

International Telecommunication Union

ITU-T

Technical Paper

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

(8 November 2013)

SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS
Infrastructure of audiovisual services – Communication
procedures

HSTP-IPTV-AM.101

**Introduction to the ITU-T H.741-series – A new
video engagement audience measurement
standard**

ITU-T

Summary

Non-Service Provider stakeholders have long desired comprehensive audience measurement from TV. However the value and cost of providing proprietary comprehensive TV audience measurement has not been attractive to Service Providers (SPs). The specification in ITU-T H.741 provides measurements which are valuable to service providers while incorporating cost minimizing functions, while addressing concerns over security and privacy. This paper presents motivations and values of audience measurement, summarizes what is measured then considers next steps. The appendix can be used to quickly understand how ITU-T H.741 works without reading the whole standard.

Keywords

audience measurement, audience viewership, audience rating service, content rating, monitoring, viewer permission, privacy protection, engagement metrics, IPTV, personalised service, linear TV, metadata

Change Log

This document contains Version 1 of the ITU-T Technical Paper “*Introduction to the ITU-T H.741-series – A new video engagement audience measurement standard*” approved at the ITU-T Study Group 16 meeting held in Geneva, 28 October - 8 November 2013.

Editor: Hideki YAMAMOTO
Oki Electric Industry
Japan

Tel: +81 48 420 7012
Fax: +81 48 420 7138
Email: yamamoto436@oki.com

Contents

Page

| | | |
|----------|---|-----------|
| 1 | BACKGROUND AND MOTIVATION | 1 |
| 2 | VALUE OF AUDIENCE MEASUREMENT | 1 |
| 3 | VALUE OF AUDIENCE MEASUREMENT FOR SERVICE PROVIDERS | 2 |
| 4 | VALUES OF AUDIENCE MEASUREMENT FOR NON-SERVICE PROVIDERS | 2 |
| 5 | WHAT IS MEASURED | 3 |
| 6 | EVENTS | 3 |
| 7 | SAMPLES | 4 |
| 8 | VIEWER PRIVACY | 5 |
| 9 | NEXT STEPS | 5 |
| | APPENDIX I: HOW IT WORKS | 7 |
| | I.1 PRIVACY PERMISSION MODES | 7 |
| | I.2 CONFIGURATION MODES | 7 |
| | I.3 MEASUREMENT TRIGGERS | 8 |
| | I.4 REPORT DELIVERY MODES | 8 |
| | I.5 REPORTING OPTIONS | 9 |
| | I.6 MULTICAST OPTIONS | 9 |
| | I.7 SECURITY | 9 |
| | REFERENCES | 10 |

ITU-T Technical Paper Introduction to the ITU-T H.741-series – A new video engagement audience measurement standard

Summary

Non-Service Provider stakeholders have long desired comprehensive audience measurement from TV. However the value and cost of providing proprietary comprehensive TV audience measurement has not been attractive to Service Providers (SPs). The specification in ITU-T H.741 provides measurements which are valuable to service providers while incorporating cost minimising functions, while addressing concerns over security and privacy. This paper presents motivations and values of audience measurement, summarises what is measured then considers next steps. The appendix can be used to quickly understand how H.741 works without reading the whole standard.

1 Background and motivation

Despite the desire of media measurement stakeholders and others to measure video audiences, there has historically been concern over the return on investment for infrastructure providers and vendors to provide standardised audience measurement data. Multiple factors have recently emerged which contribute to change this situation, including:

- Media industry dissatisfaction with traditional audience measurement techniques and calling for new standards
- Network Service Providers seeing increasing competition and completing harvesting of low-hanging fruit, allowing audience measurement-based values to gain mindshare.
- Advances in analytics and big data technologies

Driven partly by these factors, the principles adopted in developing this standard became:

- Minimization of service provider infrastructure resource usage
- Possibility to integrate with existing service provider services
- Provision of a large toolkit supporting the flexibility to incrementally implement from a very simple to a comprehensive measurement collection system
- Support for many heterogeneous devices having differing resource levels
- Privacy is provided by design. This feature includes the ability to honor viewer's privacy policies and to meet emerging regulations and legislation.
- Limit scope to data collection (without analytics which differentiate stakeholders' offerings)
- Implementable both as a captive Audience Measurement (AM) service within a Service Provider, and by an independent Audience Measurement Service Provider
- Scalability and security for millions of viewer devices

2 Value of audience measurement

Before providing an overview of the new standard, we briefly try to answer the question "*Why should I care?*" – For each of several stakeholder types there are somewhat different reasons. Here we will focus on summarising the values of implementing AM for Service Providers.

3 Value of audience measurement for service providers

Audience measurement has strong economic imperatives for service providers. Knowing details of how audiences engage with their services allows service providers to receive feedback which is critical in optimising the quality and monetisation of those services. Audience measurement provides a rich set of raw data regarding traditional and emerging personalised IPTV services.

The application of analytics to audience measurements (audience analytics) provides service providers with valuable insights. Specifically, these insights can generate value in the following five areas:

1. Consumer product design / planning: e.g. packaging/bundling, pricing, functions/features
2. Business product design / negotiations: e.g. media delivery, advertising, carriage fees, ad sales, channel positions
3. Competitive service offering: e.g. service personalization, content recommendation, targeted advertisements
4. Operational optimization: e.g. channel-line up, bandwidth allocation, equipment life-cycle, staffing
5. Customer relationship management: e.g. cross-sell, up-sell, retention (churn reduction)

Audience analytics can be usefully combined with other analytics used by service providers to enhance services. Two examples of service enhancements are:

Example 1: Combining audience analytics with network analytics. Consider that a network has QoS issues in multiple locations, by correlating these locations with viewer engagement by time and location, the impact of the network QoS issues on viewers can be understood. The answer to the question of how many viewers leave channels following high error rate across locations can then be used to prioritize the schedule for remedial action across those locations.

Example 2: Combining audience analytics with recommendation engine analytics. Audience measurement provides the raw data for recommendation engines. It can also be used to improve recommendation engine quality based on feedback to see how often a viewer chooses to accept a recommendation and then how much of a recommended show they actually watch.

In addition, output data can generate value to service providers through barter / sale to third parties such as listed below.

4 Values of audience measurement for non-service providers

The information from AM provides additional benefits in comparison to traditional audience measurement approaches. The most important of which include: a larger audience population sample, more detailed engagement metrics, and passive data collection.

Examples of the diverse use cases to which AM information provides value include:

1. Content Providers:
 - Content creation and optimization e.g. actors, interactivity, duration, metadata
 - Windowing optimization
 - Pricing/licensing
 - Aggregated data products
 - Insight products
2. Market Research
 - Aggregated data products

- Insight reports e.g. ads - channel, location
- 3. Networks/Programmers
 - Content selection
 - Optimize content and promo placement
- 4. Advertiser/Agency
 - Ad Placement
 - Target audience segments
 - Return on Investment
 - "Creative" optimization
- 5. Data Processors
 - Aggregated data products
 - Insight reports

5 What is measured

AM measurements include the collection of "raw" behavioural information (channel change, mute, etc.) and contextual data (location, device, etc.) plus viewer voluntary information (interests, etc.) from viewers' STBs, TVs, PCs, smart phones, and other devices.

Viewer behaviour and context are measured by detecting events and periodic sampling of information. Event detection and reporting is the primary method expected to be used. Periodic sampling is useful when events are not detected and reported or summaries of events are wanted.

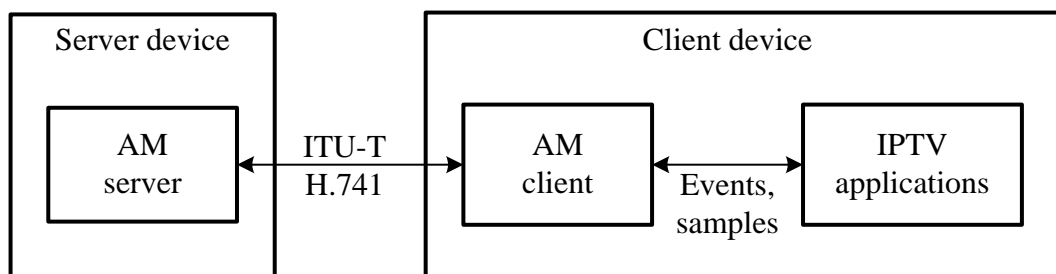


Figure 1: AM Architecture

6 Events

Up to thirteen types of events may be configured to be measured and reported, every report includes Subscriber ID, Terminal ID and the time that each report was generated plus event specific information. The events are as follows:

- **Audio Focus** – Indicates that the audio source from among multiple concurrently displayed "windows" has changed, which reports the instance of the channel which now generates audio.
- **Audio Language Change** – Indicates that a viewer has changed the audio language, which reports the new language and the instance of the channel playing.
- **Audio Volume** – Indicates that a viewer has changed the audio volume, which reports the direction of volume change, mute or un-mute, and the instance of the channel playing.

- **Caption Language Change** – Indicates that a viewer has changed the caption language, which reports the new caption language and the instance of the channel playing.
- **Configuration Change** – Indicates that a viewer has changed their device's configuration or capabilities, which reports the AM capabilities supported by the viewer device, information related to a TV device, and related to an audio system if connected to a STB.
- **Display Status** – Indicates a change in the viewer device display status, which reports on or off.
- **Linear Channel Start** – Indicates that a linear TV channel has started to be played, which reports the device type and method used to navigate to the channel, identifies the instance of the previously viewed channel, the instance of the channel which starts to be played, and the display mode (mosaic, PIP, etc.).
- **Linear Channel Stop** – Indicates that a linear TV channel has stopped being played, which reports the device type and method used to stop the channel, and the instance of the channel which stops being played.
- **Viewer Change** – Indicates a change in viewer(s) currently thought to be present at a viewer device e.g. TV, which reports either actual or anonymous viewer IDs, and the method and confidence of determining presence.
- **Viewer Info Change** – Indicates that a viewer has changed their personal information, which reports either actual or anonymous viewer IDs, controlled information, and generic information.
- **Video Obscure** – Indicates that the obscuration of a displayed "window" has changed, which reports the percentage of obscuration and the instance of the channel obscured.
- **Video Resize** – Indicates that a viewer has collapsed or expanded a displayed "window", which reports image size, and the instance of the channel resized.
- **Video Zoom** – Indicates that a viewer has changed the zoom factor of a displayed "window", which reports the zoom factor and the instance of the channel zoomed.

7 Samples

Up to eight types of samples may be configured to be measured and reported, every report includes Subscriber ID, Terminal ID and the time that each report was generated plus sample specific information. The samples are as follows:

- **Channel Playing** – The channel currently playing, that reports unique name and instance of the channel being played.
- **Device Info** – Information about the viewer's devices e.g. mobile, TV, STB, audio system, and PC, which reports manufacturer, model and serial number.
- **Event Count** – The number of events which occurred during a program or period, which reports the count of selected events, start time and instance of the channel being played.
- **Generic Viewer Info** – Un-controlled (generic) viewer information, which reports either actual or anonymous viewer IDs, and generic viewer information (defined below).
- **Location** – Viewer device's geographic location, which reports latitude and longitude
- **Viewer Bio Info** – Controlled viewer information, which reports actual viewer ID, and controlled viewer information (defined below).
- **Viewer List** – The list of viewers currently thought to be present, which reports either actual or anonymous viewer IDs, and the method and confidence of identifying viewers.

- **Viewer Present** – Whether any viewer is currently thought to be present, which reports the method and confidence of determining that a viewer is present, and the last detected presence time.

8 Viewer Privacy

A rich viewer consent model is integral to AM, which allows AM to honour viewer's policies. Without a viewer's affirmative consent to measure, only reporting the existence of a device is allowed. The consent model includes three fundamental choices for viewers named "permission levels", which dictate what information may be measured and reported by AM. The terms "controlled" and "generic" used below are defined as:

- **controlled information:** A classification of viewer information that can be used alone or easily in combination with other information to uniquely identify, contact, or locate a viewer or subscriber.
- **generic information:** includes info such as some demographics (race, income, disabilities, education, home ownership, and employment status) and psychographics (interests, activities, opinions, attitudes, and values).

To support flexibility and extensibility, the specific information allocated to each information class is not defined in the standard. The way that information of each class is handled is.

The three permission levels which allow successively increasing scopes of measurement and reporting are:

- **Permission level 1:** Only viewer distinguishability (supported by the use of anonymous identifiers) from other viewers.
- **Permission level 2:** Viewer distinguishability and generic viewer information.
- **Permission level 3:** Identification, controlled and generic viewer information.

Additional viewer choices for viewers are expressed in a "permit", which further restricts AM by specifying restricted content genres, and the channels and viewer devices which may be measured and reported upon.

Lastly, viewer policies to allow measurement and reporting may be set to expire after some time.

9 Next Steps

The ITU-T H.741.x series of Recommendations (see References) defines a foundational platform for audience measurement of IPTV services. They focus on the interface and messages between clients and servers.

The AM platform integrates a method for viewers to report personal information, and is designed to easily add time-shifted and interactive services, and non-viewer 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.

Early deployment of pre-standard version of AM within an IPTV service provider has proven that a lightweight, time-shifting extended implementation may be easily developed and deployed. Feedback from this deployment was used to improve the standard.

The suggested next steps are for stakeholders to:

1. Evaluate the published Recommendations
2. Develop implementations
3. Deploy solutions

And to provide feedback after any of the above steps to ITU-T to further develop the Recommendations. For example, after gaining experience with deployments, definition of a set of AM capability profiles as a short-hand way to identify sub-sets of capability options for devices would be useful. These would make it easier for vendors, integrators and service providers to understand product capabilities.

Furthermore, since widespread industry adoption of any particular standard cannot be guaranteed, it is recognised that parts of these Recommendations may be helpful to the efforts of other standards development, their leveraging of ITU-T H.741 material is encouraged.

Appendix I: How it works

The AM solution can be viewed as having a Client-Server architecture, where the server configures the clients, then the clients reports to the server until told otherwise. Following the principle of providing a "large toolkit", some of these tools were developed into "Swiss army knives" – having many options available summarised below. The standard includes guidance to help implementers choose among options. This section details the major operational features of ITU-T H.741. Details of messaging, data structures, transport mechanisms and protocol considerations, examples, plus more can be found in the references provided.

I.1 Privacy Permission Modes

The two responsibilities to (1) collect viewer privacy policies, and to (2) ensure that they are followed, can be allocated between an IPTV Service Provider and an Audience Measurement Service Provider. Local filtering at clients may prevent the reporting of certain information honouring viewer privacy policies. Servers may choose how they configure clients based upon those policies. ITU-T H.741 supports three permission modes:

- **Internal permission mode:** In this mode, an AM service provider is responsible for obtaining permits, and responsible for using those permits. Permits are created at clients and may be made available to other clients. The client may use the permit for local filtering, or send it to the server to filter configuration packages.
- **External permission mode:** In this mode, an IPTV service provider is responsible for obtaining permits, and responsible for using those permits. It relies upon viewer permissions being managed external of AM. No viewer permits are used at clients.
- **Hybrid permission mode:** In this mode, an IPTV service provider is responsible for obtaining permits and an AM service provider is responsible for using those permits. The client requests the permit from the service provider system, and may use the permit for local filtering, or send it to the server to filter configuration packages. Permits are delivered to a client from the IPTV service provider.

I.2 Configuration Modes

Clients are configured by servers to provide instructions regarding measurement and reporting. The client configuration by servers specifies what, how and when measurements and reporting are to occur. The configuration includes which services (e.g. channels) are to be measured, the measurement schedule, which events and sample values are to be measured, and the measurement report message delivery schedule. It also specifies how and when measurements are to be triggered, which report delivery modes to use, which reporting modes to use, and which reporting options to use. Configuration also includes special multicast support options to address groups of devices. AM Service Providers can use configuration to avoid measurement of "sensitive" content to help motivate viewers to grant higher permission levels.

Following the "toolkit" principle, configurations may be for immediate or future execution, and may be transferred from the server to client using three modes:

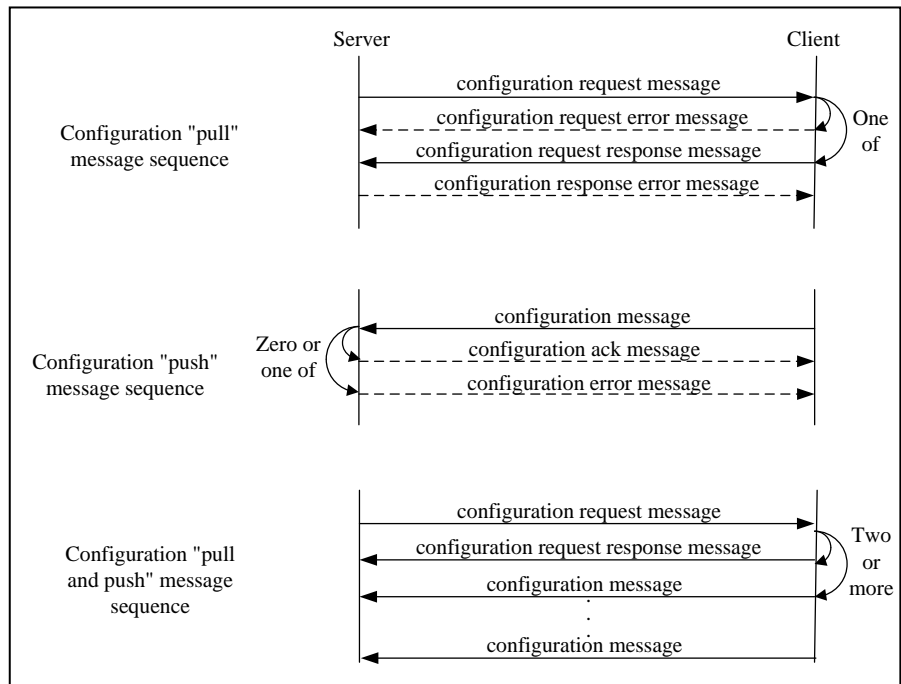
Pull configuration mode: In this mode, clients individually send requests to the server to check and conditionally receive a new configuration. Requests are sent periodically or upon detecting certain situations.

Push configuration mode: In this mode, servers send configuration packages to clients. Servers may obtain information regarding clients that are online from other IPTV services.

Hybrid (push and pull) configuration mode: In this mode, clients individually

send requests to the server to check and conditionally receive a new configuration package. Subsequently a server may send new configurations to clients, alleviating the need for further client requests.

In ITU-T H.741, messaging between servers and clients is by configuration and reporting messages sequences (Dotted arrows indicate conditional messages).



I.3 Measurement Triggers

Three types of triggers that cause when these measurements to be made are:

- **Event Trigger:** A configured viewer initiated event triggers event measurement.
- **Time Sample Trigger:** A configured schedule of a sequence of sample times triggers sample measurement.
- **Service Start Sample Trigger:** A configured schedule of service delivery start times triggers sample measurement.

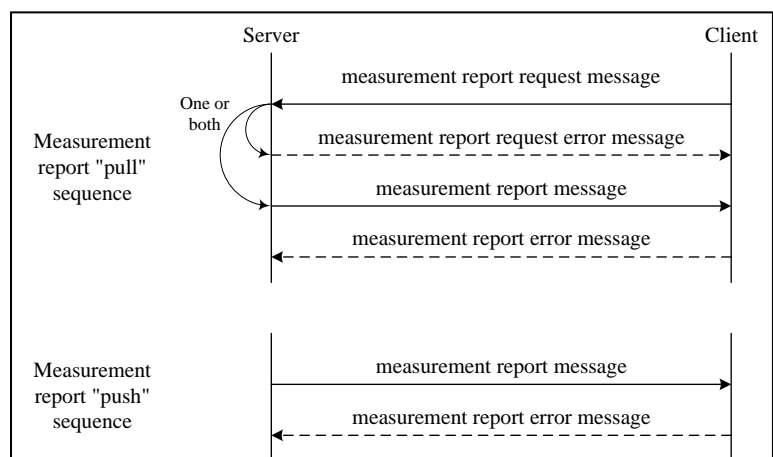
I.4 Report delivery modes

Immediate Push Mode: When a measurement is made, it is optionally grouped with a number of other measurements within a period of time before being sent to a server.

Delayed Push Mode: Measurements are stored within a client until a client randomly picked time during a configured delivery window is reached. At that time the client groups measurement reports and sends them to a server.

Pull Mode: Measurements are stored within a client until a request is received from the server. This request causes selected measurements to be grouped before being sent to a server.

A configured policy indicates what the client does in case of storage congestion.



Delayed Push and Pull Mode: Measurements are stored within a client until either a request is received from the server, or a client randomly picked time during the configured delivery window is reached. Whichever trigger is sooner causes measurements to be grouped before being sent in a measurement report package message.

Pull and Push reporting messaging sequences are as shown (Dotted arrows indicate conditional messages).

I.5 Reporting options

Summary and filtering of reports is supported as follows:

- Suppression of duplicate reports
- Distance thresholds in movement of location are used to filter mobility reporting
- Reporting of multiple up/down arrow functions used in channel navigation is suppressible

I.6 Multicast options

Following the scalability principle, AM supports application-level multicast and network-level multicast in order to more easily handle very many clients. Sub-sets of clients can be configured to respond with acknowledgements and error reporting, which will allow better understand the health of an AM system and the client population. Sub-addressing of target clients addressed by multicast is supported by four mechanisms.

Range sub-addressing: This feature adjusts the size of the sub-set of the responding clients. It may be used for network congestion avoidance as the number of clients grows. A client accepts a configuration only if a local random number falls within a configured range. Multiple configuration messages with different ranges can optionally be used to uniquely configure multiple sub-sets of clients.

Device type sub-addressing: Specifies the viewer device type(s) which are to process the configuration.

Viewer info sub-addressing: Specifies that a match between information in the configuration and voluntary viewer provided information occur in order for the client to process the configuration.

MAC addresses sub-addressing: Specifies the MAC addresses of the clients which are to process the configuration.

I.7 Security

Security is a design principle of the audience measurement system, and is detailed in ITU-T H.741. Summarising the key aspects:

- Clients and servers are required to authenticate each other directly or indirectly via a third-party.
- Confidentiality requires that all unicast AM messages are encrypted. All multicast AM messages are recommended to be encrypted.
- The integrity of every AM message is protected by having its own expiration time. Every multicast message also has its own cryptographic digest and a digital signature.
- Privacy as described above, provides viewer control over what is allowed to be measured and reported by clients. The server has the responsibility to filter privacy-related information prior to sharing with third parties.
- Non-repudiation for client AM reports is provided by the inclusion of signatures.

References

- ITU-T H.741.0 (03/2012), *IPTV application event handling: Overall aspects of audience measurement for IPTV services.*
 - ITU-T H.741.1 (06/2012), *IPTV application event handling: Audience measurement operations for IPTV services.*
 - ITU-T H.741.1 (06/2012) Amendment 1 (01/2013), *IPTV application event handling: Audience measurement operations for IPTV services: New Appendices VIII and IX with XML schema on audience measurement service discovery.*
 - ITU-T H.741.2 (06/2012), *IPTV application event handling: Data structures of audience measurement for IPTV services.*
 - ITU-T H.741.2 (06/2012) Amendment 1 (11/2013), *IPTV application event handling: Data structures of audience measurement for IPTV services: New Appendix I with XML schema on the data structures of audience measurement for IPTV services.*
 - ITU-T H.741.3 (06/2012), *IPTV application event handling: Audience measurement for IPTV distributed content services.*
 - ITU-T H.741.4 (06/2012), *IPTV application event handling: Transport mechanisms for audience measurement.*
-