Broadcasting System Based on Home Servers Utilizing Telecommunications Network

- Digital TV to become home integrated services television -

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I joined NHK in 1996 and have been at NHK Science and Technical Research Laboratories since 2000. I have studied about new digital broadcasting system utilizing home storage devices and Internet. My recent research interests include metadata technology and RMP technology for digital broadcasting system based on home servers.

STRL's research and development related to broadcasting services based on home servers is advancing. A home server is a receiver with a large-capacity storage function and a communications function.

Broadcasting based on home servers will enable a diverse range of viewing styles with the use of metadata (program-related information) provided by broadcasters. For instance, viewers will be able to watch any program at their convenience and retrieve only the information of interest. The advent of the home server will be the beginning of full-scale integrated services television, which will integrate various new services exploiting the home server's broadcasting, communications, and storage functions (Figure 1).

Research is underway on the element technologies, including metadata application technology and advanced CAS[1] technology, which will enable content rights protection and viewing control.

■ Metadata application technology

With the extended version of the BML[2] data broadcasting description language, we constructed a BML browser compliant to broadcasting based on home servers. This browser allows users to employ a wide range of viewing styles using metadata, such as program/scene unit retrieval, and digest viewing. One example of such applications is shown in Figure 2. When a user selects a scene, the system displays video and textual data for that particular scene.

We also developed a scheme through which a user can obtain content without necessarily being aware of the broadcasting time or URLs on the Internet. This will make a broadcasting service that links broadcasting, communications, and storage feasible without requiring the user to have knowledge of the data distribution channel.

■ Advanced CAS technology

Broadcasting, communications, and storage linked services provided over home servers will require a safe distribution environment for program content and metadata. A new protection/management and viewing control using a single CAS card (Figure 3) has been developed for this purpose. It will be able to acquire the licensing information necessary for content viewing via broadcasting and communications and control content utilization by authorization check of metadata.

For digital TV to evolve into integrated services television, we are studying an advanced CAS technology that can work with electronic-government /municipality services. It will ensure secure, accurate processing of personal data, considering protection, identification, and fee related matters.

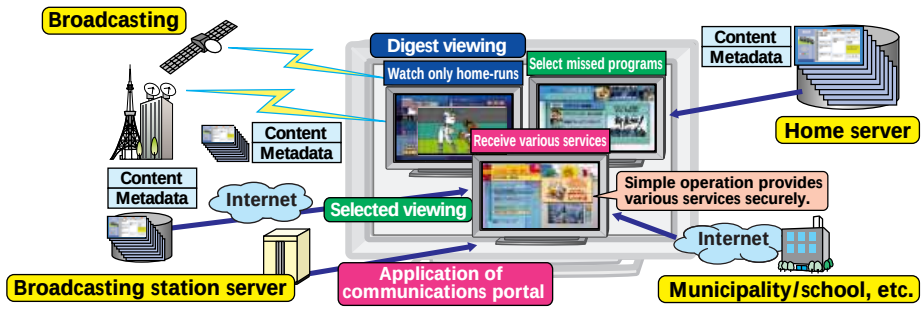

Figure 1: Integrated services television service image

Figure 2: Data broadcasting screen image using metadata

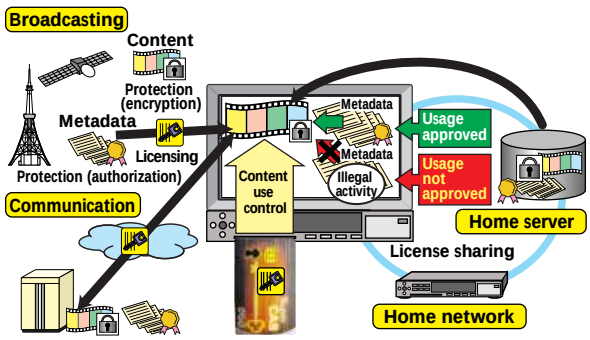

Figure 3: Advanced CAS technology overview

[1] Conditional Access System
[2] Broadcasting Markup Language

Generation of a Dynamic 3D Object

- Video images that can be viewed from an arbitrary viewpoint -

We would like to create a new form of image expression by which a moving object can be viewed from arbitrary view points. At present, our research is on generating dynamic 3D object of a moving human body. This dynamic 3D object can reproduce a person's movements and the way his or her clothes look while they are moving.

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I joined NHK in 1998 and have been with NHK Science & Technical Research Laboratories since 2001.
I have been studying 3D video coding for broadcasting.

■ Shooting System

The shooting of the subject is performed in a special studio equipped with 19 cameras arranged in a circle, as shown in Figure 1. The camera positions and angles are calculated in advance.

Figure 1: Shooting studio

■ Generation Technique

A dynamic 3D object is composed of successive 3D models. These 3D models are generated using images taken with the shooting system, and with the application of a unique technique that combines a volume intersection method1 and a stereo matching method2 by video frame unit (Figure 2).

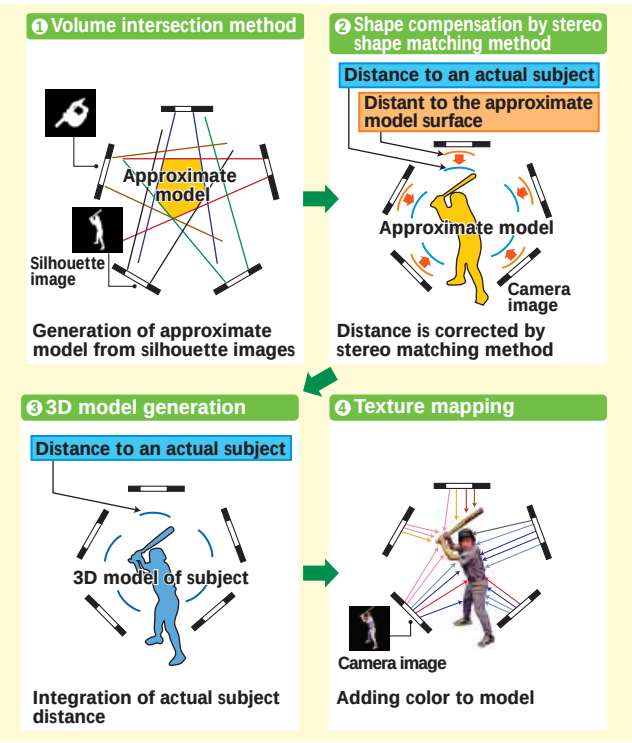

Figure 2: Dynamic 3D object generation method

(1) Using the volume intersection method, the system obtains an approximate model of a subject, based on subject silhouettes in multiple shots.
(2) The stereo matching method is then used to search for fields that include the same portion of a subject from adjacent camera images. It then refines the distance to the approximate model surface, to obtain a more accurate distance to the subject.
(3) The 3D model is generated after integrating the distance to the subject obtained in the stereo matching method.
(4) Finally, the system performs texture mapping onto the surface of the 3D model, adding color information from the camera images.

Repeating this process for each video frame generates a dynamic 3D object.

■ Display Method

The dynamic 3D moving object are displayed in sequence as shown in Figure 3. That allow a moving subject to be seen from arbitrary viewpoints, even from an angle where there is no camera actually installed, such as from below looking up or from above looking down on the subject.

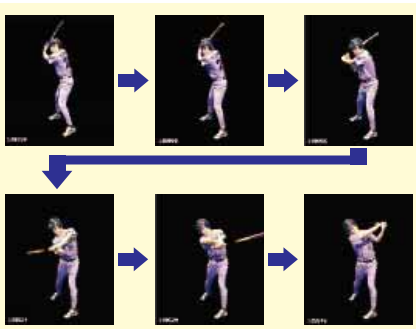

Figure 3: Dynamic 3D object

We plan to improve the shooting conditions, such as the camera arrangement and lighting environment, as well as improve the texture mapping method, in order to attain a higher picture quality for the dynamic 3D object. Moreover, we will record 3D moving images of Kabuki and Noh performers for a 3D archive of Japanese traditional performing arts.