Service Delivery Platform Implementing IP Multimedia Subsystem

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With telecommunications carriers shifting their business focus from voice telephony services to packet-based services for E-mail and Web applications and the provision of high-speed services becoming possible as network speeds increase, there is a need for a mechanism that can facilitate the creation of new services. Although the IP Multimedia Subsystem (IMS) has been attracting attention as an architecture that can separate the call control network from applications and combine voice and packet services, architectures based on industry standards and recommendations like IMS may still have problems, such as insufficient business-oriented functions and poor connectivity with service providers. This paper introduces IMS problems from the network architecture viewpoint and describes a service delivery platform that solves them.

1. Introduction

The IP Multimedia Subsystem (IMS), which is an architectural framework for delivering multimedia services using the Internet protocol (IP), is being introduced by telecommunications carriers as a solution for achieving many services based on session initiation protocol (SIP) and integrating voice and packet services. As access networks increase in speed, value-added services such as the provision of multimedia and large-volume content are predicted to expand rapidly in both fixed-line and mobile systems. In Japan, although value-added services that can contribute to business success through the use of IMS have long been anticipated, they have not yet appeared. Therefore, telecommunications carriers look forward to the rapid provision of value-added services that can be sustained by IMS into the future and to a decrease in the total cost of ownership involved in the provision of those services.

In this paper, we consider a service model for these much anticipated value-added services from the perspective of market trends, introduce a function model and architecture for the service platform necessary to achieve such services, and mention future issues.

2. Market trends

Compared with mobile communications, fixed communications have traditionally excelled in terms of speed, reliability, and price. In recent years, however, mobile communications networks in Japan have been migrating to what are essentially third-generation (3G) systems and introducing mobile Worldwide Interoperability for Microwave Access (WiMAX) and Long Term Evolution (LTE) technologies with the result that fixed and mobile communications have come to have little difference in transmission speed. Moreover, the fees for mobile communications have been shifting to flat-rate pricing, so price differences have also been disappearing.

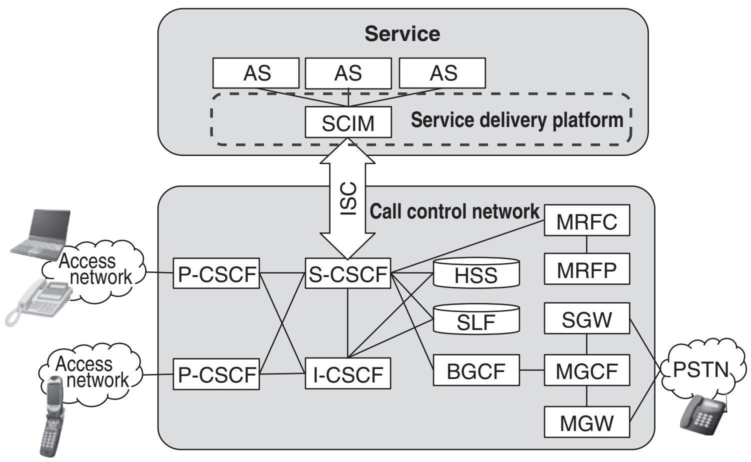
In this changing environment, services that make use of rich content that traditionally could be received only by fixed communications are now becoming receivable by mobile communications as well. To a service provider, the elimination of differences between fixed and mobile communications means an increase in business opportunities. However, to fixed and mobile communications carriers, it means the introduction of severe competition between the two where no competition previously existed. Thus, for both carriers and service providers, it is becoming crucial to find ways of developing attractive value-added services quickly and providing them cheaply.

At the same time, a move toward open systems in carrier networks has been taking place. Carriers, who can no longer expect to increase revenues from subscriber fees, are adopting a business scheme in which revenues are obtained from operators that provide services over their networks. The move toward open carrier networks has been described in guidelines[1] pertaining to mobile virtual network operators and has been progressing on the national level. For carriers, the way in which service providers use their networks is becoming an increasingly important issue.

3. Network architecture

A service provider that wishes to develop services that use a carrier network must separate those services from the network. Today, as the conversion of carrier networks to IP proceeds, fixed and mobile communications carriers are beginning to deploy the IMS architecture, which promotes the standardization activities of the 3rd Generation Partnership Project (3GPP) and 3GPP2, which are specifications for unifying voice and data. An outline of IMS architecture is shown in **Figure 1**. Here, the network for performing call control centered on the call session control function (CSCF) is separated from application servers (ASs) that make up the service group, and services are achieved mostly through the use of SIP. An interface called IMS Service Control (ISC) is established between the serving call session control function (S-CSCF) and the ASs using SIP.[2]

However, even when an AS conforming to ISC is deployed, services often do not begin immediately after a maintenance person sets the initial filter criteria—subscriber information stored in the home subscriber server (HSS)—and the S-CSCF transfers the SIP method to the AS. For example, it is not unusual for service operation not to begin even though commercial AS products for providing instant messaging, presence, conferencing, and other services have



BGCF: Breakout gateway control function
I-CSCF: Interrogating call session control function
MGCF: Media gateway control function
MGW: Media gateway
MRFC: Media resource function control
MRFP: Media resource function processor
P-CSCF: Proxy call session control function
PSTN: Public switched telephone network
SGW: Signaling gateway
SLF: Subscription locator function

Figure 1
Outline of IMS architecture.

been installed and a connection with the carrier's S-CSCF has been made by ISC. Here, various issues must be dealt with, including connectivity problems due to differences in protocol between AS vendors even for the same ISC, device faults and load distribution, charges, and service level agreement guarantees. To this end, a service capability interaction manager (SCIM) between the S-CSCF and AS has been defined by 3GPP to supplement ISC. That definition, however, is still somewhat vague, and there are differences in interpretation among vendors providing SCIM products.

Against the above background, there is a need for functions between S-CSCF and AS at the position of SCIM to launch service operations. For these functions, we chose to use a network architecture that plays the role of a service delivery platform to deal with the move toward open networks and to provide services that are differentiated by delivery speed.

4. Architecture of service delivery platform

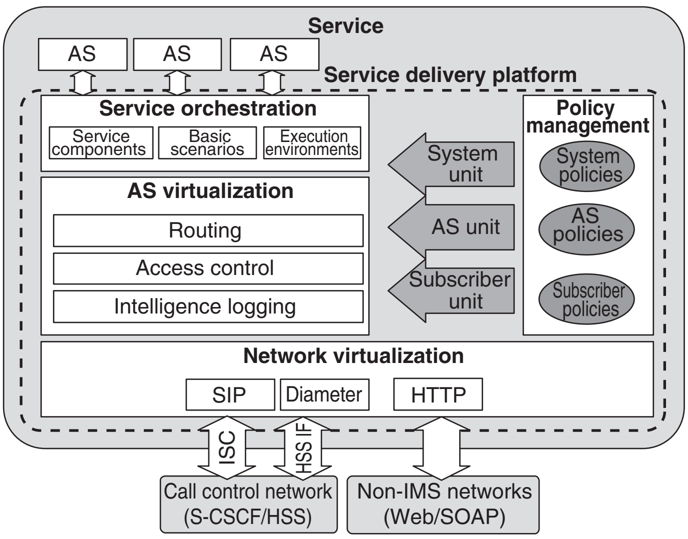
The basic architecture of this platform is shown in **Figure 2**. The platform provides network virtualization, AS virtualization, and service orchestration functions for executing value-added services and a policy management function for controlling the execution of those services, as described below.

1) Network virtualization

Network virtualization is an effective technique for service providers using the network. To provide compelling value-added services, a connection must be made between ASs and two networks: the call control network that provides presence, instant messaging, and other services applying SIP-based connections and subscriber information stored in the HSS, and a non-IMS network such as the Internet that provides Web services using hypertext transfer protocol (HTTP). The network virtualization layer provides functions for making seamless connections between ASs and these two networks.

2) AS virtualization

AS virtualization is effective for achieving quick provision of value-added services. For prompt service provision, AS addition must be



Diameter: Type of SIP client
IF: Interface
SOAP: Simple object access protocol

Figure 2
Architecture of service delivery platform.

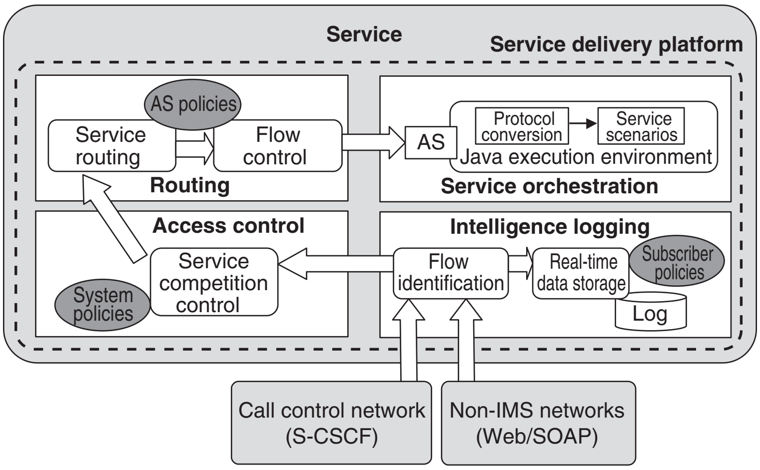


Figure 3
Functions of service delivery platform.

performed independently of the network. The AS virtualization layer provides intelligence logging, routing, and access control functions and provides a function for adding ASs independently of the network.

3) Service orchestration

The service orchestration function is needed to provide new value-added services quickly and cheaply. The service orchestration layer consists of service components that can be used (and reused) in common by multiple applications, basic scenarios that define combinations of components, and execution environments for executing those scenarios.

4) Policy management

Policy management is divided into three stages: system policies, AS policies, and subscriber policies. System policy management provides a function for managing policies defined for the system in terms of a service delivery platform; a typical example is control of service competition between ASs. AS policy management provides a function for managing policies defined for each AS; a typical example is AS flow control. Subscriber policy management provides a function for managing policies defined for each subscriber; a typical example is intelligence logging.

5. Functions of service delivery platform

In this section, we describe the functions provided by the platform (**Figure 3**).

5.1 Intelligence logging

This function lies at the point where information is received from the network. It consists of flow identification and real-time data storage. The flow identification section uses a layer-7[note)] information-analysis function to identify incoming information and forwards the analysis results to access control and real-time data storage. The real-time data storage section saves log data deemed necessary for subscriber policies. In addition to conventional applications such as charging and statistical analysis, logged data is expected to be used for high-value services such as life logs, data mining, and recommendations.

5.2 Access control

This performs various control functions, such as regulating the number of simultaneous connections based on the service level agreement

note) Layer 7 is the application layer in the seven-layer Open Systems Interconnection reference model.

with the subscriber, regulating access when the usage limit has been exceeded in the case of prepaid charging, and controlling competition between services when the user contracts for multiple services.

The service competition control function has two sub-functions—a simultaneous-service-launch conflict check and a service-launch-order check—that operate in accordance with system policies. Note that competition control is needed not only for SIP-based services but also for HTTP-based services and for SIP-HTTP combination services. Thus, by providing competition control for both telephone connections and information services like chat, E-mail, games, video delivery, and video sharing, we can expect a new type of integrated user experience to be created.

5.3 Routing

The routing function receives requests from the network and decides which AS to send each request to. It consists of service routing to allocate requests based on static information and flow control to allocate requests based on dynamic information.

5.3.1 Service routing

This sub-function decides the destination AS of a request on the basis of AS policies. Although the S-CSCF chooses the transfer-destination AS based on the initial filter criteria, the addresses of such destination ASs have been statically set. In actual system construction and operation, new ASs may be installed in response to rising traffic levels, or, in the case of a “small start”, new services may be provided by implementing them on existing ASs or services may be rearranged on other existing ASs or new ASs as traffic increases. Service routing permits such flexible AS arrangements, which can be hidden from the S-CSCF, and enables ASs to be added independently.

5.3.2 Flow control

This sub-function decides the destination AS on the basis of load development logic (round-robin, etc.) determined by AS policies and on the basis of existing node information (CPU utilization, number of accesses, operating conditions, etc.). Flow control supports stable AS operation, facilitates AS development, and enables the prompt provision of value-added services.

5.4 Service orchestration

In addition to linking service components, service orchestration enables Java-based scenarios to be described and diverse specifications and requirements to be supported by operations that include timing control, conditional branching, and fault processing.

6. Future issues

Although IMS specifications call for ISC (SIP) as a standard protocol between ASs and the network, that protocol is limited in terms of control and extensibility. Therefore, there will be studies on giving it a protocol equivalent to the intelligent network application protocol (INAP), which is a standard protocol for common channel signaling networks that exchange signals between a telephone switch and a service control station. Our service delivery platform will have to be upgraded sequentially in this manner.

7. Conclusion

This paper introduced Fujitsu’s activities related to a service delivery platform implementing IMS, which is expected to add value to the network and enable the creation of new services. This platform has many possibilities including the creation of new businesses for telecommunications carriers, creation of new services that are even easier to use through the interworking and cooperative efforts between carriers, reduction of service provision costs, and prompt provision of services. To make these possibilities a reality, Fujitsu intends to continue developing novel products, establish technology for visualizing the value of this service delivery platform in the field, and expand its solutions business.

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