Architecture of the SMMD Media Service System†

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Abstract: - Based on this research to design the SMMD-based media control architecture, this paper proposes a service control method. SMMD technology is to play media by interlocking multi-device. The main feature of the proposed control architecture is to allow systematic consolidated control by controlling media service according to synchronization between a media and multi-device. The proposed media control architecture should be preceded by the creation of a new media that defines the control information of linked device that could maximize the effect of existing media. By providing media service that links devices surrounding a user based on this new format of media, it is purposed to be used as the next-generation realistic media service.

Key-Words: SMMD, ne-media, synchronization, device control

1 Introduction

With the advent of the period of digital convergence, digital home technology has achieved ubiquitous home that transcends the boundaries of space by making transformations from the period of white appliances thru smart home to living-room theatre and to conversion of den to office [1][2].

With these changes, the evolution of media, device, and services is ongoing. Especially, the current media like video, audio, and texts are in development to a form of media to which the concept of realistic feeling and five senses are added and they are being diversified to interactive media, customized media, rich media, five-sense media, converged media, and realistic media. Devices that play these types of media have also been evolved into DTV that support high resolution, DMB phone that support portability, and wall display that uses mirror, glass, and wall.

However, these have single-media single-device architecture.

In order to play media more realistically, in addition to the development of stereoscopy or three-dimensional image media, stereoscopic device or three-dimensional image device to play these media are being developed. While it is expected that these will replace the existing devices in the future, there are many technological limitations that should be solved before reaching the mature stage of technological development.

Therefore, instead of the current medial production method of single-media single device, ongoing research is to advance technology in order to play the media actively link several digital devices that have different functions. This technology is a place to provide the effects in various formats to a media and it is a method to make a new media that defines the control information of connected devices that maximize the effect of an existing media and to play this by linking with various devices surrounding a user.

Research of technology that links media and device has expanded an area and it is expected to be emerged as a new issue in the future media and device market.

Thus, through research and development for technology to create and play new media, we attempts to apply SMMD as a new technology for IPTV service in order to maximize multi-media services.

As the first step, SMMD service control architecture is designed to realistically play by linking a media and a device and a control method is introduced.

This paper is organized as follows: Section 2 examines SMMD-based media service, followed by Section 3 in which SMMD service system is designed and Section 4 where SMMD media service control mechanism is designed. Lastly, Section 5 concludes the paper with suggestions for future research topics.

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2 SMMD-based Media Service

2.1. Development of Media Service

The concept of linking media and device is used in various areas. Devices, such as music fountain that dances by music, vibration joystick or vibration chair for realistic game, singing-room lighting system where lighting effects differ by music, are systems that increase realistic feeling or stimulate people's senses by operating proper devices depending on the characteristics of media.

Other relevant technologies include PreAuthor[3] which is production tool to show presentation at many displays and Multimedia Presentation [4] to play diverse data through various devices. SONY provides a service that allows users to identify locations where pictures are taken through digital camera and GPS-CSI in Google Earth. Intel has improved multi-media response capacity while planning digital home platform Viiv™; and, with DLNA[5], it is jointly studying a way to simply share digital contents between devices connected through networks at home. In addition, at MS, Easy Living Project is ongoing to develop technology and prototype architecture for the construction of intelligent environment, and SONY and Intel is developing technology to realize ubiquitous home which provides services and contents in a format that a user wants [6].

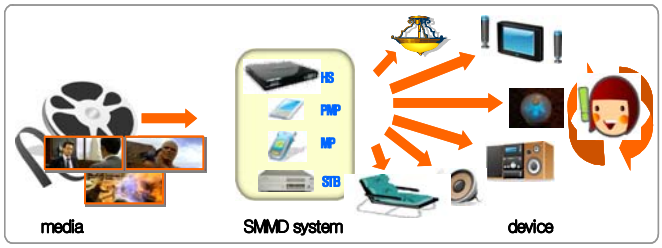
2.2. SMMD Service Technology

SMMD Technology is a media playing method by using the next-generation media (ne-media) to which device interlocking neodata is added to the existing media. To efficiently and realistically play media, instead of the existing single device play method, it uses a method to play a media in cooperation with multi devices.

Here, ne-media is a new format of media that includes audio, video, texts, and realistic and five-sense information, digital device control adjacent to a user to express these types of information, and synchronous information.

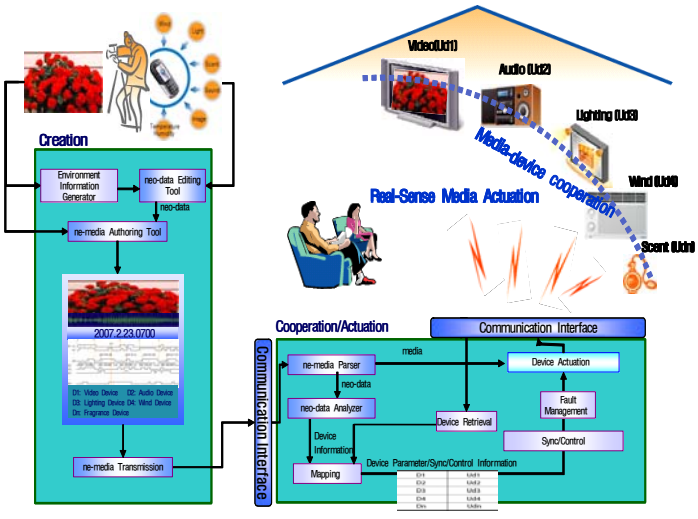
SMMD Technology is to support optimal media service at any time and at any place by maximally utilizing a user's peripheral devices to maximize the effect of media playing. This is the base technology that can create new added value by incorporating business companies that provide the media such as broadcasting, films, and telecommunication, which is associated with general system architecture that creates, delivers, plays, and serves media of a new concept and connects with devices.

Figure 1 shows the conceptual diagram of SMMD technology.



(Fig. 1) SMMD Technique

Figure 2 illustrates the concept of SMMD service in the service aspect from the creation of media to actuation. Media creation process presented in this picture shows the service architecture in which a user films a video at a garden, obtains environmental information such as temperature, humidity and strength of the wind to create ne-media and play at a user terminal. That is, with ne-media, it is possible to reproduce the situation when filming was done even after several years. With a media that has already been made, it defines a device to be connected according to the contents of media and connect various devices, which allow more realistic playing of the effect provided by the existing media.



(Fig. 2) SMMD Service Concept

3. SMMD-based Media Service System Design

3.1. SMMD System Requirements

The required functions of a system are examined.

1) Device Control Function
- It should provide a function that controls devices.
- It should provide a function of interface between system and device.

2) Media Decoder Function
- It should provide a function that decodes the media.

3) neodata Create Function
- It should provide a function to create the information of device connection according to media contents.

4) ne-media Create Function
- It should provide a function to create ne-media which combines neodata and media resource.
- It should provide a function of object creation and encoding for audio/video/images.
- It should provide BIFS and OD encoding.

5) ne-media Parsing Function
- It should provide ne-media parsing function that could separate each object such as media (A/V signal) and neodata.

6) A/V media Play Function
- It should provide functions of media buffering and decoding for media play.

7) neodata Analysis Function
- It should provide a function to analyze device connecting information(neodata) and to compose of device control information.

8) ne-media/Device Synchronization Function
- It should provide a function to search a device to be linked and control synchronization between a media and device.

9) Ne-media/Device Mapping Function
- It should provide a function that maps device information defined in ne-media as device information within home.

10) Device Control Function
- It should provide a function to create control instructions for each device and deliver the created instructions for device control to a device.

11) Device Profile Management Function
- It should provide a function that manages profiles of devices within home.

12) Ne-media Transport Function
- It should provide a function that transmits ne-media.

13) Device Attribute Management Function
- It should provide a function that collects/analyzes and manages the properties of devices.

14) Device Status Management Function
- It should provide a function to automatically manage the condition of devices.

15) Multi Device Synchronization Clock Management Function
- It should provide a function to manage global clock for synchronization among multiple devices.

16) Ne-media Storage Function
- It should provide a function to save ne-media at stream server.

17) Device Execution Error Processing Function
- It should provide a function to treat errors in the operation of linked device during media service.

3.2. The SMMD system design concept

In the ubiquitous home network, the SMMD system has to be designed so that it can be played in order to play the next generation media actually actively while a media operates with multi-device.

As to a system, it is designed to have the architecture including main processor, device interface, MPEG codec, output/input unit, media player, and device control module.

Furthermore, the architecture is designed to manage all control logics centering on synchronization module with services connected according to synchronization of media and devices.

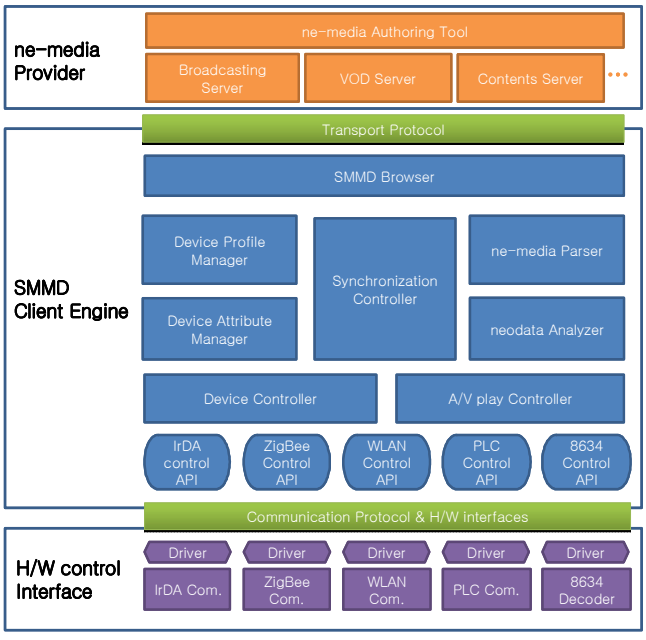
The SMMD system designs in consideration of expandability so that it can be facilitated to accept services and interlock a device.

Accordingly, the following matters were considered in designing the SMMD system.

- The architecture of the function to create ne-media
- The architecture of accommodating technology to play ne-media
- The architecture of accommodating technology to interlock a media with multi-device.
- The architecture of accommodating technology for storage and transfer server of a media.
- The architecture of accommodating various standard interfaces.
- The function configuration to automatically and clearly recognize the service provided according to the characteristics of terminal and user.
- The use of a hardware decoder considering a performance.
- Consideration of modularity, flexibility, and expandability
- The architecture of the adaptation of interface for multi-device.
- The use of RTP, RTSP and RTCP protocols for the IP stream transmission.

4. Design of the SMMD Control Architecture

4.1. SMMD System Architecture

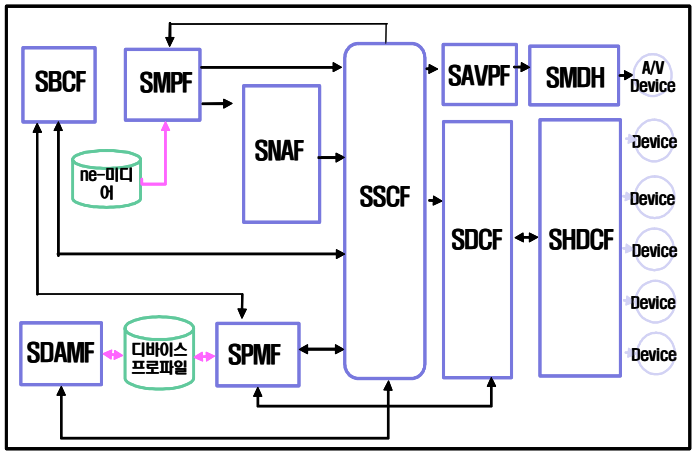


(Fig. 3) SMMD System Logical Architecture

As shown in Figure 3, the SMMD system has 3 subsystem architectures: the ne-media provider that creates and stores ne-media; the SMMD client engine part to play ne-media by interlocking various devices; and the hardware part that controls H/W processor, provide interface, and control device equipments.

4.2. SMMD Control Architecture

Functions to play ne-media consists of ne-media browser, ne-media parser, neo-data analysis, synchronization, media replay, device control. Operation principle of functions for playing ne-media is shown in Figure 4.



(Fig. 4) SMMD Control Architecture

The function blocks that compose of the SMMD system are as follows:
- SMCF (SMMD ne-media Creating Function Block)
: neodata and media resource are united and the ne-media is created.

- SBCF (SMMD Browsing Control Function Block)
: According to the user input and the user I/O interface (GUI), each function module and interlocking control is performed.

- SMPF (SMMD ne-media Parsing Function Block)
: The function of separating the ne-media from each object including a media(audio/video) and neodata, and etc. is performed.

- SAVPF (SMMD AV Media Play Function Block)
: Media buffering, media control and decoding functions are performed.

- SNAF (SMMD neodata Analysis Function Block)
: neodata is analyzed and the device control information is constructed.

- SSCF (SMMD Synchronization Control Function Block)
: The device interlocked with a media is searched and is mapped. Synchronization control function between a media and device is performed while managing the synchronization information.

- SDCF (SMMD Device Control Function Block)
: The function which generates the device control command and delivers the generated device control command to a device is performed.

- SPMF (SMMD Device Profile Management Function Block)
: The function of the profile management of a device is performed.

- SDAMF (SMMD Device Attribute Management Function Block)
: The function to collect the attributes of devices and analyze and manages them is performed.

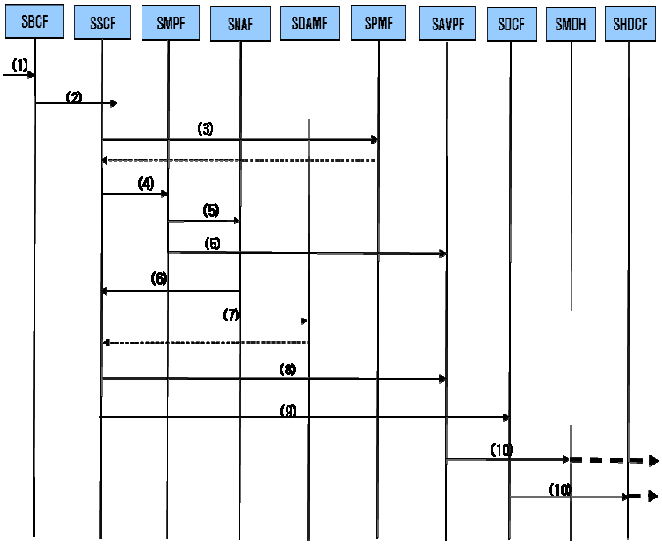
- SHDCF (SMMD Hardware Device Control Function Block)
: The control function of hardware device units is performed through the different communications interfaces.

- SMDH (SMMD Medea Decoder Hardware Block)
: The hardware function for media decoding is performed.

- SMPUH (SMMD Home Server Main Processor Unit Hardware Block)

4.3. SMMD Control Procedure

The ne-media play procedure used with a media and multi-device interlocking-technology are as shown in Figure 5.



(Fig. 5) SMMD Control Procedure

(1) Service media is selected through ne-media browser (SBCF) in order to receive ne-media service.
(2) It is requested to play ne-media as well as the selected media information to the SSCF.
(3) The SSCF acquires the device list within home by performing the status check and secures the device information.
(4) SSCF requests that selected media is read and parsed with SMPF.
(5) SMPF composes of the parsed results in a unit of object and informs them to SAVPF and SNAF.
SAVPF performs buffering by reading the parsed data and waits for play start command from SSCF.
(6) SNAF analyzes the data in binary format, tabulates the neo-data information and informs it to SSCF.
(7) SSCF resets a media and devices to be interlocked by using the analyzed neo-data and performs mapping devices to be operated by analyzing the information of device properties.
(8) SSCF gives the commands to begin media play and device actuation along with the time when media play is started.
(9) SAVCF begins media play at the starting time of media playing.
SSDCF confirms driving device, driving time and interface and sends control signals to hardware SHDCF by performing the coordination of interface for a given device.
(10) SMDH plays a media with A/V device and SHDCF drives a given device.

5 Conclusion

In this study, the SMMD-based media control architecture was designed and a service control method was proposed.

The SMMD-based media service control architecture proposed by this paper utilizes a media of a new format which defined the control information of interlocked devices to maximize the effect of existing media and performs consolidated control of media service according to synchronization between a media and multi-device so as to allow systematic consolidated control to be used for the next-generation realistic media service.

For this,
- Function requirements demanded for SMMD service system were taken into consideration.
- For SMMD-based media service control, 10 function blocks were composed.
- With services interlocked according to synchronization of media and devices, all control logics are observed centering on synchronization module.
- Besides the existing function for media play, functions such as ne-media parsing, neo-data analysis, synchronization, and device control were added.

In the next-generation ubiquitous period, media service will be possible at any time and at any place through any device with media technology that is constantly developed. Especially, technology is being developed to maximize the effect of media play by interlocking a media and a device and to allow users to feel realistic sense. Also, it is expected that SMMD-based media service technology will be a core technology even in the area of IPTV service. There will be a lot of discussions and suggestions on SSMD-based IPTV service control technology so the process of standardization should go together.

References

[1] Abowd, G. and Mynatt, E. “Charting past, present, and future research in ubiquitous computing,” ACM Trans. on Computer-Human Interaction, vol.7, no.1, 2000, pp.29-58.

[2] Brumitt, B., Meyers, B., Krumm, J., Kern, A. and Shafer, S., “EasyLiving: technologies for intelligent environments,” Proc. of the 2nd International Symposium on Handheld and Ubiquitous Computing, 2000, pp.12-29.

[3] H. Zhang, Q. Lid, S. Lertsithichai, C. Liao, D. Kimbe, “A Presentation Authoring Tool for Media Devices Distributed Environments”, 2004 IEEE International Conference on Multimedia and Expo (ICME), 2004

[4] C. Elting, “Orchestrating Output Devices - Planning Multimedia Presentations for Home Entertainment with Ambient Intelligence”, Joint sOc-EUSAI conference, 2005

[5] DLNA, “DLNA Overview and Vision White Paper 2006,”http://www.dlna.org/industry/about/dlna_white_paper_2006.pdf.

[6] Bormans, J., Gelissen, J. and Perkis, A. “MPEG-21: The 21st century multimedia framework,” Signal Processing Magazine, IEEE vol.20, issue 2, 2003,pp.53-62.