

Media Asset Management (MAM) System for Efficient Content Management Using Metadata

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Abstract

Video content distribution services are thought to have great market potential, but it can be costly to implement various features such as content management, content delivery across different media types, and sales trend analysis. As a result, the services on offer are still not as good as one might hope for. We have developed the core functions of a media asset management (MAM) system that provides an efficient means of tagging video content with metadata, allows content to be searched quickly, and allows the content usage history to be analyzed for sales promotion purposes. This will prepare the way for the introduction of broadband video delivery services.

1. Introduction

With the recent growth of broadband services, video content distribution services are expected to have considerable market potential. Broadband delivery services offering a wide variety of video content are already beginning to appear. However, there are still some technical issues such as copyright processing that need to be addressed in these systems, and there are other strategic problems that need to be resolved such as the distribution of popular broadcast content via communication media. Unless these issues can be resolved, video content distribution will not live up to its promise of being a killer application for broadband. To overcome the distribution problem, we must solve the following technical problems to enable the distribution of content via various channels ranging from broadcast media to packages and communication media:

- Content providers incur higher content management costs for the secondary use of programs and other material.
- It is more expensive to distribute broadcast content via communication media.

- It can also be costly to analyze sales trends to obtain demand feedback for the content providers.

Recent developments such as the commencement of terrestrial digital broadcasting have given content providers an incentive to manage their content more efficiently. In line with this trend, we have developed a media asset management (MAM) system that addresses the above problems.

Because existing MAM systems were designed only to perform effective management of content that was stored beforehand, they have some drawbacks: they lack system scalability, realtime registration of metadata is impossible, the schema for metadata is restricted, and so on. In our MAM system, we have solved these problems. And in consideration of general usage, we enabled the addition of various kinds of media indexing, further speeded up content searching, and provided sales analysis support functions. We think that our MAM system can expedite the spread of services that distribute video content via communication media.

2. System design

The core functions and the role of our MAM system, which is designed for content management markets aimed at the multimedia development of broadcast content, are shown in **Fig. 1**. The metadata cre-

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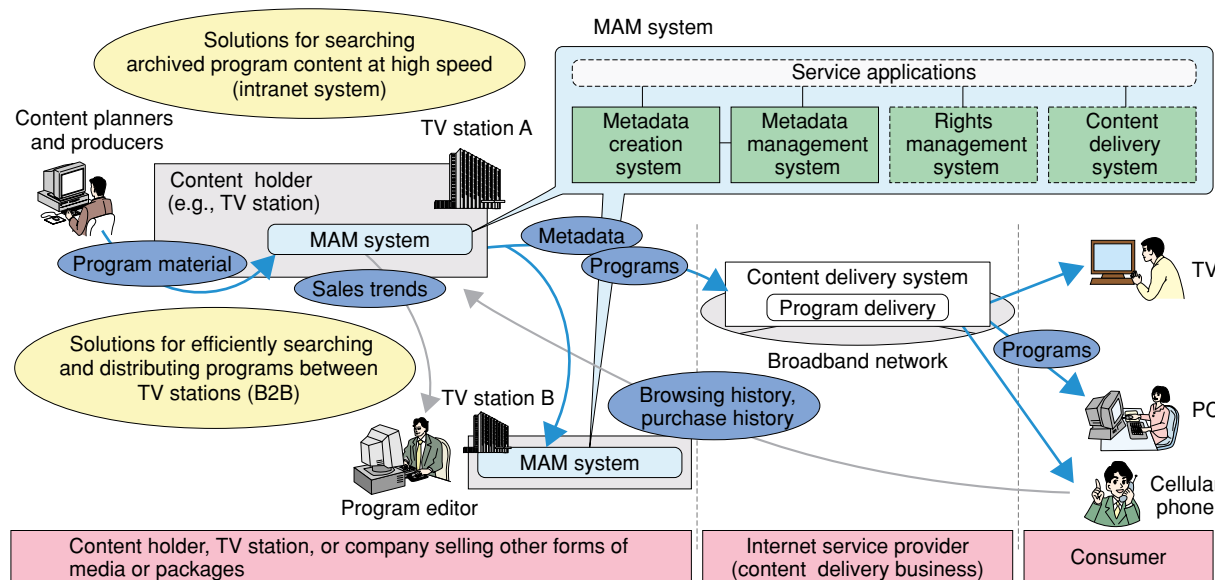


Fig. 1. Role of the MAM system.

ation and management systems have already been developed. They are based on technology developed at NTT Cyber Space Laboratories for a system called “MetaConcierge” [1], which is a platform of tools that allow users to quickly access large quantities of video content and search through it with ease. The MAM system was constructed by integrating a content delivery system (already developed by NTT Laboratories), a rights management system (already developed by NTT Laboratories), and service applications (consisting of a graphical user interface and user applications) into the metadata creation and management systems.

Video content distribution services are chiefly required to handle the following three types of metadata.

- Content description metadata
Title, summary, keywords, scene information, copyright information, etc.
- User description metadata
User’s name, address, age, gender, interests, etc.
- Content usage history metadata
Information linking content to users, including search history and purchase history.

Our MAM system has made it possible to supply content and service providers with metadata creation and management systems. A metadata creation system is an environment for efficiently creating content description metadata; a metadata management system is an environment for developing applications

that have high-speed searching functions using each type of metadata and analyzing the content usage history and sales trend reports.

To keep our MAM system compatible with existing broadcast content management systems, we made sure that our laboratory studies were conducted while considering applications in a wide variety of fields including corporate infomercials, educational content, and online museums. We also considered factors such as the following:

- Performance scalability
The system performance can be linearly increased by using distributed processing and load control techniques to modify the hardware.
- Continuous remote monitoring/maintenance operation functions
The design allows operations that affect performance and mission-critical work to be carried out reliably and securely.

3. Advantages of the metadata creation system

3.1 Elimination of metadata bottlenecks

The content description metadata of video content includes a description of the content and segment metadata that relates to its constituent scenes (title, summary, keywords, start and end times of the content, etc.). The study group on MPEG-7 [2], which is an international standard for multimedia content description, is promoting the TV-Anytime platform

[3] as a standard for content delivery to a home server based on MPEG-7. Although it is known that the ability to add content metadata makes the content easier to manage and distribute, not much work has been done on improving the trade-off between the cost and effect associated with this work. This is called the “metadata bottleneck”.

The metadata creation system of our MAM incorporates a video indexing system called SceneCabinet [4], developed at NTT Laboratories, that automatically detects and displays events such as scene transitions, camerawork such as zooms and pans, superimposed text/image sections, and sections containing speech or music. This supports the creation of segment metadata, which has been a time-consuming process in the past, so it should eliminate the metadata bottleneck. The publication “Standard Technologies” produced by the Japanese Patent Office describes NTT’s patents as key technologies in this field.

3.2 Recent improvements

In this study, we improved our metadata creation system (Fig. 2) by incorporating a more comprehensive range of metadata creation support functions (scalable automatic indexing) compatible with the management of broadcast content. This involved implementing the following functions based on established techniques:

- Client/server implementation of SceneCabinet
We implemented a low-cost metadata creation environment based on simultaneous parallel creation at multiple workstations and reduced the system scale by sharing resources needed by the engines that perform media analysis.
- Indexing tools with a plug-in architecture
The architecture can be scaled to suit the task requirements, ranging from large-scale configurations including engines specialized for different genres to small-scale configurations with just the basic engine. It is also possible to modify the architecture and introduce/replace engines after the system has been introduced.
- Sequential output of metadata
It is possible to perform realtime indexing while simultaneously recording broadcast content.

4. Advantages of the metadata management system

4.1 Metadata management search tool

MetaConcierge provides functions for flexible storage and management of content description metadata based on the international MPEG-7 standard and for diverse and high-speed searching of this metadata. It supports various techniques including metadata searching by genre or keywords, high-speed searching of similar scenes based on their atmosphere or

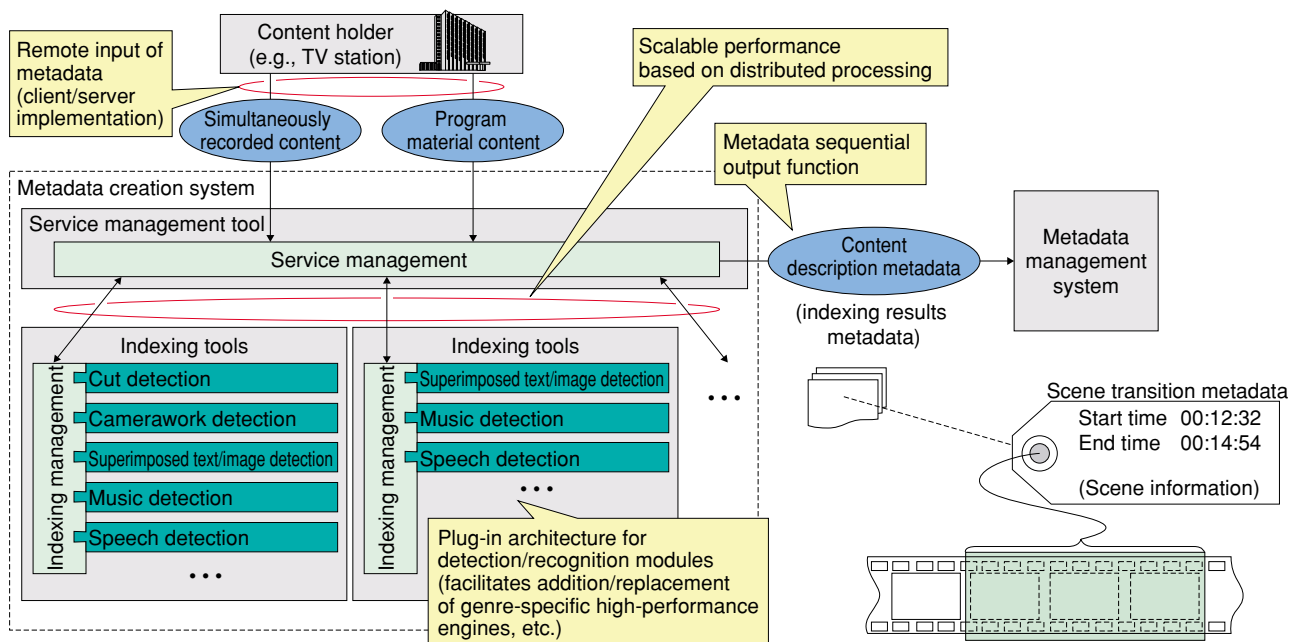


Fig. 2. Functional overview of the metadata creation system.

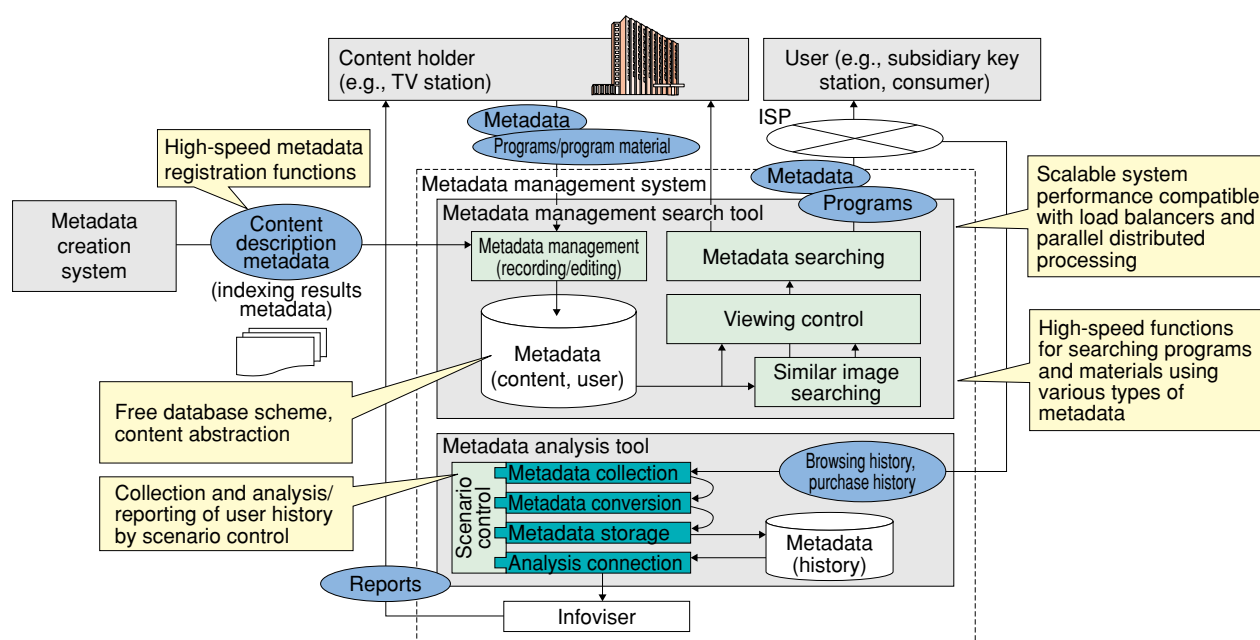


Fig. 3. Functional overview of the metadata management system.

color using representative scene images as keys, combination searches that combine the above techniques, and metadata matching techniques that adapt to circumstances such as the recommendations and viewing restrictions for each user segment. The metadata management search tool of the metadata management system (Fig. 3) is implemented based on Meta-Concierge.

- High-speed metadata searching
This provides diverse high-speed searching through a combination of images and keywords representing a scene. (On its own, the similar image searching function can search through one million images in 0.4 s.)
- High-speed metadata registration
This provides sequential registration of realtime indexing results along with simultaneous recording of broadcast content.
- Free database scheme for content description metadata
Content management is implemented without relying on any particular metadata format such as MPEG-7, TV-Anytime, LOM, or J/Meta.
- Content abstraction
The framework is compatible with other types of content besides video (such as still images or audio).

4.2 Metadata analysis tool

Most video content distribution systems tend to concentrate on the one-way flow of content from the content provider to the users. Although metadata can be used in this direction, the MAM system also allows metadata to circulate, leading to a framework for creating new added value. This was implemented by adding a history management plug-in to the XML (extensible markup language) sharing platform system [1] and controlling the scenario by linking it with the Infoviser [5] data analysis engine developed in NTT Cyber Solution Laboratories.

This framework makes it possible to analyze the users' video content browsing and purchasing behavior and produce reports of the results of sales trend analyses based on data mining techniques. It also makes it possible to provide users with individually tailored recommendations by using server scripting tools such as ASP.

5. Development of MAM services

MAM services are ranked as one of the core applications of broadband networks, and they are expected to find their way into various business fields in the future (Fig. 4).

(1) Broadcast content

Work has begun on the development of an intranet system (for use within TV stations) that can build

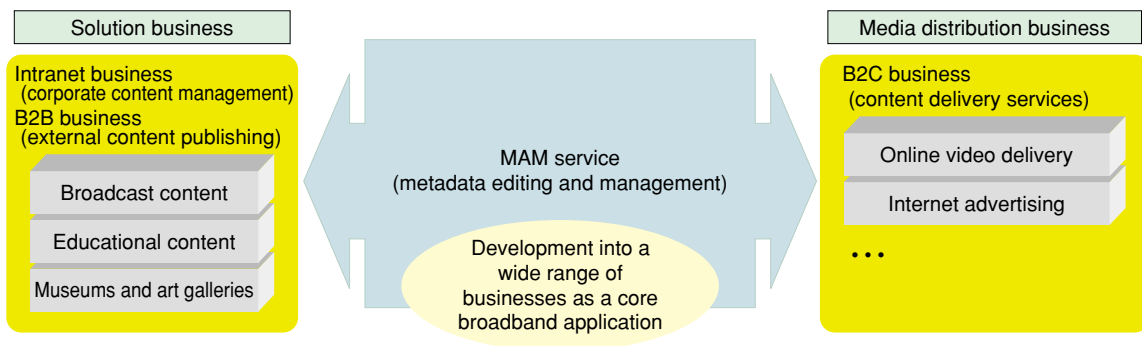


Fig. 4. Development of MAM services.

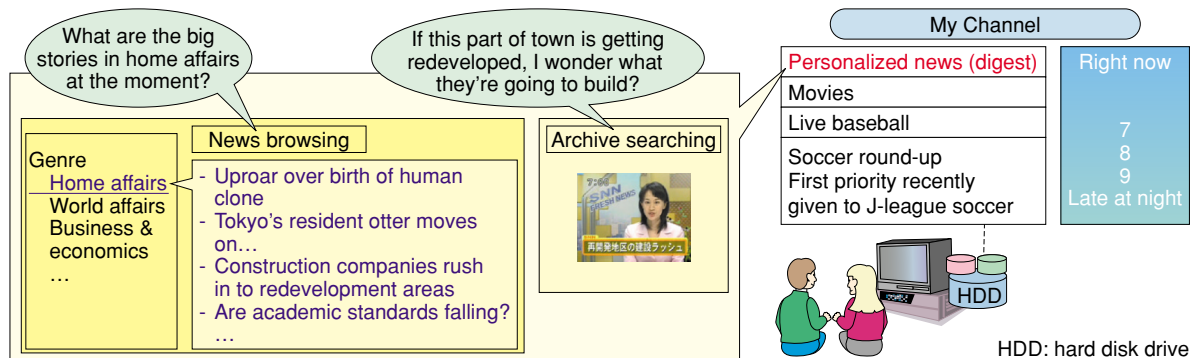


Fig. 5. Concept of personal video viewing using metadata.

efficient archives from old and new video content and allow this content to be searched at high speed.

Business-to-business (B2B) applications (between TV stations) require solutions for efficient program searching, distribution, and transactions.

As digital broadcast services continue to expand in the future, they will probably begin to offer interactive TV functions such as allowing users to select and view interesting parts of programs using simple keywords (Fig. 5). For this purpose it will be essential to create and manage metadata related to program content, such as keywords and topics. But it will also be important to minimize the impact of introducing these features on existing corporate facilities and to construct a system that can be introduced incrementally.

(2) Educational content

We are continuing with the development of packages for the integrated management of educational resources (content) such as teaching materials that lie scattered around in schools and teaching facilities. This will allow content to be shared easily among stu-

dents and teachers by such means as searching and browsing.

It will eventually become possible to gain qualifications through educational content distributed in this way. For this purpose we are considering investigating services for comparing the topics covered by different sources of educational content, searching for the information required by the user, and providing the user with a summary of this information.

(3) Museums and art galleries

We are investigating the application of this system to a framework that provides seamless access to a wide variety of digital archives at public facilities such as museums and art galleries at a wide range of levels from researchers to the general public.

6. Conclusion

This paper has introduced our MAM system. We have now completed product development of its basic functions. In the future we plan to broaden this system's scope to address the needs of the business com-

munity and enhance its commercial benefits.

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