Standardization Trend for IPTV audience measurement

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Along with increasing availability of broadband, IPTV (Internet Protocol TV) services, which use IP to stream videos and provide other contents, have begun to spread across the world. Commercial service is already available in Japan with over 1.4 million subscribed users, and membership is growing by several hundred thousand users each year[1]. Initially, IPTV offered basic service that included linear TV and VOD (Video on Demand). Linear TV uses the IP network to stream TV programs, which were conventionally broadcast over the airwaves. VOD allows the viewer to control programs in a way similar to videos recorded at home starting and stopping programs over the IP network as the viewer wishes. In recent years, a variety of new services have emerged such as start-over service that allows the viewer to stop a program and restart it from the beginning; streaming service to smartphones, tablets and other mobile devices; and service integrated with electronic commerce.

In order for IPTV to spread further, the end users need to be provided with an easier way of seeking out content they desire from among the vast video contents that are available. To do so would require the use of audience information such as what kind of contents a user has viewed. Applications that use such information include audience ratings reported in the news that indicate the popularity of programs. Unlike traditional broadcasting, IP communications technology used in IPTV makes it easier to collect information about what contents users has viewed, when it was viewed and how often it was viewed.

However, the user's viewing habits are personal information, and service providers that collect such information for the purpose of new services must have the consent of the user and treat the information with utmost security. To promote services that deal with this important information, ITU-T has undertaken the standardization of IPTV audience measurement ensuring security issues are fully addressed. This article presents an overview of IPTV audience measurement, standardization trends[2] and OKI's initiatives.

Importance of IPTV Audience Information

Audience surveys of traditional broadcasted programs required special information collecting equipment in homes of carefully selected sample audiences. With IPTV, special equipment is not required since terminals are already connected to the network. Information can be obtained by implementing collection and transmission functions into the IPTV terminals. IPTV audience information mentioned here is program independent referring to information about the actual audience (user information) and that audience viewed contents (viewing history). IPTV audience measurement has the following characteristics.

(1) Collect large volumes of user information

If the information collector has sufficient equipment, information from all IPTV users can be obtained. Furthermore, terminals can be classified according to user attributes enabling information to be collected from users belonging to a particular audience segment.

Determining how many users view which content is critical to service providers for selecting future contents. If advertisement is to be streamed along with content, advertising rates can be changed depending on the number of users. Information about each audience segment is also important for targeted advertisements.

(2) Collect detailed information on IPTV terminal operations

More than information regarding which programs and contents were viewed, but information about fast-forwarded VOD or viewing stopped in the middle of the program can be collected. If the user terminal is closely linked with a TV, volume changes or zoom-ups during certain parts of the program can also be detected.

Such information is useful for content (program) producers in creating contents that can be viewed without extra operation from the user.
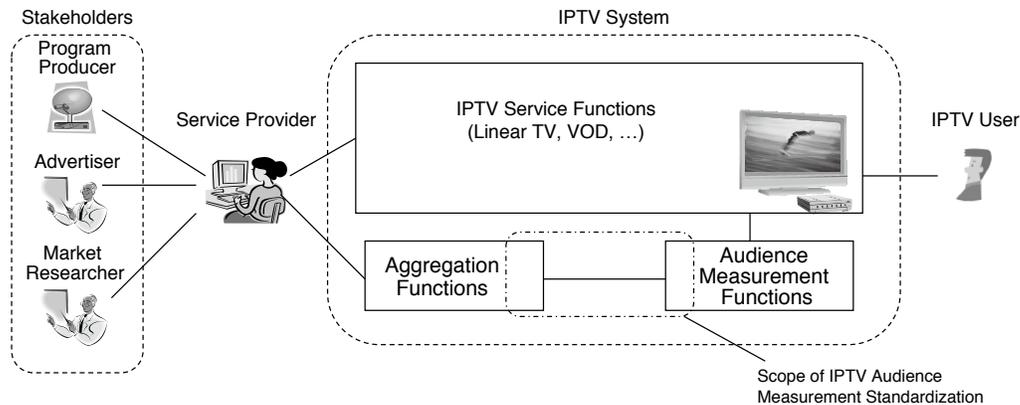
Figure 1. Flow of IPTV Audience Information

(3) Collect IPTV information for other services

When an error occurs in the communication channel, the time and information of users at that time can be used to see how many users switched channel/content and measure other degrees of impact the error had on service. Additionally, the user's selection of contents can be used to recommend contents to other users who have made similar choices.

The first type of information is vital for network operators while the second information would be useful for IPTV service providers in providing content recommendation services.

Scope of Audience Measurement Standardization

To tap the potentials of user information for application in an IPTV system, the following functions are required.

・ Function to measure user information
・ Function to collect and process the measured information for use by stakeholders

The first function is referred to as the Audience Measurement Function and latter as the Aggregation Function. Relationships between the IPTV user, the two information collection functions and stakeholders are shown in **Figure 1**. Due to the variety of possible applications, standardizing the Aggregation Function for each application is currently considered too difficult a task to undertake. Therefore, scope of IPTV audience measurement standardization is currently limited to the interface between the Audience Measurement Function and Aggregation Function.

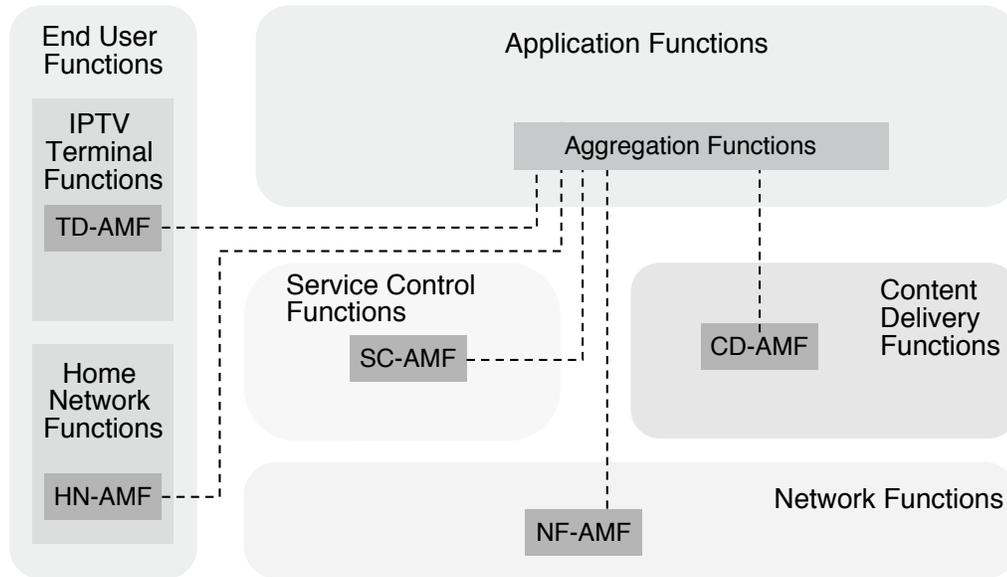## IPTV Architecture Including Audience Measurement

IPTV architecture has already been standardized by ITU-T and appears in Recommendation ITU-T Y.1910. Collection of user information requires an Audience Measurement Function and an Aggregation Function. Measuring IPTV user's selection of contents/channels is not limited to the IPTV terminal (STB or STB-equipped TV), but can be performed at various locations. Possible locations of the Audience Measurement Function (AMF) appear as XX-AMF (XX is TD, etc.) connected to the Aggregation Function with a dotted line in the IPTV architecture (**Figure 2**). AMFs placed in locations other than the IPTV terminal is described below.

Channel selections of linear TV that are streamed using multicast technology can be measured at the home gateway or router as part of the multicast protocol. That is, the AMF can be integrated into the Home Gateway or Network Functions.

When viewing VOD, content selection is sent from the IPTV terminal to the VOD server, which is part of the Content Delivery Functions, and then VOD server delivers the selected content. Therefore, VOD audience measurement can be part of the Content Delivery Functions. Likewise, measurement of various application services selected from the IPTV terminal can be placed with the Service Control Functions.

Permission to Allow Audience Measurement

In performing IPTV audience measurement, giving the user a choice to simply permit or not permit collection of all channel/VOD viewing history is insufficient to receive user consent. For example, users might wish place a time

TD-AMF : Terminal Device Function-Audience Measurement Function
HN-AMF : Home Network Function-Audience Measurement Function
SC-AMF : Service Control Function-Audience Measurement Function
NF-AMF : Network Function-Audience Measurement Function
CD-AMF : Content Delivery Function-Audience Measurement Function

Figure 2. IPTV Architecture Including Audience Measurement[2)]

restriction allowing measurements to be taken only during periods when children are primarily making channel selections and forbid measurements at other hours. From such consideration, work to standardize specifications for indication of audience measurement permission is underway.

User Information Privacy Levels and Provided Services

IPTV user information is personal information that can be used for variety of services as described above, and naturally it must be handled in accordance with the privacy laws of each country. In the IPTV audience measurement standard, user information is divided into privacy levels and provided services for each level are indicated. That way, service providers needing to access user information to actually implement service will not handle sensitive information more than is necessary. Privacy levels are shown in **Table 1**.

Level 1 grants access to user's viewing history but do not allow use of identifiable user information. Only anonymous information is available at this level, however audience ratings can be collected to measure content popularity. At level 2, access is granted to user attributes. Attributes include age, gender, family structure and region the user resides. This information along with user's viewing history can be used to determine the primary audience of a particular program. If majority of a program's viewers are women, advertisement broadcasted together with the program can be geared toward women, thus enabling segmented advertising. User identifiable information

Table 1. User Information Privacy Levels and Service Examples

	Level 1	Level 2	Level 3
User Information Permitted	User's viewing history only. (No user identifiable information)	Viewing history and anonymous user information. (User attributes)	Viewing history and user identifiable information. (Name, email, etc.)
Example Data	Channel 228 was watched from 15:00 to 15:30 by an anonymous user on terminal type "003".	Channel 228 was watched from 15:00 to 15:30 by a female user on terminal type "003".	Channel 228 was watched from 15:00 to 15:30 by user John Smith (email: js@aaiptv.net) on terminal type "003".
User Permission	Required	Required	Required
Threat of Personal Information Leak	Low since there is no user identifiable information.	Same as left.	High since user identifiable information is present.
Service Example	Contents ranking (Audience ratings service)	Segmented advertisement	Direct advertisement

including name and email address is accessible at level 3. Information available at this level can be used with the user's viewing history to provide direct adverting.

There are two points of importance here. First, level 3 access is not always necessary. Even at level 1, the use of IPTV user information enables collection of accurate large-scale information compared with what can be achieved from audience ratings of traditional TV. Second, information available at level 1 is still personal information, and user consent is required according to each country's privacy laws before information is collected.

Audience Measurement Messages and Transmission Timing

Audience measurement message consists of configuration messages that indicate what information to measure and reporting messages used to send the measured results to the Aggregation Functions. Information included in configuration messages are (a) which service to measure; (b) when to measure; (c) what to measure; (d) when to report; (e) how to report; (f) how to handle exceptions.

Reporting messages are created according to the configuration messages and sent to the Aggregation Functions. When collecting information from the Audience Measurement Functions, simultaneous transmissions of messages will congest the network or place heavy loads on the Aggregation Functions. Therefore, the transmission timing needs to be different for each terminal.

Standardization Roadmap

Measurement and collection of IPTV user information are functions related to all IPTV services. Besides the basic linear TV and VOD content delivery services, viewing on personal recording devices, viewing contents on mobile devices, TV based services such as electronic commerce, various information services, education services and medical services are also included in ITU-T's IPTV service scope. However, some services such as medical services themselves are not fully standardized, therefore handling of user information related to those services cannot currently be standardized. Thus, ITU-T plans to proceed with user information standardization according to the evolution of IPTV services. Initially, ITU-T is modeling functions for the STB, TV and other IPTV terminals to measure linear TV user information. The first version is targeted for completion by the end of the study period in 2012.

IPTV User Information Standardization and OKI's Initiatives

OKI considers IPTV user information to be a valuable part of a technology that will make IPTV services more user-friendly. A prototype of an audience measurement system has been developed and functional verification has been performed. Based on the lessons of prototyping, OKI is working on the standardization in ITU-T. In particular, proposal was made to divide privacy levels as shown in **Table 1** and required the specifications place emphasis on protecting the user's personal information.

As described in this article, the use of IPTV user information will give birth to services such as presentation of popular contents and recommendation based on user preference that easily guide users toward contents they wish to view. Meanwhile, along with the popularity of SNS (Social Network Service), new usage pattern is appearing where the viewers themselves disclose their viewing history leading to contents being enjoyed by several viewers. In the future, linking SNS service with utilization technology of IPTV user information will likely create new services that make IPTV even more enjoyable. Through the technology mentioned in this article, those new services can be used confidently without unnecessarily disclosing viewing history.

OKI will continue to promote standardization including those new services to achieve a safe audience measurement system and provide standard-compliant[3] products.　　　　　　　　　　　　　　　　　◆◆

■ References

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