M2M Service Platform to Support “Carrier Cloud”

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Abstract

Communication carriers (fixed line and mobile) believe that the unified management of the devices connected to their networks is the key to realize the “Carrier Cloud.” New ubiquitous society is realized, allowing secure and reliable use and combination of information on a network. This paper introduces an M2M (machine to machine) service platform to support the Carrier Cloud service.

Keywords

M2M (Machine to Machine), home automation, telemetry, telematics

1. Introduction

M2M (Machine to Machine) is the concept of providing communication between machines, and it plays a role as the infrastructure for a ubiquitous society. In a ubiquitous society, the whole business world (e.g. energy, traffic, medical services, security, agriculture, etc.) are connected to (or fused to) a communication network. This concept aims to realize a world in which everything exists in a network and everything can be managed via that network.

Communication carriers (fixed line and mobile) can realize a new society with ubiquitous infrastructure by uniformly managing everything connected to their network, and by using and combining secure and reliable information on that network. We call it a “Carrier Cloud” (“Cloud” type of services operated by communication carriers). We are examining and developing an M2M service platform by which communication carriers can provide the aforementioned infrastructure. This paper introduces an M2M service platform to support communication carriers in creating new infrastructure businesses with the Carrier Cloud. The platform is designed to be expandable and flexible. Therefore, it can correspond to various M2M applications such as home automation, telemetry and telematics, and operate these applications efficiently.

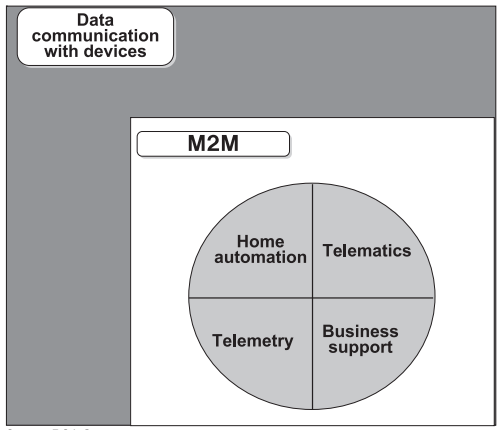
2. M2M Market Environment and Classification

In the M2M market, many applications have been developed in various business fields, and these applications are expected to be applicable to a wide range of markets. One existing and well-known application is remote meter reading for utilities (e.g. electricity, gas and water). Applications for consumers have also been appearing recently. Principal applications include network-connected home appliances (e.g., audio-video equipment), and other applications such as remote control of lighting equipment. In general, these M2M applications can be classified as shown in **Fig. 1** .

The market shows diverse aspects; therefore, it is not easy to appropriately describe the size of the market. However, it is possible to know the growth potential of the market by watching the market scale of M2M in mobile networks, which are considered to be the mainstream of future networks (**Fig. 2**).

It is forecasted that the market will reach 2 trillion yen level in Japan alone in 2010. In addition, it is said that there is a possibility that the market will show growth of 2,000% in the next seven years.

The aforementioned M2M applications are in a market which is expected to grow in relation with the networks of



Source: ROA Group

Fig. 1 M2M applications.

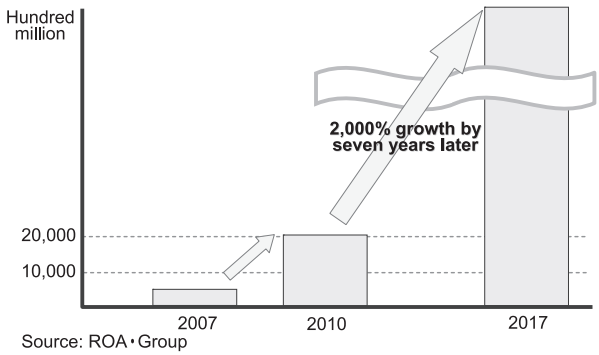


Fig. 2 Market for mobile M2M communication modules.

communication carriers as mentioned above. In this market, communication carriers are required to target all sizes of enterprises (i.e. not only big enterprises, but also small and medium-sized enterprises). Connecting the maximum possible of various devices to their network will be the key to succeed in this market. We will provide an M2M service platform to the market, so that communication carriers, as the Carrier Cloud, can correspond to various M2M applications.

3. M2M Service Platform Concept

At present, only big enterprises which are able to own their service infrastructure are performing M2M services, and communication carriers just provide these enterprises with communication lines as "pipes." Most current cases use a "vertical integration model," and the growth of the market will hit a ceiling soon if this situation continues. We believe that communication carriers should provide service execution environments in order to stimulate the market for M2M services. In other words, communication carriers should provide the Carrier Cloud which uses a "horizontal integration model" in which even small and medium-sized enterprises can participate (**Fig. 3**).

In the above, we have talked about the role of "inevitability," which is an important concept regarding M2M service platforms. It is necessary to continue collecting information on various devices and to be able to manage and control these devices. In addition, carrier assets (e.g. line information, positional information, authentication, billing, etc.) should be open as common functions, and the information should be provided with managed communication carrier networks. An M2M service platform will support the creation of the Carrier Cloud and will also bring a fusion of communication and information safely, securely and easily. An M2M service platform is a concept for realizing the aforementioned "Inevitability"(**Fig. 4**). This new horizontal integration model (a fusion of vertical and horizontal integration models) is expected to provide communication carriers with the means to streamline OPEX and CAPEX by shortening the preparation period before starting services and fusing/integrating services.

4. Configuration of M2M Service Platforms

Configuration of M2M service platforms is layered in accordance with roles as follows (**Fig. 5**).

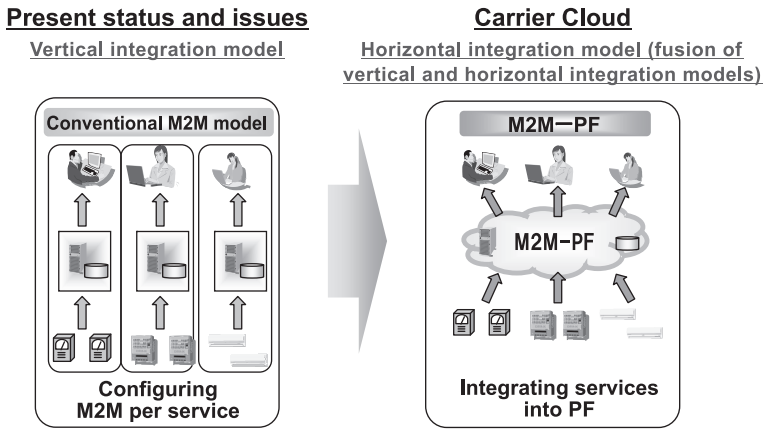


Fig. 3 Model of the Carrier Cloud to be provided.

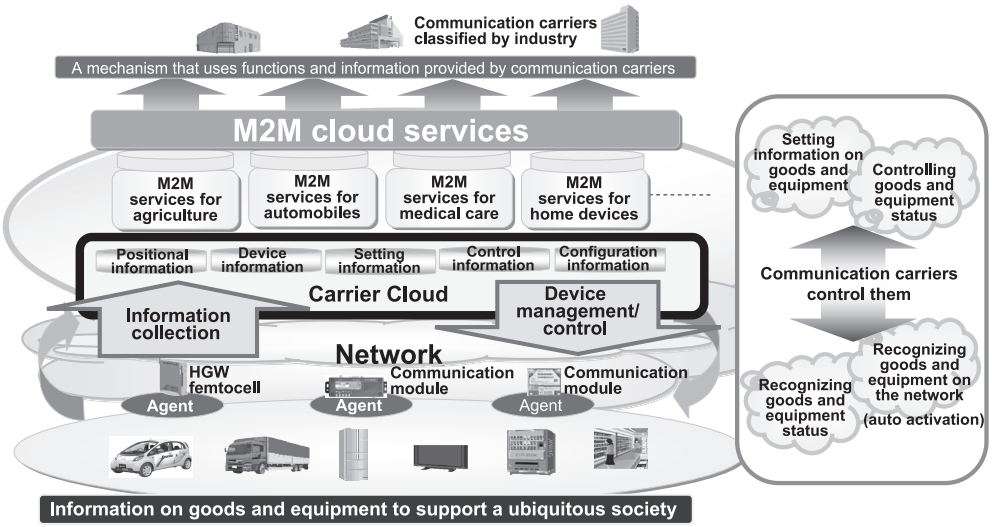


Fig. 4 M2M service platform concept.

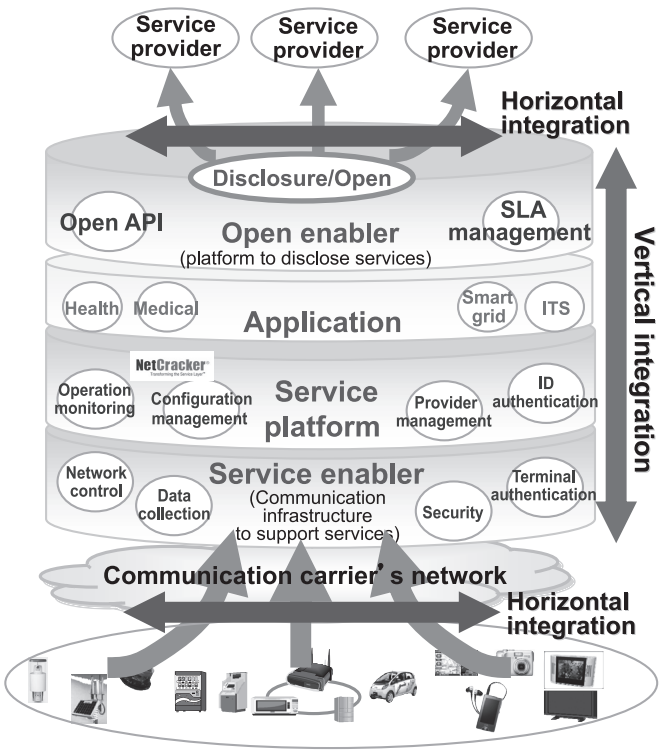


Fig. 5 Configuration of M2M service platforms.

1) The “service enabler” is the communication infrastructure supporting services. Its roles include network control, monitoring and control of M2M devices, collection of device data and device authorization.
2) The “service platform” is the service infrastructure which works as a core of the platform. Its roles include support for the introduction and operation of services and the management of service providers.
3) “Applications,” which use the aforementioned layers, are the services of communication carriers.
4) The “open enabler” is the infrastructure for making the functions of each layer open to the 3rd parties.

These layers correspond to the expected three business models of communication carriers as follows. (1) The first business model is the “communication service provision type,” in which the communication lines of carriers are used only as a means for communication. In this conventional case, communication carriers provide service providers with functions to operate and monitor communication lines, while the service infrastructure is owned by service providers. (2) The second model is the “MVNE type,” in which communication carriers perform communicative functions such as operation, monitoring and controlling of the network, and service providers provide services and perform communication-related operation. (3) The third model is the “solution provision type,” in which communication carriers provide all of the communication and M2M services as a single solution.

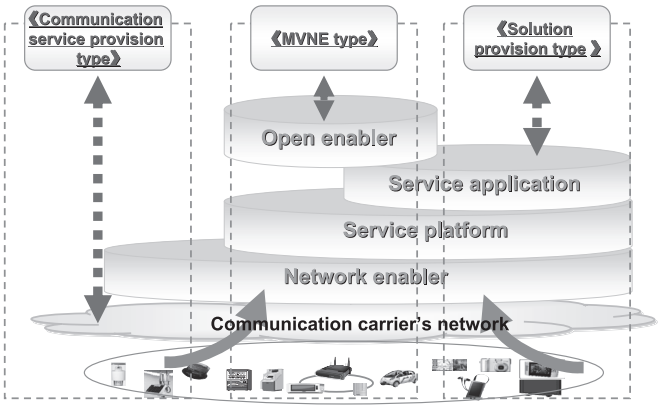


Fig. 6 Communication carrier business models.

The M2M platform in the aforementioned configuration corresponds to these business models and supports the business of communication carriers from various perspectives to a maximum extent (**Fig. 6**).

5. Configuration of Functions and Principal Technologies

In the previous section, we showed the logical organization of the platform layers corresponding to the business models of communication carriers. This section explains the technical configuration of functions and the principal technologies supporting these functions (**Fig. 7**).

In general, functions can be divided into (1) the functions of the "M2M service platform," which will be intensively explained in this section, (2) the functions of the "M2M agent," which works as a client of M2M (HomeGW is included as well), and (3) the functions of the "front end," which provides service providers with an enabler as an API.

In terms of the M2M service platform, which is the main issue here, the core is "M2M core control," which is in charge of core functions including management of various devices such as communication modules, device status management and collection/accumulation/analysis of information from M2M applications (devices). There is also "M2M service introduction support," which is in charge of inventory, provisioning and configuration management, with the purpose of offering various services in a timely manner. In terms of system architecture, Fig. 7 shows the functions common to all M2M applications. However, it is actually assumed to be SOA (service-oriented architecture), by which the service-specific functions in the "application layer" (see Fig. 6 in the previous section) can be added, as needed, as common functions.

Regarding the role of the "M2M interface," a standard interface is implemented with the principle that "a platform

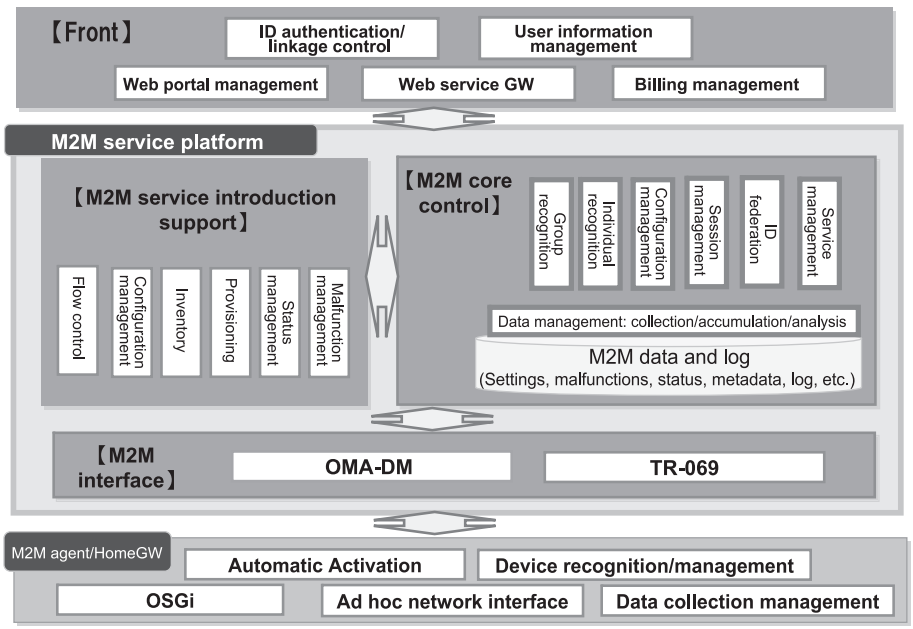


Fig. 7 Configuration of M2M service platform functions.

which can correspond to a wide variety of services should be able to connect to a wide variety of agents and devices." In terms of an M2M communication module for mobile purposes, Device Management (OMA-DM), which is defined by OMA (Open Mobile Alliance), is implemented. For fixed lines for home gateways (HGW), such as broadband lines and NGN lines, TR-069, which is defined by Broadband Forum (formerly known as DSL Forum), is implemented. Thus, it is possible to correspond to various M2M applications using mobile communication and fixed lines. Since the details of these standards have been defined and explained by each standard-setting organization, we will skip the details in this paper.

Here, we will explain the principal technologies needed to add further dynamism to the M2M market. Above all, in the case of M2M applications for consumers (BtoC and BtoB-toC), such as home automation, it is important that the end user can receive services just by connecting M2M devices to a HGW (i.e. a home network). In other words, we believe that the market will not be stimulated unless all categories of user are able to use the services without any trouble. Most end users are still non-PC users and do not have sufficient IT knowledge. Realizing "Automatic Activation" function is very important. The idea is to extend so-called "zero configuration" technology to the level of service activation. In order to realize it, an intelligent agent is necessary, and the agent will work together with the M2M service platform on the server side.

The concrete procedure for Automatic Activation is as follows:

1) Automatic detection of connected M2M devices, model recognition, etc.
2) Management of device configuration (management of home network configuration).
3) Distribution of the OSGi [*1] Bundle App to run services on connected devices.
4) Acceptance by the user to connect devices to the home network and to receive services.

Automatic Activation is generally realized by these functions and procedures.

Fig. 8 shows an example of Automatic Activation. The figure illustrates the process from connecting a network camera to receiving home monitoring service.

For the detection of devices, and the recognition of specific models, the necessary information is obtained from the UPnP (Universal Plug and Play) or DHCP (Dynamic Host Configuration Protocol) header, both of which are protocols implemented as standard in network devices. In order to receive services using devices (in this example, watching home video on a tablet terminal using an internet camera), OSGi Bundle App is delivered from a platform. The application used here has a function to activate the camera from the tablet terminal and to deliver the video captured by the camera to a tablet terminal. The key point here is to make an M2M service platform, associate a service with detected/recognized devices and deliver the appropriate Bundle App for the service. In order to achieve this, a platform is needed to manage the status of the user (e.g. authorized to use the service or not) and the

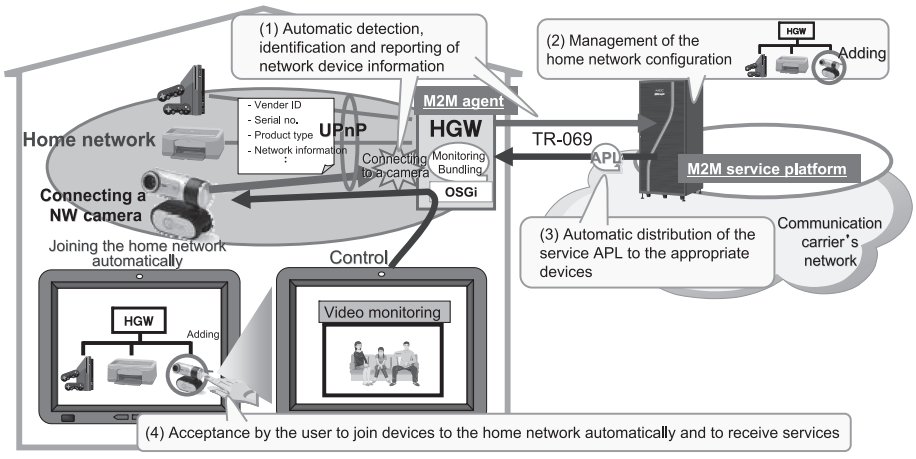


Fig. 8 Example of automatic activation.

[*1] OSGi (Open Services Gateway initiative): a Java-based framework defined by OSGi Alliance (a non-profitable standard-setting organization) to remotely control and manage devices.

information about the devices to be used. These tasks are principally handled by the aforementioned M2M service introduction support, which has inventory and provisioning functions. As a matter of course, authentication procedures such as service authentication are performed by the platform and integrated agent.

This is the outline of functions and related processes. It might seem easy to realize them; however, there are some problems to be solved. For example, in the case shown in Fig. 8, in (4) the device is used to receive services, and the user is required to give permission for this usage, which is troublesome to some degree. There are other concerns. For example, since the information obtained by the aforementioned UPnP and DHCP protocols varies by vendor, it is necessary to figure out measures to let end users know the facts without giving much confusion. In other words, it might be difficult for users without sufficient IT knowledge to associate connected devices with services. To solve this problem, we would like users to have a certain degree of IT knowledge first; then it will be possible to figure out how to improve convenience. There is another big concern: this implementation method is only applicable to network devices. In other words, it is impossible to apply it to non-network devices such as home appliances. Regarding this problem, Z-Wave [*2] is attracting attention, principally in North America. Z-Wave is a protocol replacing infrared remote controls. This protocol makes it possible to control certain kinds of home equipment. There are attempts to treat home equipment like network devices through conversion to IP. Observing such trends, we would like to examine how to implement non-network devices with an M2M agent.

6. Conclusion

As mentioned above, there are still many problems to be solved. However, we will make our best efforts, in a timely manner, to adopt movements and trends both in Japan and overseas and to provide them to communication carriers. We will promote the introduction and development of an M2M platform so that communication carriers can build the new civil infrastructure for a ubiquitous society using our M2M platform. We sincerely hope that many applications, of a variety of business types, will appear in the new infrastructure, and we foresee huge new markets opportunities which are safe and secure.

Reference

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[*2] Z-wave: A wireless communication protocol with interoperability, developed by Zensys, a Danish firm and Z-Wave Alliance. It is designed for applications requiring low power consumption and long-hour operation, such as home automation and sensor networks.