Techniques for Utilizing Metadata in IPTV

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Abstract

We introduce some services for IPTV (Internet protocol television) that make effective use of metadata and overview the technologies that support them. As examples, we consider time-shift viewing facilitated by metadata and a service that delivers metadata by email to mobile phones.

1. Introduction

With the spread of technologies such as digital broadcasting, there are growing opportunities to implement services that connect between and integrate broadcasting and communications. The NTT Group is taking an active interest in services and systems for IPTV (Internet protocol television). We have long been involved in the study of technologies related to IPTV as a media distribution service [1], and we are currently studying IPTV services that are implemented based on these technologies.

IPTV is a video delivery service that uses an IP network. It can be implemented in an IP broadcast (IP multicast) mode where the TV programs to be broadcast are scheduled in the same way as in current TV broadcasting and viewed by many people at the same time or in a video-on-demand (VOD) mode where individuals can view whatever they like, whenever they like. With the continued expansion of broadband networks and changes in the content supply environment, the amount of content provided by these services is expected to grow significantly. Furthermore, due to the diversification of terminal equipment, there is a growing trend towards "one source, multi-use" delivery models, which present information from a single resource in various different ways. For example, broadcast video content can be delivered in a VOD service or converted for delivery to mobile phones. These trends are resulting in an increase in similar items of content and in the number of content items, so it is becoming harder for viewers to obtain the content they want. To resolve this problem, it is essential to promote the transition to IPTV services from existing TV with its simple operations.

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2. Use of metadata

To address these issues, users must be offered features that allow them to search for content efficiently. For example, these features could include program searches based on keywords or genres and the delivery of recommendations based on user preferences. Metadata plays an important role in implementing such features. It allows users to search programs in flexible ways and obtain detailed information about them, thereby making IPTV services more enjoyable and user-friendly.

Although many different types of metadata are used in IPTV services, such as delivery control metadata and digital rights metadata, the types that the viewer deals with are program information metadata and segment metadata.

Program information metadata includes information about the contents of a program, such as the title, synopsis, keywords, genre, credits (performers,

director, etc.), broadcast time (delivery period), and delivery route (channel). This metadata can be used in various different aspects of IPTV services but is mainly found in electronic program guides. An electronic program guide's program listings can be presented in various different ways. Since broadcast services have fixed schedules, they tend to present this information in the form of program listings ordered by broadcast time with a separate column for each channel. In VOD services, on the other hand, this information is often displayed by genre instead.

Segment information metadata [2] is a subset of program information metadata that records information about the scenes within a program. It is associated with each scene interval within a program, such as separate items in a news program. This segment information metadata can be used as chapter data in VOD services or data broadcasts that run concurrently with programs, allowing users to search for and watch selected scenes of the program.

In this article, we introduce some services that utilize program information metadata and segment information metadata as a means of using IPTV services more effectively.

3. Advanced time-shift viewing

3.1 Overview

An advanced time-shift viewing service lets viewers get more out of programs by providing additional information on demand. For example, a viewer that has missed the start of a live baseball game can catch up by viewing content such as a summary of the game played so far and selecting particular players or scenes up to that point before actually watching the live broadcast in real time.

This is made possible by live (segmentation) metadata updates that provide realtime links from a live broadcast program to its associated on-demand content, derived from the original live broadcast through storage on the network or on the viewer's digital video recorder. A live metadata updating service is a delivery service that uses an IP network to deliver live programs such as sports events and news programs with additional time-varying scene information represented in the form of segment information metadata. In digital broadcasting, it is possible to use data services that display information on the screen together with the broadcast video. It is thus possible for receivers to receive the latest segment information metadata and present it on the data broadcast screen.

An example of a screenshot from a live metadata broadcast is shown in **Fig. 1**. In addition to the live video picture, the viewer is presented with a list of scenes summarizing each batter's performance. In this example, each visit to the batter's box is defined as a single segment. As the baseball broadcast progresses, the number of completed batting visits increases. Therefore, the list of titles at the left side of the screen in Fig. 1 changes as the game progresses. By allowing viewers to sort this list by content (e.g., by strikes or points scored), by batter's name, or in some other way, the system lets them easily find the scenes they want to watch.

While scene summaries alone provide some indication of how each batter has performed, the user can see actual footage, such as highlight scenes from the game, by using the segment section information in the segment information metadata to play back the corresponding scenes by VOD delivery.

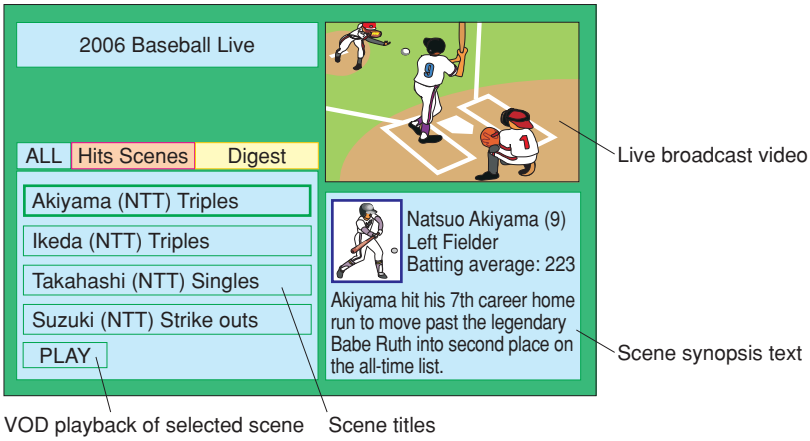

Fig. 1. Advanced time shift viewing service.

3.2 Live updates of metadata for advanced time-shift viewing

The configuration of a system for implementing advanced time-shift viewing is shown in **Fig. 2**. This system consists of a metadata generation unit and a metadata delivery unit.

(1) Realtime generation of metadata

Image recognition and speech recognition can be used to reduce the operator workload and generate segment information metadata semi-automatically. This makes it possible to produce the segment information metadata more efficiently and in real time.

(2) Realtime delivery of segment information metadata updates

The generated segment information metadata is kept on a metadata delivery server. This delivery server converts the metadata into a form suitable for data transmission and uses it to periodically refresh the data broadcast screen so that a data broadcast screen incorporating the latest metadata is delivered to the viewer's TV.

4. Metadata email for mobile phones

4.1 Overview

Following the start of "one-seg" (one segment) services broadcasting TV programs to mobile terminals based on the ISDB-T (integrated services digital broadcasting terrestrial) standard, there has been considerable growth in TV audiences using mobile terminals such as mobile phones. Since mobile phones have small screens, they are expected to be increasingly used not as a means of viewing high-quality video content but as a means of occupying spare moments by searching for information and content that the viewer can enjoy later on a large-screen TV back at home. Consequently, for services targeting mobile users, it is useful to include not only the ability to view metadata content but also functions for searching and bookmarking content and transmitting the search results and bookmarks to the TV in the home. Metadata email is a service that facilitates this metadata browsing and communication with TV at home. The service is outlined in **Fig. 3**.

Metadata email basically involves delivering the metadata itself to a mobile phone, where it is read in by

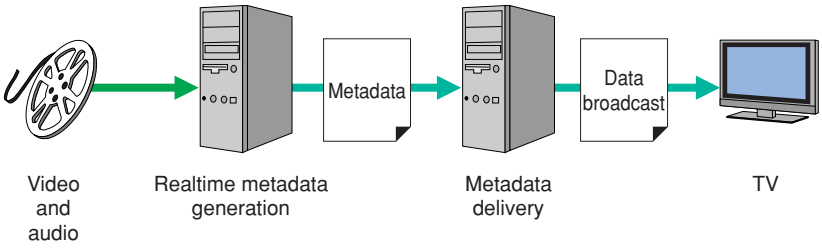

Fig. 2. Advanced time-shift viewing metadata delivery system.

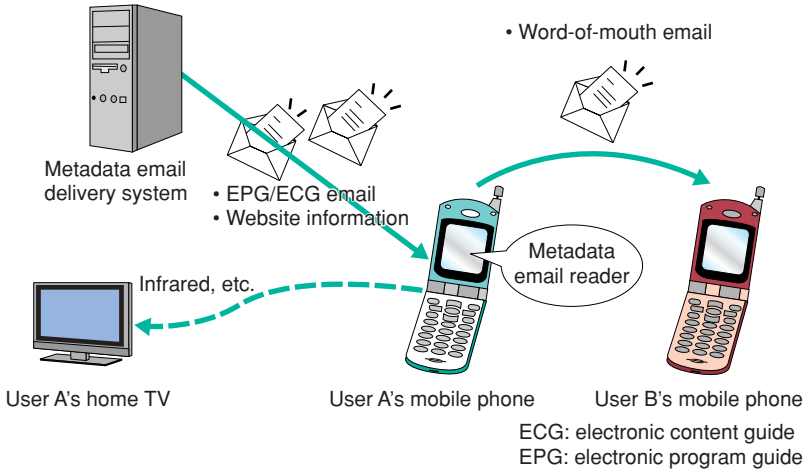

Fig. 3. Concept of the metadata email service.

specialized software that displays the detailed contents of the metadata in graphical form. Using images and multiple screen transitions, it offers a richer display of information than ordinary plain text or HTML email. It also supports functions such as ones providing program timers, recording timers, and bookmarks and the viewing of short clips such as movie trailers. Since detailed information is also delivered along with metadata email, it is possible to display large amounts of information by switching the screen without having to engage in communication. Consequently, it can be enjoyed even in places such as subways and remote locations where it is not possible to get a strong enough signal. It is also possible to use the positional data notification functions of mobile terminals to send information related to the user's current location, allowing the user to obtain information in a timely fashion. The metadata email concept is illustrated in **Fig. 4**.

The metadata email service supports the following functions:

(1) Displaying recommended program

Program information is displayed with still images and the contents of the metadata. The displayed information includes the program titles, synopses, and thumbnail images. By clicking a button for further details, the user can see more information on a separate page, such as scene information and video clips.

(2) Web browsing

Users can access websites that are linked to program-related websites and the like.

(3) Timer/alarm

By clicking on the timer button, users can set up timers to record programs or reminders to warn them before the start of a program they want to watch. Since mobile phones have no recording capacity, the timer function sets a recording timer on the video recorder in the user's home by communicating via email (for remote control from a distance) or infrared communication (for remote control within the same room).

(4) Word-of-mouth email transmission

This function enables users to send their friends information about programs and websites they learned about through metadata email. It can be used to pass on recommendations to a friend or to provide something he or she has been looking for. Receiving such information by email is convenient for users because it saves them the effort of actively seeking it. Email content can be individually tailored by using the user's attributes and positional information. Furthermore, by synchronizing the user information in the home terminal with the user information at the remote location, the system can provide users with personalized information even when they are away from home.

4.2 Metadata email delivery control system

The metadata email delivery control system comprises three subsystems: the attribute exchange system, metadata email delivery system, and metadata email reader. These are described below.

(1) Attribute exchange system

The attribute exchange system allows the exchange of personal metadata such as account information, preferences, and personal profiles, which we call here

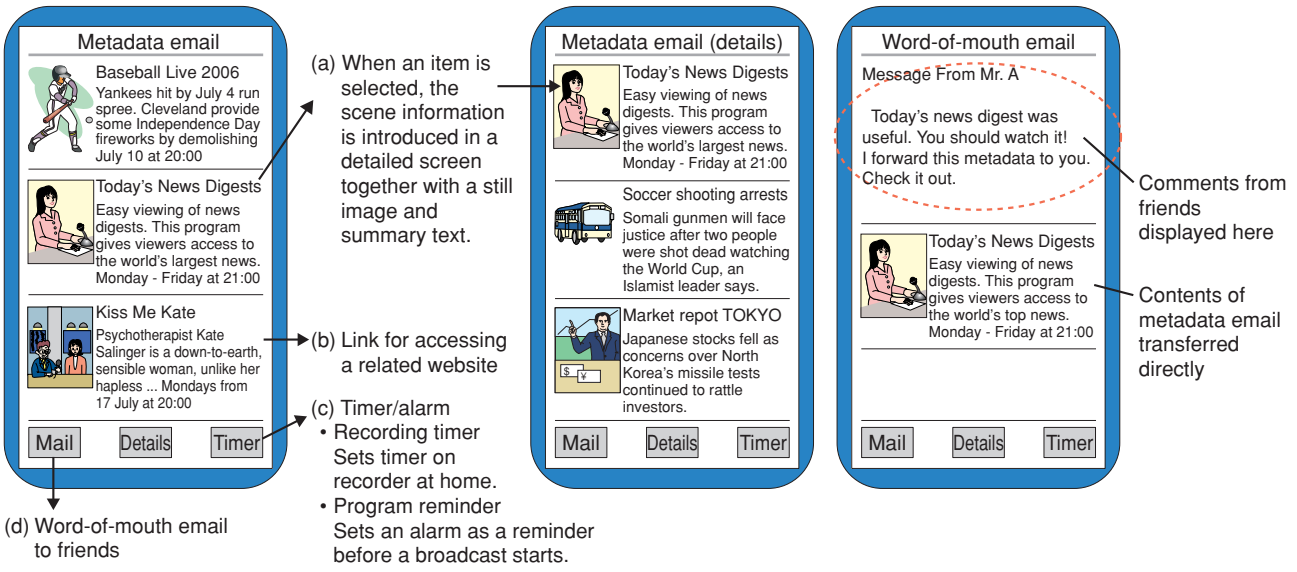

Fig. 4. Metadata email.

user attributes, between service providers in a trusted and secure manner.

The management of user accounts is performed on a per-provider basis and the user information held by a service provider is not usually shared with other service providers, especially because of security and privacy concerns. But there are many services where the sharing of user information is beneficial not only to users but also to service providers. Credit card information and frequent flyer mileage points are two such examples of the types of information that can be shared among service providers to the benefit of users. Our system enables the exchange of such user attributes with mutual trust between service providers who agree to join together in order to exchange user attributes based on the protocol provided by our system. This circle of trust contains a function called "identity provider" for maintaining and managing identity information and another called "attribute provider" for processing, managing, and maintaining user attributes. In our current application domain, the user attributes comprise information about the user's preferred programs and viewing history as well as other service-specific data.

Suppose, for example, that a service provider of video content delivery and a service provider offering a data service to mobile phones belong to a trusted circle, each with its own user accounts and databases, and that a customer is subscribing to both services. The customer may well use different user ID's and passwords to access these two service providers. Our system allows the customer to have the data about his preferred programs and most viewed content, which is stored by the video service provider, shared by the mobile service provider, who has information about the customer's geolocation. The mobile service provider is then able to send to this customer the information related to his preferred topics relevant to his particular geolocation, without exposing confidential information or disclosing the true identity of the customer. This system implements the attribute exchange specifications standardized by the TV-Anytime Forum [3] and the Liberty Alliance [4].

(2) Metadata email delivery system

The metadata email delivery system consists of a delivery timing management function, a recommendation function, and an email creation and delivery function.

(3) Metadata email reader

The metadata email reader can display program information metadata, segment information metadata, and thumbnail images. It also enables the user to view video clips, access related websites, set timers for recording programs and program reminders, and create and send word-of-mouth emails.

4.3 Metadata compression and division

Metadata with segment information and images can become large and bulky. Since mobile phones in particular are limited in terms of the size of a single email and the available storage capacity, it is not possible to transmit large blocks of data by email. Furthermore, it is often inefficient to send metadata, which is coded in XML (extensible markup language), in a textual format by email directly. BiM (binary format for MPEG-7) is a standard for compressing metadata, which allows more information to be provided and more emails to be stored [5]. BiM is promising because it achieves a high compression factor and can be read easily, even by equipment such as mobile terminals that have little processing power. In cases where size limits would still be exceeded even by BiM-compressed metadata, the data is split into multiple transmissions. BiM-compressed metadata can be displayed if BiM decoders are added to mobile phones and TVs [6].

5. Future work

We have described some new IPTV services that utilize metadata. So far, these services have been implemented by adapting technology that has already been studied by NTT Cyber Solutions Laboratories so that it can be applied to IPTV systems. In the future, we will continue to work at promoting the use of metadata and on further developments such as the integration of metadata with other technologies.

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