New Services and Technologies Associated with Metadata

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Abstract

This article presents an overview of new services that could be made widely available by contents distribution businesses through the application of metadata. Technologies supporting these new services and NTT Laboratories' recent R&D initiatives in this area are also described.

1. Introduction

Now that broadband network services have become available and greater amounts and varieties of contents are being digitized, there is a growing need for data that helps people to locate and identify content. "Metadata", which is data about data, indicates what the content represents, where it is located, and other relevant attributes, in much the same way that index cards help people locate books in libraries. Pressure to attach metadata to various contents that can be accessed over networks is growing.

This article introduces some of the services and businesses relating to content distribution that will be created by applying the metadata concept. It also covers some breakthroughs for implementing metadata, technical and market trends relating to metadata services, and the latest initiatives by NTT Laboratories in this area.

2. Metadata elements

To understand metadata, let us consider some of its defining characteristics.

2.1 What does metadata describe?

Metadata elements depend on the media type or usage of the content. To enable them to be shared among people dealing with content, the core set of metadata elements must be standardized. The standardization efforts started in 1995 when "Dublin Core", a workshop held in Dublin, Ohio, defined core attributes of documents on the network. Recently, organizations in various industries have become involved in standardizing metadata. Interoperability between the standards has become a salient issue as industries have converged and their boundaries have faded.

2.2 How should metadata be represented?

One basic choice for representing elements is to use HTML tags. However, they cannot represent grouped or structured elements. On the other hand, Extensible Markup Language (XML) has become popular for representing the structure of random data. Furthermore, the Resource Description Framework (RDF) schema is used for describing semantics.

2.3 What is metadata used for?

Metadata is used for many purposes such as:

(1) Reference data in searching for information.

(2) Reference data describing attributes of components consisting of content in secondary use.

XML has a mechanism called "NameSpace", which enables metadata elements defined as different metadata sets to be processed together, even when the components of the content are synthesized.

(3) Reference data indicating copyright

If copyrights are described as metadata, copyright issues could be resolved much more easily. This

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would prevent illegal use of content and make it easier for users to obtain permission from the copyright holders.

3. Example of metadata

Figure 1 illustrates how metadata might be implemented for an electronic program guide service. Various kinds of metadata are used for different purposes: "program information" is used for searching for programs, "segment information", which describes the attributes of a segmented program, is used for editing content to produce a digest version or for inserting an advertisement between segments, "rights information" is used for processing copyrights, and "user information" is used for billing. Furthermore, "network control information" associated with a program, or user metadata, enables seamless distribution of contents without the user being consciously aware of the network settings, as discussed in section 8.

4. Services created by metadata

Metadata could make content distribution much more efficient and enable value to be added to the content, particularly when distributing video content such as television programs. This is because it is extremely difficult to search the video material itself, and the sheer quantity of such program material is enormous. Traditional TV broadcasting has been presented on TV channels and time slots that were unilaterally determined by the broadcaster. Now a different service landscape is beginning to take shape: Providers may offer electronic program guides that are customized for individual viewers based on their preference or behavior, so viewers can watch what they want and when they want. This could open the way to online TV guides customized for individual viewers (Fig. 2(1)). Metadata could lead to new services that offer:

- The ability to select particular shots taken from various camera angles, such as the feed from cameras mounted on racing cars (Fig. 2(2)).
- Additional information relating to the contents, such as the profiles of the actors or actresses in a drama or information about materials used in the scene (Fig. 2(3)).
- Inducements to purchase other products or services, such as the soundtrack of the movie that the viewer is watching (Fig. 2(4)).
- Targeted advertising based on the user's profile or preferences (Fig. 2(5)).
- Combined billing for multiple services or flexible billing based on user class or commercial policy.

As these services become more widely available, the value of metadata itself will increase. If this value

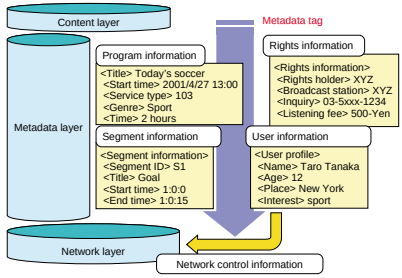

Fig. 1. Metadata example

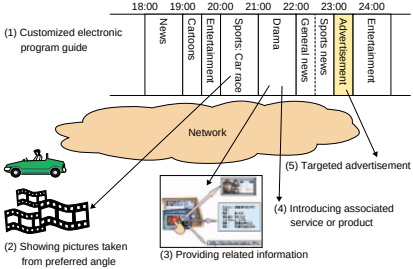

Fig. 2. Services applied by metadata

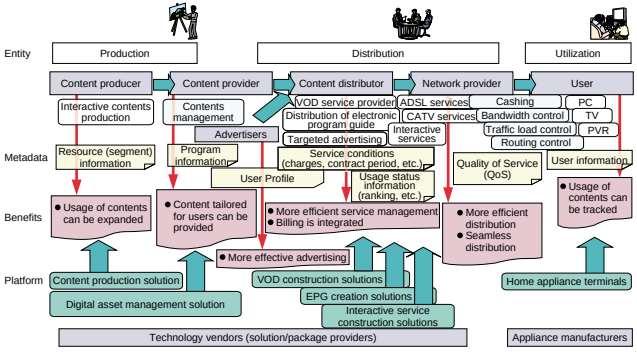

Fig. 3. Metadata value chain model.

exceeds the cost of making the metadata, then new businesses could emerge, and TV and movie guides and free local newspapers could be made available. Figure 3 shows a value chain of metadata, benefits that operators involving in content distribution businesses could gain, and a platform supporting the value chain.

5. Creating new markets

In some cases, the person gaining benefit from metadata may be different from the person generating it. This is one of the issues regarding the metadata value chain. To build up a value chain successfully, the cost of making metadata should be held down. Techniques for generating metadata automatically using voice/image recognition could help reduce costs. Furthermore, sharing metadata as widely as possible could reduce the cost per user. Exchanging ready-made metadata is also effective.

To sustain the value chain, all parties that have stakes in the market (including the contents-holders, the distributors, the system providers, and the consumers) should be able to derive benefits.

NTT Laboratories are consulting with some associates, and pointing out the benefits that can be derived from the metadata value chain. Then we are setting up some services as explained in the article “Implementation Measures to Expand Metadata Application Services” on page 51, which presents examples of metadata generation, applications for the convergence of broadcasting and communications, video portals, a contents guide, interactive services, and service mediation.

6. Standardization and implementation

Recently, a few sets of standardized metadata have actually been implemented. For example, the P/Meta project, led by the European Broadcasting Union (EBU) is aimed at exchanging and sharing their programs among broadcasters in different countries, in different languages [1]. OnTVEurope [2] is conducting a trial to provide an electronic program guide with metadata defined by the TVAnytime Forum [3], by retrieving service information from broadcast stations.

NTT Laboratories are contributing to international forums for metadata standardization such as MPEG-21and TVAnytime, forging global partnerships, and developing a content circulating platform that applies standardized metadata.

7. Technologies supporting these services

NTT Laboratories are actively involved in the development of core technologies enabling metadata-

based services, based on the technological expertise built up so far.

The article, "Framework for Supporting Metadata Services," gives a detailed overview of the core technologies in terms of the generation, distribution, and use of metadata.

On page 62, "Speech and Language Processing for Generating Content Description Metadata for Broadcast News," describes how voice recognition could simplify the generation of metadata.

"Knowledge Sharing Platform Technology for Using Metadata on the Semantic Web," describes a platform for sharing individual data as common knowledge using metadata technology that can process not only the representation but also the meaning. This technology can process metadata including semantic components. To understand relationships among contents, human beings must not only recognize the representation but also understand the overall meaning. These capabilities may make it possible for users to search for information, link, and introduce related content in a manner similar to the way humans process information.

The last of the Special Features, "Towards the Real-World Semantic Web—Web Search based on Spatial and Temporal Metadata," gives an overview of the latest technological developments relating to the Semantic Web. It describes efforts to extend the breadth of searches and mediation by converting metadata in the real world using ontologies that take into account time or location.

8. Associating with network functions

In an advanced contents distribution service, users want to be able to retrieve content anytime and from anywhere, regardless of the type of terminal, amount of bandwidth it can use, and traffic volume being carried by the network. This will impose additional requirements on the service, such as the need to distinguish access privileges according to user-class, convert content formats, and provide content handover across multiple terminals, enabling a user to watch a movie seamlessly and continuously when changing terminals, for example, from a PC at home to a mobile terminal outdoors.

To distribute high-quality contents and provide better security, network operators must put additional efforts into configuring and controlling the network: assigning appropriate bandwidth, selecting the optimum route, balancing traffic, and so on. Generally, the quality of service (QoS) that satisfies users depends on the type of content. In the case of a sporting event where images contain fast action and movement, the transmission delay should be minimized. In other cases, such as panoramic landscape scenes, packet loss should be minimized to keep resolution high.

Metadata may help operators configure network parameters or control the networks if it indicates the features of the content. A number of ideas will be addressed in the near future: guaranteeing bandwidth automatically depending on the content resolution, selecting the optimum route based on content features, and setting security levels, and quality controls [4]. Figure 4 shows a model that determines the deliv-

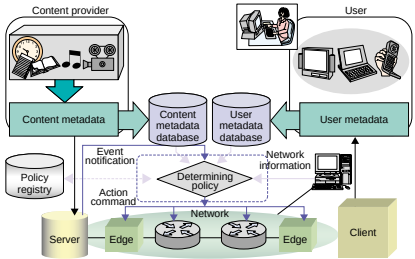

Fig. 4. Associating with the network control.

ery policy and controls of various network resources based on content features and user metadata.

As personal computer networks become increasingly diversified in the years ahead, the ability to seamlessly distribute digital contents across heterogeneous environments made up of various types of terminal and network channels will be critical. Associating metadata with network functions may create new services and high value. NTT Laboratories are actively studying these prospects.

9. Conclusions

This article described how digital contents could be utilized more efficiently and in more diversified ways if standardized metadata were added to the content that can be accessed over networks. Future work will focus on metadata standardization and the deployment and evaluation of a robust contents distribution platform.

References

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[4] M. Kawarasaki and J. Kishigami, "Metadata-associated Network Service and Capabilities," Proc. Int. Conf. on Dublin Core and Metadata for e-Communities 2002, pp. 225-227, 2002.

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As a director at NTT Labs, he is promoting the labs' activities overseas. He has been active in promoting the concept of "metadata", which will be a key function in new convergence businesses. He is Secretary General at cIDf (Content ID Forum), which he founded with Professor Yasuda, the University of Tokyo. He is a columnist in the Nikkei IT Forum. He was a vice president and general manager at IP headquarters in NTT America from 1994 through 1999. His main mission was to create and promote Internet businesses in the US and Japan. He coordinated ISPs and the backbone between the US and Japan. He was a member of ARIN (American Registry for Internet Numbers), IEEE, Smart Valley, Inc., and SVMF (Silicon Valley Multimedia Forum), JV:SV (Joint Venture Silion Valley).
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