported either directly by the network, or by transport protocols which support multicast by replicating unicast messages on the network, the data structures of Table 5, Table 7 and Table 9 are to be used.

6.2 Delivery of the data structure "configuration package request"

A unicast transport delivery mechanism is used by TD-AMFs during a pull sequence to deliver the configuration package request data structure.

The data structure of the "configuration request message" is as indicated in Table 3.

Table 3 – Data structure for the "configuration request message"

Element	Description	Support/ type	Notes or value domain
MessageType	Indicates configuration package request message.	1	Defined in Table 2.
Expiration Time	Security element indicating the message expiration time.	1	Defined in Table 2.
Protocol Version MajorID	Indicates the major protocol version of this message. Differences in major protocol versions indicate incompatibility where mandatory functions have changed so that an older version receiver would not be able to interoperate with a newer version source if it simply ignored the elements and attributes it did not understand and took the actions defined in the older recommendation.	1	Defined in Table 2.
Protocol Version MinorID	Indicates the minor protocol version of this message, generated by the source of the message. Differences in minor protocol versions indicate compatibility. The minor version number is incremented only if significant new capabilities have been added to the AM protocol (e.g., new message).	1	Defined in Table 2.
MessageID	Element of ConfigRequestMsg Message identifier.	1	Defined in Table 2. Generated by TD-AMF.
Compression	Indicates the compression/decompression algorithm used for the XML payload.	0-1	Defined in Table 2.
Config Package Request	Element of ConfigRequestMsg Container for a configuration package request data structure.	1	Defined in [ITU-T H.741.2].

6.3 Delivery of the data structure "configuration package request response"

A unicast transport delivery mechanism may be used by aggregation functions during a pull sequence to deliver the configuration package request response data structure.

A multicast transport delivery mechanism may be used by aggregation functions during a push sequence to deliver the configuration package request response data structure.

For unicast, the data structure of the "unicast configuration request response message" is indicated in Table 4.

Table 4 – Data structure for "unicast configuration request response message"

Element	Description	Support/ type	Notes or value domain
MessageType	Indicates package request response message.	1	Defined in Table 2.
ExpirationTime	Security element indicating the message expiration time.	1	Defined in Table 2.
ProtocolVersion MajorID	Indicates the major protocol version of this message.	1	Defined in Table 2.
ProtocolVersion MinorID	Indicates the minor protocol version of this message.	1	Defined in Table 2.
MessageID	Element of UnicastConfigRequestResponse Msg Message identifier.	1	Defined in Table 2. Generated by TD-AMF in configuration request message.
Compression	Indicates the compression/decompression algorithm used for the XML payload.	0-1	Defined in Table 2.
ConfigPackage Request Response	Container for a configuration package request response data structure.	1	Defined in [ITU-T H.741.2].

For multicast, the data structure of the "multicast configuration request response message" is indicated in Table 5.

Table 5 – Data structure for "multicast configuration request response message"

Element	Description	Support/ type	Notes or value domain
MessageType	Indicates configuration package request response sent over multicast.	1	Defined in Table 2.
ExpirationTime	Security element indicating the message expiration time.	1	Defined in Table 2.
Digest	Integrity check element covering all XML elements.	1	Defined in Table 2.
Signature	Security element indication of authentication.	1	Defined in Table 2.
ProtocolVersion MajorID	Indicates the major protocol version of this message.	1	Defined in Table 2.
ProtocolVersion MinorID	Indicates the minor protocol version of this message.	1	Defined in Table 2.
MessageID	Message identifier.	1	Defined in Table 2. Generated by aggregation functions, may be used by TD-AMF error messages.
Compression	Indicates the compression/ decompression algorithm used for the XML payload.	0-1	Defined in Table 2.

Table 5 – Data structure for "multicast configuration request response message"

Element	Description	Support/ type	Notes or value domain
ResponseQualifier	Qualifies which type(s) of special responses are requested.	1	Defined in Table 2. Restricted values: 0 = no error response requested 1 = error message response requested only.
TerminalDevice Target	Identifies a terminal device, target of this message, uniquely identifies an end user's terminal device based on hashing of the device's MAC address.	0-*	Defined in Table 2.
UserInfoTarget	Container for elements specifying user info to be used for targeting TD-AMFs.	0-*	Defined in Table 2.
ConfigPackage RequestResponse	Container for a configuration package request response.	1	Defined in [ITU-T H.741.2].

6.4 Delivery of the data structure "AMF configuration package"

A unicast transport delivery mechanism may be used by aggregation functions during a push sequence to deliver the AMF configuration package data structure.

A multicast transport delivery mechanism may be used by aggregation functions during a push sequence to deliver the AMF configuration package data structure.

For unicast, the structure of the "unicast configuration message" is indicated in Table 6 and, for multicast transport, the structure of the "multicast configuration message" is indicated in Table 7.

Table 6 – Data structure for the "unicast configuration message"

Element	Description	Support/ type	Notes or value domain
MessageType	Indicates a configuration package sent over multicast.	1	Defined in Table 2.
ExpirationTime	Security element indicating the message expiration time.	1	Defined in Table 2.
ProtocolVersion MajorID	Indicates the major protocol version of this message.	1	Defined in Table 2.
ProtocolVersion MinorID	Indicates the minor protocol version of this message.	1	Defined in Table 2.
MessageID	Message identifier.	1	Defined in Table 2. Generated by aggregation functions.
Compression	Indicates the compression/ decompression algorithm used for the XML payload.	0-1	Defined in Table 2.
ImmediateAnd Future Configuration	Container for the immediate and future configuration directives.	1	Defined as ConfigPackage RequestResponse in [ITU-T H.741.2].

Table 7 – Data structure for the "multicast configuration message"

Element	Description	Support/ type	Notes or value domain
MessageType	Indicates a configuration package sent over multicast.	1	Defined in Table 2.
ExpirationTime	Security element indicating the message expiration time.	1	Defined in Table 2.
Digest	Integrity check element covering all XML elements.	1	Defined in Table 2.
Signature	Security element indication of authentication.	1	Defined in Table 2.
ProtocolVersion MajorID	Indicates the major protocol version of this message.	1	Defined in Table 2.
ProtocolVersion MinorID	Indicates the minor protocol version of this message.	1	Defined in Table 2.
MessageID	Message identifier.	1	Defined in Table 2. Generated by aggregation functions.
LowerThreshold	It indicates the threshold to be used with the generation of a random number between 0 and 10000 by the TD-AMF to decide if the receiving terminal device accepts the configuration message (random number above lower threshold) or not (random number below lower threshold).	1 Note 2	Defined in Table 2.
UpperThreshold	It indicates the threshold to be used with the generation of a random number between 0 and 10000 by the TD-AMF to decide if the receiving terminal device is to accept the configuration message (random number below upper threshold) or not (random number above upper threshold).	1 Note 2	Defined in Table 2.
Response Qualifier	Qualifies which type(s) of special responses are requested.	1	Defined in Table 2.
TerminalDevice Target	Identifies a terminal device, target of this message, uniquely identifies an end user's terminal device based on hashing of the device's MAC address.	0-*	Defined in Table 2.
TerminalDevice TypeTarget	This element identifies a terminal device type, target of this message.	0-*	Defined in Table 2.
UserInfoTarget	Container for elements specifying user info to be used for targeting TD-AMFs.	0-*	Defined in Table 2.
Compression	Indicates the compression/ decompression algorithm used for the XML payload.	0-1	Defined in Table 2.

Table 7 – Data structure for the "multicast configuration message"

Element	Description	Support/ type	Notes or value domain
ImmediateAnd Future Configuration	Container for the immediate and future configuration directives.	1 Note 1	Defined as ConfigPackage RequestResponse in [ITU-T H.741.2].
NOTE 1 – The code element within ImmediateAndFutureConfiguration has enumeration including code as "2" (no configuration package change), which is not to be used here. NOTE 2 – The conditions of both LowerThreshold and UpperThreshold must be met to accept the configuration message. If the values of LowerThreshold and UpperThreshold are the same, then thresholds are not used.			

6.5 Delivery of the data structure "Measurement report request"

A unicast transport delivery mechanism may be used by aggregation functions during a pull sequence to deliver the measurement report request data structure.

A multicast transport delivery mechanism may be used by aggregation functions during a pull sequence to deliver the measurement report request data structure.

For unicast transport, the structure of the "unicast measurement report request message" is given in Table 8, and for multicast transport, the structure of the "multicast measurement report request message" is as shown in Table 9.

Table 8 – Data structure for "unicast measurement report request message"

Element	Description	Support/type	Notes or value domain
MessageType	Indicates a unicast configuration package request response message.	1	Defined in Table 2.
Expiration Time	Security element indicating the message expiration time.	1	Defined in Table 2.
Protocol Version MajorID	Indicates the major protocol version of this message.	1	Defined in Table 2.
Protocol Version MinorID	Indicates the minor protocol version of this message.	1	Defined in Table 2.
MessageID	Message identifier.	1	Defined in Table 2. Generated by aggregation functions.
Compression	Indicates the compression/ decompression algorithm used for the XML payload.	0-1	Defined in Table 2.
Measurement ReportRequest	Container for a measurement report request data structure.	1	Defined in [ITU-T H.741.2].

Table 9 – Data structure for "multicast measurement report request message"

Element	Description	Support/ type	Notes or value domain
Message Type	Indicates a multicast configuration package request response message.	1	Defined in Table 2.
Expiration Time	Security element indicating the message expiration time.	1	Defined in Table 2.
Digest	Integrity check element covering all XML elements.	1	Defined in Table 2.
Signature	Security element indication of authentication	1	Defined in Table 2.
Protocol Version MajorID	Indicates the major protocol version of this message.	1	Defined in Table 2.
Protocol Version MinorID	Indicates the minor protocol version of this message.	1	Defined in Table 2.
MessageID	Element of MulticastMeasReportRequestMsg Message identifier.	1	Defined in Table 2. Generated by aggregation functions.
Response Qualifier	Element of MulticastMeasReportRequestMsg This element qualifies which type(s) of special responses are requested.	1 (Note 1)	Defined in Table 2.
Terminal Device Target	Identifies a terminal device, target of this message, uniquely identifies an end user's terminal device based on hashing of the device's MAC address.	0-*	Defined in Table 2.
Lower Threshold	Indicates the threshold to be used with the generation of a random number between 0 and 10000 by the TD-AMF to decide if the receiving terminal device accepts the configuration message (random number above lower threshold) or not (random number below lower threshold).	1 (Note 2)	Defined in Table 2.
Upper Threshold	Indicates the threshold to be used with the generation of a random number between 0 and 10000 by the TD-AMF to decide if the receiving terminal device is to accept the configuration message (random number below upper threshold) or not (random number above upper threshold).	1 (Note 2)	Defined in Table 2.
Compression	Indicates the compression/decompression algorithm used for the XML payload.	0-1	Defined in Table 2.
Measurement Report Request	Container for a measurement report request data structure.	1	Defined in [ITU-T H.741.2].

NOTE 1 – Only ResponseQualifier values 0 or 1 are permitted in this structure.

NOTE 2 – The conditions of both LowerThreshold and UpperThreshold must be met to accept the configuration message. If the values of LowerThreshold and UpperThreshold are the same, then thresholds are not used.

6.6 Delivery of the data structure "AM report package"

A unicast transport delivery mechanism may be used by a TD-AMF during a pull or push sequence to deliver the data structure of a set of measurement reports. See Table 10.

Table 10 – Data structure for the "measurement report message"

Element	Description	Support/type	Notes or value domain
MessageType	Indicates a measurement report message.	1	Defined in Table 2.
Expiration Time	Security element indicating the message expiration time.	1	Defined in Table 2.
Signature	Security element indication of authentication.	1	Defined in Table 2.
Protocol Version MajorID	Indicates the major protocol version of this message.	1	Defined in Table 2.
Protocol Version MinorID	Indicates the minor protocol version of this message.	1	Defined in Table 2.
MessageID	Message identifier.	1	Defined in Table 2. Generated by TD-AMF if push delivery. Generated by aggregation function in measurement report request if pull delivery.
Compression	Indicates the compression/ decompression algorithm used for the XML payload.	0-1	Defined in Table 2.
AMReport Package	Container for data structure of a set of measurement reports.	1	Defined in [ITU-T H.741.2].

6.7 Delivery of the data structure "Ack"

A unicast transport delivery mechanism may be used by a TD-AMF during a push sequence to deliver the ack data structure. See Table 11.

Table 11 – Data structure for the "configuration ack message"

Element	Description	Support/type	Notes or value domain
MessageType	Indicates an acknowledge message.	1	Defined in Table 2.
Expiration Time	Security element indicating the message expiration time.	1	Defined in Table 2.
Protocol Version MajorID	Indicates the major protocol version of this message.	1	Defined in Table 2.
Protocol Version MinorID	Indicates the minor protocol version of this message.	1	Defined in Table 2.

Table 11 – Data structure for the "configuration ack message"

Element	Description	Support/type	Notes or value domain
MessageID	Message identifier of the configuration message being responded to.	1	Defined in Table 2.
Compression	Indicates the compression/ decompression algorithm used for the XML payload.	0-1	Defined in Table 2.
Ack	Container for acknowledge message.	1	Defined in [ITU-T H.741.2].

6.8 Delivery of the data structure "Error"

A unicast transport delivery mechanism may be used by a TD-AMF or aggregation functions during a push or pull sequence to deliver the error data structure. See Table 12.

All five error messages (configuration request error message, configuration response error message, configuration error message, measurement report request error message, and measurement report error message) are identical to the "Error" data structure.

Table 12 – Data structure for the "error message"

Element	Description	Support/ type	Notes or value domain
MessageType	Indicates an error message.	1	Defined in Table 2.
ExpirationTime	Security element indicating the message expiration time.	1	Defined in Table 2.
ProtocolVersion MajorID	Indicates the major protocol version of this message.	1	Defined in Table 2.
ProtocolVersion MinorID	Indicates the minor protocol version of this message.	1	Defined in Table 2.
MessageID	Message identifier of the message being responded to.	1	Defined in Table 2.
Compression	Indicates the compression/ decompression algorithm used for the XML payload.	0-1	Defined in Table 2.
Error	Container for error message.	1	Defined in [ITU-T H.741.2].

Appendix I

Transport protocol considerations for audience measurement

(This appendix does not form an integral part of this Recommendation.)

Following the specification of the audience measurement (AM) application, this appendix examines AM and its considerations for designers and the selection of suitable transport protocol(s).

AM has eleven message types (see [ITU-T H.741.0]) of which all can be unicast at the application level; they are to be transported as unicast. Three of the (downstream direction) message types can be multicast at the application level; these are best transported using network multicast but may be replicated at the transport level using unicast (which increases network congestion). AM defines both unicast messages and multicast message for these three message types. It is recommended that the multicast version be used when multicast by replicated unicast is used. Appendix II of [ITU-T H.741.1] provides considerations for unicast vs multicast implementation.

I.1 AM message size characteristics

Table I.1 describes whether unicast and/or multicast protocols can be used for each message type. It provides relative message size range estimates of each message with dependencies which increase size. S=Small, M=Medium, and L=Large.

Table I.1 – Relative size characteristics of AM message types

Message	Unicast	Multicast	Relative size range	Dependencies that increase message size
Configuration request message	X		M-M	Hybrid permission mode
Configuration request error message	X		S-S	Number of errors
Configuration request response message	X	Y	S-M	Configuration complexity and second configuration
Configuration response error message	X		S-S	Number of errors
Configuration message	X	Y	S-M	Configuration complexity and second configuration
Configuration ack/error message	X		S-S	Number of errors
Measurement report request message	X	Y	S-S	Number of measurement requests
Measurement report request error message	X		S-S	Number of errors
Measurement report message	X		S-L	Batched reporting, scheduled push delivery or pull delivery modes. Maximum size limited by TD-AMF storage
Measurement report error message	X		S-S	Number of errors

I.2 AM message reliability needs

It is expected that AM be used for both aggregate and individual end-user device use cases. For aggregate use cases, e.g., viewership count, a statistical result is sufficient. It is not required that continual and proper participation in AM be guaranteed for every end-user device. For individual use cases, e.g., input for personalized recommendation engines, the historical information is sufficient. Again, it is not required that continual and proper participation in AM be guaranteed for every end-user device. It is therefore acceptable that any AM message type may infrequently fail to be delivered. However, since report messages may be very large when scheduled or pull delivery modes are used, it is recommended that reliability be sufficient to assure delivery of large report messages. In considering the partitioning of reliability between the AM application and transport protocols, it should be noted that, at an application level, AM supports a report message retry count and multiple delivery destination addresses.

It is acceptable to use different transport protocols for different message types.

AM functional aspects that suffer from a loss of reliability are: timeliness in delivery and loss of data. Table I.2 describes the need for reliability for each message type described in [ITU-T H.741.0] and the impact when messages are not delivered.

Table I.2 – AM message reliability needs

Message	Reliability need	Impact of non-delivery of message
Configuration request message	Low	Message retry, possible gap in measurements, or wrong measurements
Configuration request error message	Low	Message retry, possible gap in measurements, or wrong measurements
Configuration request response message	Low	Message retry, possible gap in measurements, or wrong measurements
Configuration response error message	Low	Message retry, possible gap in measurements, or wrong measurements
Configuration message	Low	Possible gap in measurements or wrong measurements
Configuration ack/error message	Low	Lower system health confidence, possible gap in measurements, or wrong measurements
Measurement report request message	Low	Loss of stored measured data
Measurement report request error message	Low	Loss of stored measured data
Measurement report message	Higher if large message sizes are expected	Loss of measured data
Measurement report error message	Low	Loss of measured data

When considering higher reliability in the transport of report messages, it should be borne in mind that the more highly reliable transport protocols may require substantially more states to be stored by aggregation servers in large-scale deployments, and may have an impact on their requirements.

I.3 AM message QoS needs

The impact of loss is described in clause I.2. Furthermore, since jitter and delay are not important for the operation of AM, AM traffic may be marked as bulk class or equivalent.

I.4 AM message integrity needs

The integrity of AM messaging is important for its operation. Since AM includes an integrity check via cryptographic hash in the delivery-dependent XML and binary header, it does not require that transport protocols provide integrity checks.

I.5 AM message encryption needs

AM report messages (upstream direction) can contain controlled information which must be encrypted. Since AM includes support for encryption, it does not require that transport protocols provide encryption.

Bibliography

[b-ITU-T H.720] Recommendation ITU-T H.720 (2008), *Overview of IPTV terminal devices and end systems*.

[b-ITU-T H.740] Recommendation ITU-T H.740 (2010), *Application event handling for IPTV services.*

[b-ITU-T J.183] Recommendation ITU-T J.183 (2001), *Time-division multiplexing of multiple MPEG-2 transport streams over cable television systems*.

[b-ITU-T M.1400] Recommendation ITU-T M.1400 (2001), *Designations for interconnections among network operators*.

[b-ITU-T X.891] Recommendation ITU-T X.891 (2005) | ISO/IEC 24824-1:2007, *Information technology – Generic applications of ASN.1: Fast infoset*.

[b-ITU-T Y.101] Recommendation ITU-T Y.101 (2000), *Global Information Infrastructure terminology: Terms and definitions.*

[b-ITU-T Y.1901] Recommendation ITU-T Y.1901 (2009), *Requirement for the support of IPTV services*.

[b-ITU-T Y.1910] Recommendation ITU-T Y.1910 (2008), *IPTV functional architecture*.

[b-ETSI TS 102 472] ETSI TS 102 472 V1.3.1 (2009), *Digital Video Broadcasting (DVB); IP Datacast over DVB-H: Content Delivery Protocols*.

[b-IETF RFC 5905] IETF RFC 5905 (2010), *Network Time Protocol Version 4: Protocol and Algorithms Specification*.

[b-IETF RFC 6151] IETF RFC 6151 (2011), *Updated Security Considerations for the MD5 Message-Digest and the HMAC-MD5 Algorithms*.

[b-ISO 19136] ISO 19136:2007, *Geographic information – Geography Markup Language (GML).*

[b-ISO/IEC 23001-1] ISO/IEC 23001-1:2006/Cor 1:2007, *Information technology – MPEG systems technologies – Part 1: Binary MPEG format for XML*.

[b-FIPS PUB 180-3] National Institute of Standards and Technology (NIST), FIPS PUB 180-3 (2008), *Secure Hash Standard (SHS).*

[b-FIPS PUB 186-3] National Institute of Standards and Technology (NIST), FIPS PUB 186-3 (2009), *Digital Signature Standard.*

[b-W3C EXI] W3C Recommendation (2011), *Efficient XML Interchange (EXI) Format 1.0*.
http://www.w3.org/TR/exi/

SERIES OF ITU-T RECOMMENDATIONS

Series A	Organization of the work of ITU-T
Series D	General tariff principles
Series E	Overall network operation, telephone service, service operation and human factors
Series F	Non-telephone telecommunication services
Series G	Transmission systems and media, digital systems and networks
Series H	**Audiovisual and multimedia systems**
Series I	Integrated services digital network
Series J	Cable networks and transmission of television, sound programme and other multimedia signals
Series K	Protection against interference
Series L	Construction, installation and protection of cables and other elements of outside plant
Series M	Telecommunication management, including TMN and network maintenance
Series N	Maintenance: international sound programme and television transmission circuits
Series O	Specifications of measuring equipment
Series P	Terminals and subjective and objective assessment methods
Series Q	Switching and signalling
Series R	Telegraph transmission
Series S	Telegraph services terminal equipment
Series T	Terminals for telematic services
Series U	Telegraph switching
Series V	Data communication over the telephone network
Series X	Data networks, open system communications and security
Series Y	Global information infrastructure, Internet protocol aspects and next-generation networks
Series Z	Languages and general software aspects for telecommunication systems

Printed in Switzerland
Geneva, 2013