Media Processing | Value-added Media | Media Services

Technology Reports

Media Processing Node for Providing Value-added Media Services

We have developed media processing node specialized for media services that can incorporate the excellent commercially available technology to allow rapid deployment of various kinds of media communication services and efficiently provide added value for audio, video or other media for users.

Core Network Development Department

Atsuto Miyata†
Takuji Sakaguchi††
Masaru Takahashi
Hiroshi Matsunaga

1. Introduction

In the context of providing different kinds of services which use video, audio, text or other media, construction of the ALL-IP network and introduction of Long Term Evolution (LTE)[*1] will allow implementation of multimedia communication services that take advantage of the high-speed network. There is a demand for rapid deployment of new media communication services and provision of new network added value to users.

For the provision of new media communication services, an extensible service provision system with a configuration that allows easy addition of functions is desired. To meet such needs, we designed a Media Processing Node (MPN) that is specialized for media services and equipped with functions for providing added value to users.

MPN integrates existing services that handle audio, video and text as media data (**Table 1**) for provision to the user and also serves as a platform system that is capable of producing new media services. In order to develop this platform system, we followed a new design policy.

Previously, media processing system was mostly designed from two separate components. Service controllers for every service to control how the each service should be executed and service components that implement media processing specialized for each service (**Figure 1** (a)). This design policy is effective from the viewpoint of system optimization that is specialized for individual services, but it has the disadvantage of longer development time and higher cost in order to deploy multiple services.

On the other hand, with MPN development time is shortened by having the respective service controllers share service components (enablers[*2]) that are required in the execution of services (Fig. 1 (b)) rather than deploying a combination of service controllers for each service and service components. In addition, MPN is constructed according to a design policy that allows incor-

Table 1 Services running on MPN

Media	Service name
Audio	Melody Call Voice mail services Mobiler's check Satellite public subscribed terminals
Video	Voice mail with videophone Video guidance service
Text	SMS Short mail

† Currently Product Department
†† Currently R&D Strategy Department

*1 **LTE**: An evolutional standard of the Third-Generation mobile communication system specified at 3GPP; LTE is synonymous with Super3G proposed by NTT DOCOMO.

*2 **Enabler**: A function or a component of a service configuration that can be used by multiple service scenario controllers.

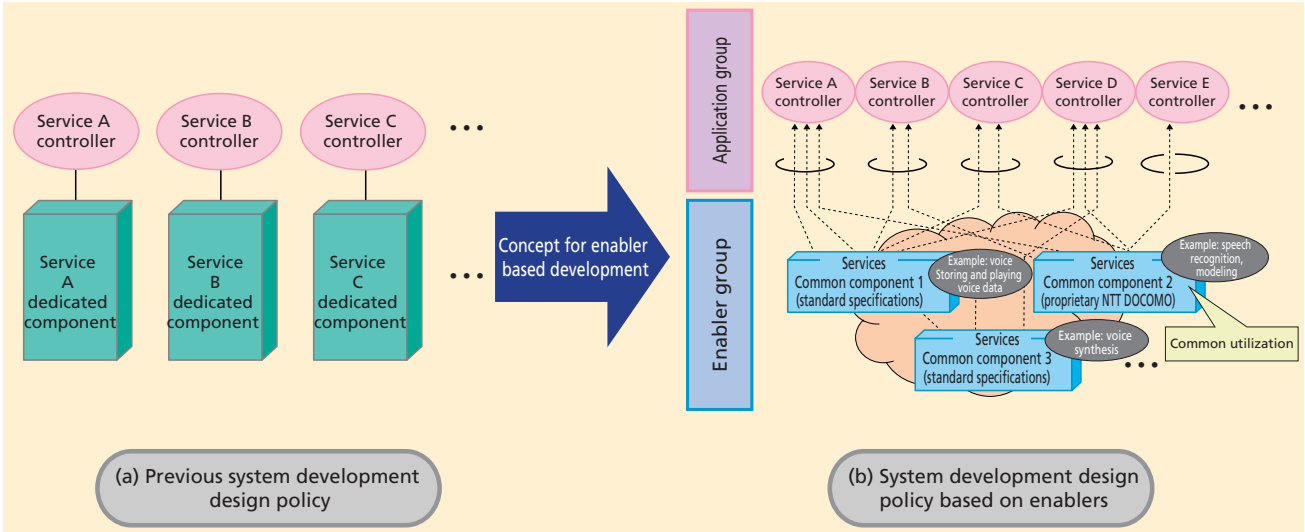


Figure 1 Design policy for MPN

poration of the excellent technology that is on the market.

In this article, we describe the configuration of MPN constructed for the provision of value-added media services and development based on a new design policy.

2. Network Migration

When first introduced, MPN is connected to the 3G circuit-switching network to migrate the various services which run on existing media processing system (Table 1). In order to minimize the modification to adjacent network nodes, MPN supports the interface of existing media processing system (**Figure 2**).

Nevertheless, the existing interface will not be able to connect to the ALL-IP network, which is being planned for near future, without modification to MPN. Therefore, considering future expansion, the Session Initiation Protocol (SIP)[*3] and Real-time Transport Protocol (RTP)[*4] that are used in the ALL-IP network are adopted as MPN's internal protocols.

Currently, provisional conversion processing is being used to compensate for the differences between a future extended interface and the existing interfaces to maintain compatibility.

3. System Overview

MPN has a hierarchical structure of service control equipment and media processing equipment to facilitate introduction of commercially available products. For the service control equipment, the Advanced Telecom Computing Architecture (ATCA)[*5] platform is adopted, considering the need for reliability and redundancy in service control. For the media processing equipment, in order to obtain excellent commercially available products, Request For Proposal (RFP) was used.

MPN features this hierarchical system architecture and functional expansibility for the service control equipment and the media processing equipment. An overview of the MPN system and features is shown in items (1) to (5) of **Figure 3**.

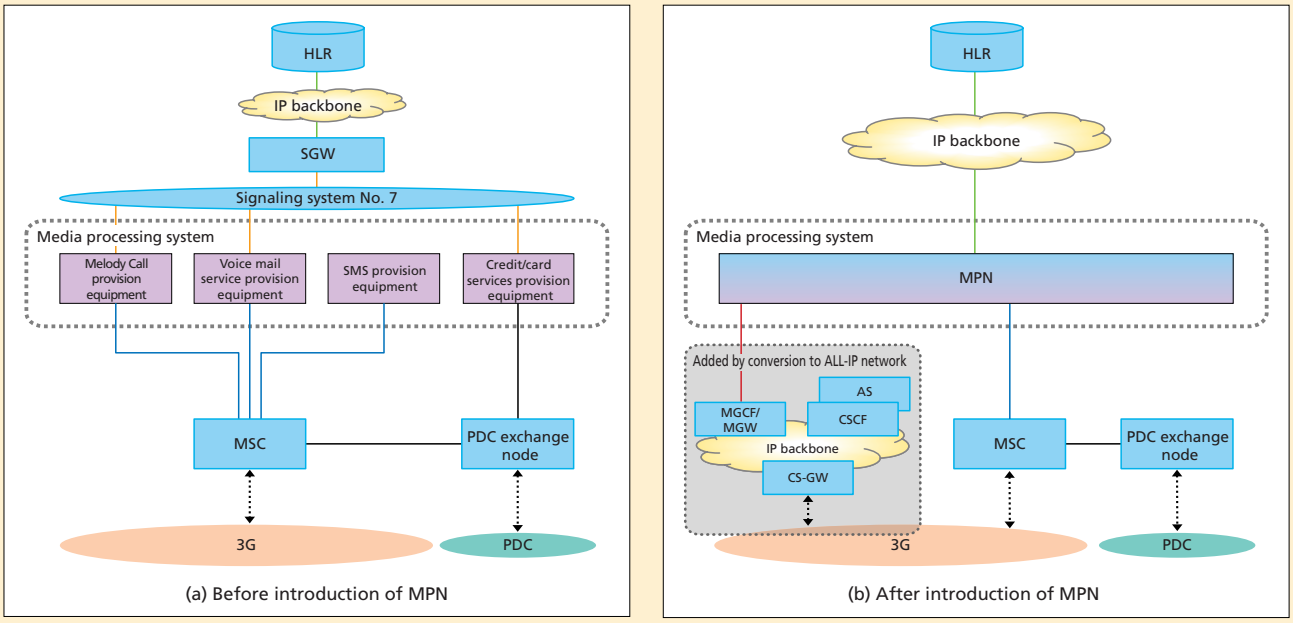
3.1 Features of the System Architecture

To simplify the introduction of commercially available products for the media processing equipment, a standard protocol between the service control equipment and media processing equipment is adopted and the operation and maintenance functions are configured in a hierarchy. The details are described below.

*3 **SIP**: A call control protocol defined by the Internet Engineering Task Force (IETF) and used for IP-phone with VoIP, etc.

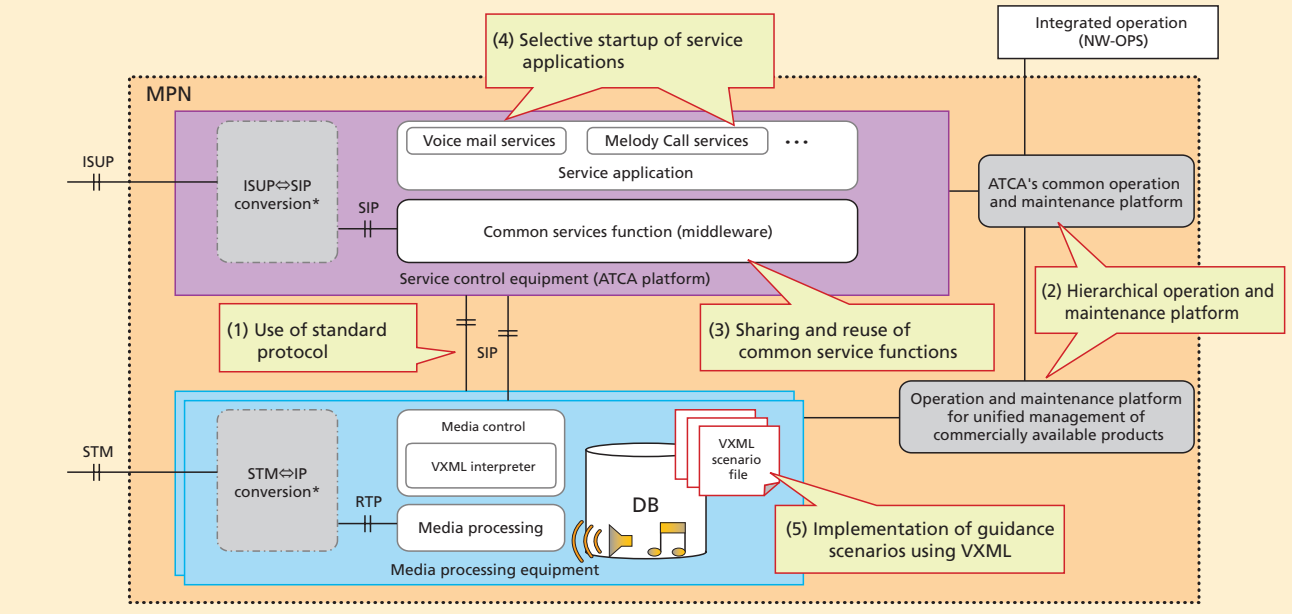
*4 **RTP**: A protocol defined by IETF for real-time distribution of audio, video or other such media.

*5 **ATCA**: Industrial standard specifications for carrier-oriented next-generation communication equipment specified by the PCI Industrial Computer Manufacturers Group (PICMG).



AS : Application Server
CSCF : Call Session Control Function
CS-GW : Circuit Switching GateWay
HLR : Home Location Register
MGCF : Media Gateway Control Function
MGW : Media GateWay
MSC : Mobile Switching Center
SGW : Signaling GateWay

Figure 2 Positioning of MPN within the core network



ISUP : ISDN User Part
STM : Synchronous Transfer Mode

*Temporary functions in advance of ALL-IP network

Figure 3 MPN system overview

1) Adoption of Standard Protocol

Commercially available products are basically provided with an interface that uses a standard protocol. Hence, in order for service control equipment to incorporate commercially available products, standard protocols must be supported. In the case of MPN, SIP was adopted since a great majority of commercially available products for the media processing used by real-time services such as Melody Call and Voice mail services use SIP for call control.

Similarly, in the future, when MPN is required to provide additional services, it will be enabled by adding commercially available products with the suitable functions.

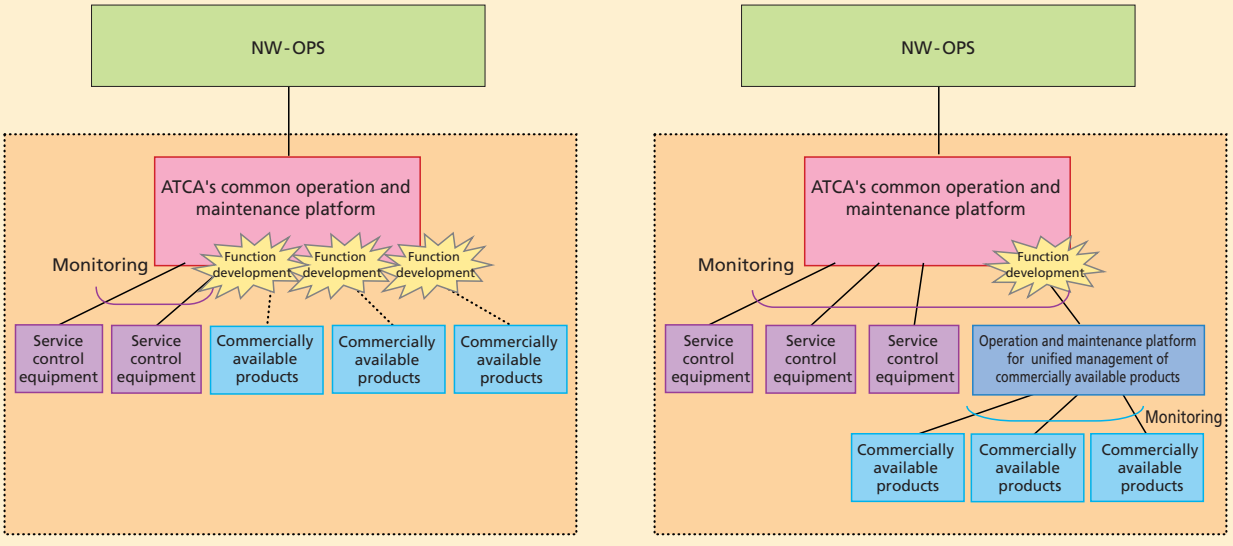
2) Hierarchical Operation and Maintenance Platform

For network nodes within the NTT DOCOMO core network, operation and maintenance functions are implemented by an integrated operating system called NetWork OPeration System (NW-OPS[*6]). For communication between the NW-OPS and monitored network nodes, Simple Network Management Protocol (SNMP[*7]), telnet[*8] or other such general protocols are used. However, those protocols are used under proprietary specifications, so those functions must be implemented when performing operation and maintenance by NW-OPS.

The NW-OPS monitors multiple network nodes which are based on the ATCA platform, hence it has a very high compatibility with the ATCA platform. Also, because the MPN uses the ATCA platform for the service control equipment, the ATCA's common operation and maintenance platform that has maintenance functions to be monitored by the NW-OPS could be used.

On the other hand, when designing systems which require multiple commercially available products to be added, the adding of operation and maintenance functions each time when new products are introduced is very inefficient. Therefore, a means of minimizing the addition of functions was necessary (**Figure 4** (a)).

In the work described here, we introduced an operation and mainte-



(a) When only ATCA operation and maintenance platform is used

(b) When ATCA operation and maintenance platform and commercial product operation and maintenance platform are used

Figure 4 Example of implementing operation and maintenance for commercially available products

*6 **NW-OPS**: A system for maintenance and monitoring of equipment within the NTT DOCOMO core network.

*7 **SNMP**: A protocol for the monitoring and control of communication devices (router or computer, terminals, etc.) on a TCP/IP network.

*8 **telnet**: Virtual terminal software for operation of a remote server from a local computer over a TCP/IP network, or the protocol that enables that function.

nance platform for unified management of commercially available products to solve that problem for the MPN. We also chose to provide a unified maintenance interface with the NW-OPS by means of ATCA's common operation, maintenance, and monitoring platform (Fig. 4 (b)). This kind of functional allocation creates a hierarchy between ATCA's common operation and maintenance platform and the operation and maintenance platform for unified management of commercially available products. This minimizes the effect on ATCA's common operation and maintenance platform when incorporating commercially available products.

3.2 Features of the Service Control Equipment

To enable flexible adaptation of adding new services, we implemented sharing and reusing of common service functions and selective service applications.

1) Sharing and Reuse of Common Service Functions

MPN is assumed to handle multiple media services, and will provide multiple services that handle audio media such as Voice mail services and Melody Call from the initial commercial launch (Table 1). In that case, functions such as retrieving user profile information can be executed by multiple services in the same way by simply calling the functions with different parameters. This allows shared use by multiple service applications, so an Application Programming Interface (API)[*9] is defined for each function and functions are grouped by similarity (**Figure 5**).

For example, Melody Call services require a user profile retrieval function, but that same function is also required by Voice mail services. If an API has been specified for the profile information retrieval function (API_B_4 in the example presented in the figure), then each service application that uses the function can share it by simply providing different parameters. Furthermore, the function is easily implemented for new service applications by using this API.

2) Selective Startup of Service Applications

In past systems, it was necessary to develop specific systems to provide functions for each service, even when services were similar. Because it is difficult to accurately estimate user demand for a service when constructing

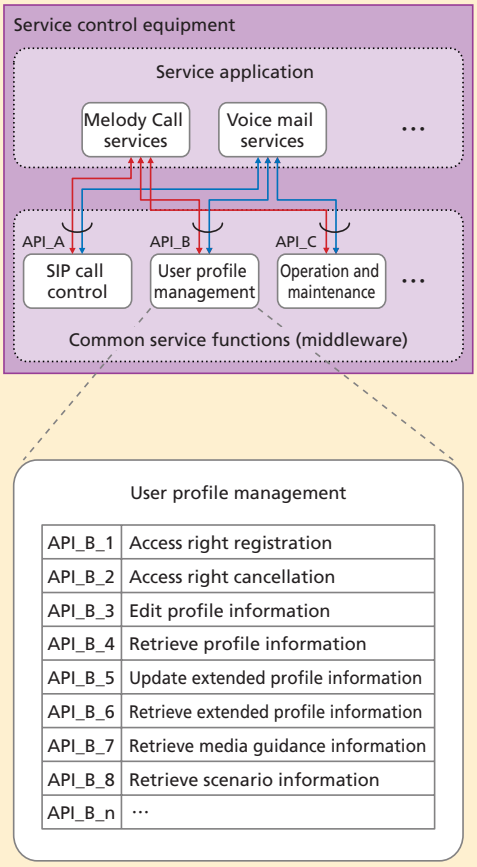


Figure 5 Example of using common service functions and API

*9 **API**: An interface that makes the functions provided by the OS, middleware and other such software available to upper-level software.

facilities before introducing services, it has been necessary to introduce extra costly equipment that is specialized for NTT DOCOMO networks to provide a margin beyond the assumed demand to avert inconvenience to users caused by insufficient equipment.

To reduce that risk in operation, MPN integrates multiple services that were previously provided by individual units of equipment. In order to do so, we chose to run all of the services provided by the MPN, including the service applications as well as the Operating System (OS) and middleware, on individual blade servers of the service control equipment.

Because the common processes and the processes dedicated to each service are all loaded and run in memory area on the blade server for the services provided by the blade server, processing is possible for any service (**Figure 6**). In practice, services provided by each blade are specified by local unit system data[*10] that defines MPN-specific information (in this example, the range of subscriber numbers of Melody Call users accommodated by the blade server (Fig. 6 (a)).

Multiple blade servers can be incorporated within a single MPN system, and it is possible to choose whether the blade servers each provide different services or all provide the same services, etc.

Implementing this configuration allows services that can accommodate the demand with a small scale of facilities to be integrated on other servers that have surplus capacity (even if they are already providing other services). Furthermore, the facilities required for services for which the number of users is increasing can be re-allocated from facilities dedicated to services that are in decline, thus making efficient use of facilities.

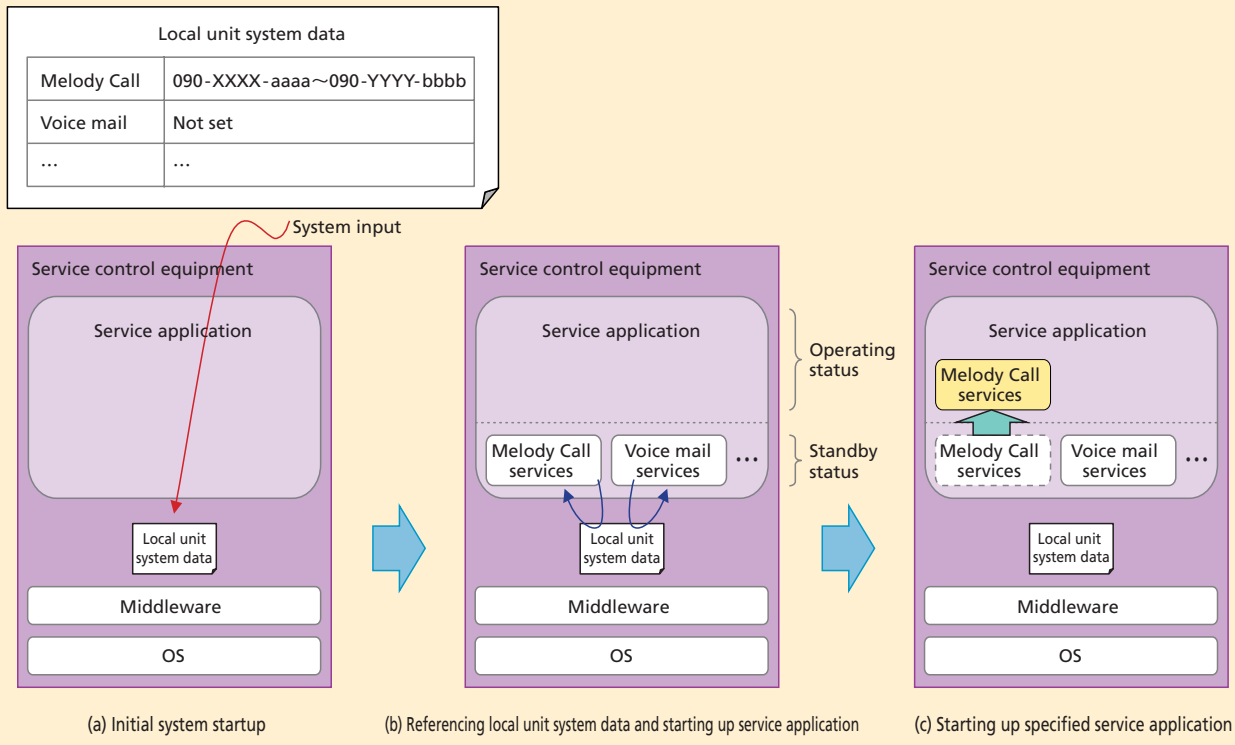


Figure 6 Example of selective execution of Melody Call service

*10 **Local unit system data**: Data that specifies node operating conditions, information on connections to other nodes, subscriber accommodation conditions, etc.

3.3 Features of the Media Processing Equipment

For flexibility in service changes with respect to the media processing equipment, we introduced guidance scenario control that employs Voice eXtensible Markup Language (VXML[*11]).

1) Implementation of Guidance Scenario Control Using VXML

Many of the services provided by an MPN, such as Voice mail services, use guidance scenarios. A guidance scenario is the use of a program to send audio messages such as "This is NTT DOCOMO." from the system to a user for menu transitions and, ultimately, to guide user actions. In conventional systems, the guidance scenario is a program on the service control equipment and an integral part of the system. It was therefore necessary to update the program files when changing the guidance scenario, which made speedy provision of services difficult.

To avert that issue, we reconsidered the deployment of the guidance scenario control and processing functions for the MPN and allocated the guidance scenario to the media processing equipment side, operating on the basis of control from the service control equipment.

In service control equipment, call processing control, profile management, etc, and service-specific processing require real-time execution, so the programs are implemented with a compiled language. For the media processing equipment, on the other hand, there is a need for flexible changing and extension of services, so the guidance scenario is implemented with VXML, an interpreted language.

VXML provides Voice XML tags that can be used to compose a guidance scenario. The operations for executing and updating a guidance scenario are shown in **Figure 7**.

Guidance scenarios described in VXML are stored as files in a DB built

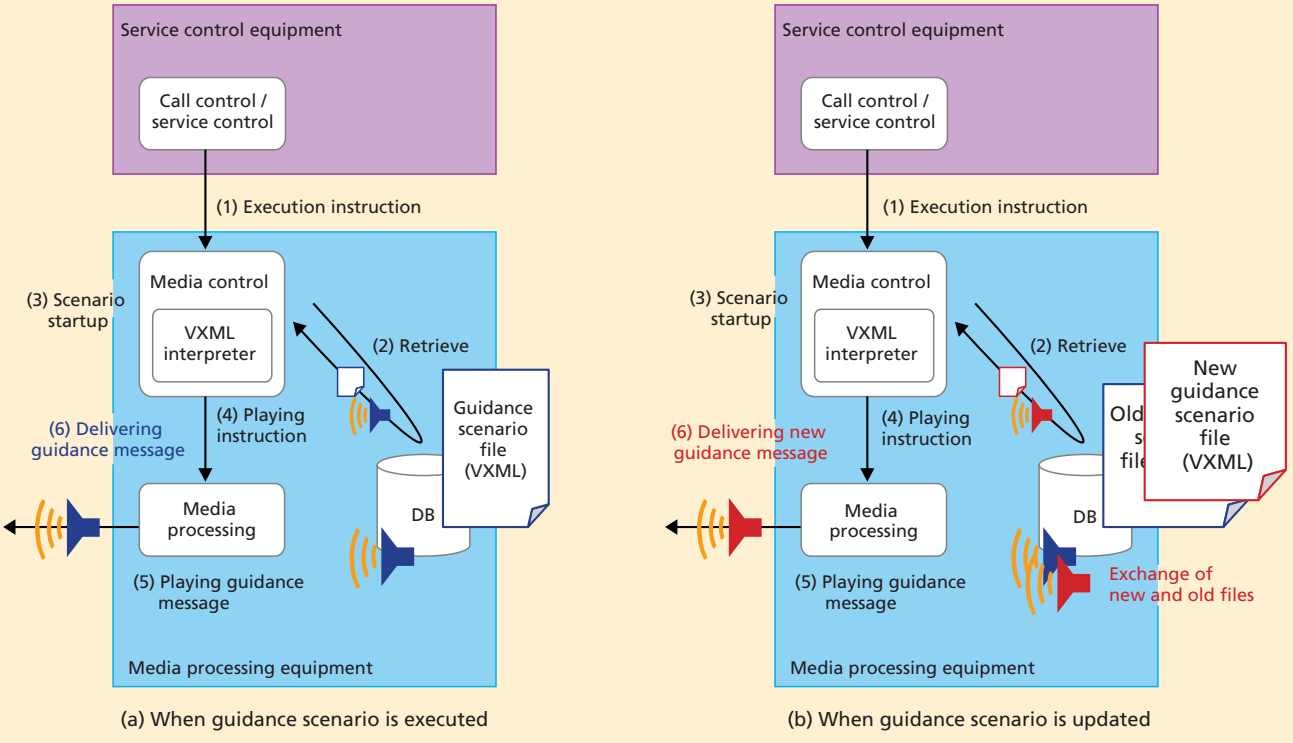


Figure 7 Example of guidance scenario execution and updating

*11 **VXML**: An XML-based language used by automatic response systems, etc. defined by the World Wide Web Consortium (W3C). The structure of interactive applications can be described with XML.

for each service. When the media processing equipment receives execution instructions from the service control equipment, it retrieves the guidance scenario file, obtains the results from the VXML interpreter of the media controller, and the media processing unit plays the guidance audio in the order described by the scenario.

A guidance scenario can be updated by replacing its DB file. The service control equipment is unaware of the change to a new guidance scenario, and continues to execute the instructions as before. The media processing equipment also continues to access and interpret the VXML file, unaware of any change in the guidance scenario. Only the guidance scenario file that is pulled into memory is changed, so there is no change in the operation of the VXML interpreter. This allows changes in the on-line guidance scenario.

4. Conclusion

We have briefly described the MPN constructed to provide value-added media services and a design policy aimed at active incorporation of commercially available products.

In future work, we will continue to investigate extension of the MPN functions and incorporation of new media processing functions for further development of value-added media services. An example of functional extension is making the guidance scenario freely customizable for each user by using the VXML described in Section 3.3 1).

Examples for the incorporation of new media processing functions include a text to speech function for audio output of text data and a speech recognition function for converting spoken words to text.

Furthermore, specifications are currently under discussion in Global System for Mobile communications Association (GSMA)[*12] toward the realization of a Rich Communication Suite (RCS)[*13] that makes advanced use of media (**Figure 8**). As shown in Fig. 8, while users are expected to accept rich communication services, technology for

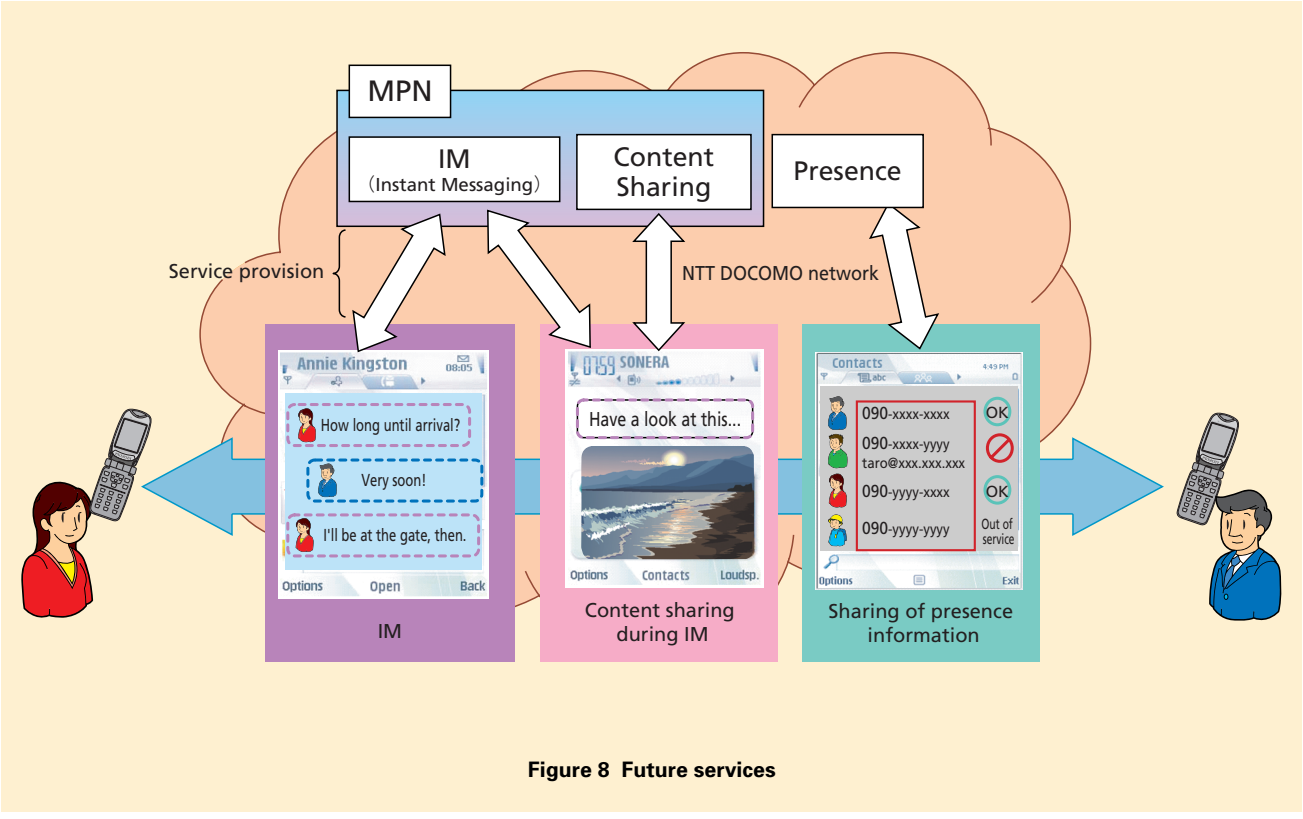


Figure 8 Future services

*12 **GSMA**: An international industrial organization that represents mobile phone companies.
*13 **RCS**: A group of services that uses Presence, IM (*14) and Content Sharing (*15) to allow spatial and temporal sharing as a basic communication tool with telephony and e-mail.

Instant Messaging (IM)[*14] and Content Sharing[*15] is the most compatible with MPN and those functions are expected to be relatively easy to implement through combinations of the media processing functions that are already provided and new commercially available products.

REFERENCES

[1] K.Inoue et. al: "Expansion of Melody Call for Enhanced Music Services," NTT DoCoMo Technical journal, Vol. 10, No.1, pp. 42-49, Jun. 2008.

[2] H.Mouri et. al: "Function Extension for Video Mail Services for Video Phones," NTT DoCoMo Technical journal, Vol. 14, No. 3, pp. 38-43, Oct. 2006 (In Japanese).

[3] H.Aoyama et. al: "Card Service Control Processor for Credit Services MCSCP," NTT DoCoMo Technical journal, Vol. 9, No. 2, pp. 52-56, Jul. 2001 (In Japanese).

[4] S.Okubo et. al: "Converting to the IP-based FOMA Voice Network for Advanced Services and Economization," NTT DOCOMO Technical journal, Vol. 10, No. 2, pp. 17-22, Sep. 2008.

*14 **IM**: A service technology that allows simple text conversations between two persons or among multiple persons.

*15 **Content Sharing**: A service technology that allows the sending and receiving of photographs, video, etc. during communication to deepen the sense of shared feelings.