Trends in M2M Standardization and NEC's Activities to Promote the Standardization of Remote Management Technologies

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Abstract

In order to improve the quality of life and also to achieve a sustainable society, new generation network services based on fine sensing and control in a physical world are increasingly in demand. M2M (Machine to Machine) communication technologies provide a platform for these services and their standardization and fundamental researches are promoted globally. This paper introduces the standardization trends of the M2M communication technologies, focusing on a remote device management function and discusses NEC's approach to their adoption.

Keywords

standardization, M2M platform, M2M device management

1. Introduction

M2M (Machine to Machine) used to be defined as a technology to conduct monitoring and controlling machines autonomously via wide-area networks such as the Internet, etc. and such services and functions have been provided mainly for enterprises and industrial markets. On the other hand, demands for new services based on the sensing and controlling in every day lives, such as for energy control, healthcare management, and traffic control are emerging these days (**Fig. 1**). As social infrastructures to support such demands, activities to realize a concept of Internet of Things are being encouraged. The Internet of Things refers to as an architecture that distributes

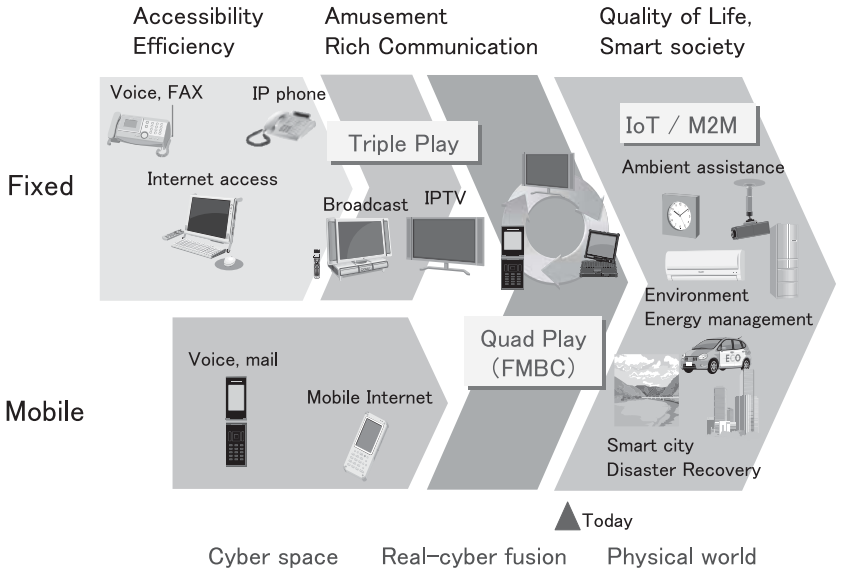

Fig. 1 Transition of network services.

information smoothly and flexibly over networks that connects all things in the physical world. The M2M platform is expected to play an important part in the communications function of the Internet of Things.

In order to create and expand the M2M market, various organizations are working on the standardization of technologies of the Internet of Things under both de jure and de facto standards. The core topic of this paper deals with the remote management technology of M2M devices via M2M platforms and outlines trends in standardization, and also NEC’s commitment is explained.

2. Issues in M2M Network Operation and Management

“FCAPS” defined by the ITU-T in specification M.3400 [1] is widely recommended for the communications networks management function model. FCAPS is an acronym of Fault, Configuration, Accounting, Performance and Security; these are the five essential functions in the operation and management of network infrastructures. These functions have been designed for the infrastructure administrators to monitor and control devices that they own and thus can directly control. However, in the M2M platform, two different types of devices and sensor nodes are involved: one type can be controlled directly and the other cannot be so controlled. In such an environment, it is necessary to design open protocols to execute FCAPS management commonly for both types of devices and to disseminate them to various devices in the networks. These are the targets of standardization of the M2M platform operation and management.

Many technical challenges pile up before constructing a satisfactory M2M platform: scalability to control connected terminals including the sensor nodes that are anticipated to increase their numbers significantly in the future, reliability in meeting mission-critical service requirements in networks that contain low performance devices, protection of individual privacies, integrity of a namespace, enhancement of service management to deal with customizing applications and interfaces, and so on. These issues must be considered in the network operation and management to a greater or lesser extent. Among them, the most significant issue is the configuration management that controls and manages the network parameters and status of M2M devices when operating and managing M2M platform. This is because, in the M2M platform, abundant terminals are allocated at the user side such as those servicing both the digital society and living environments.

3. Standardization Trends for the Remote Management of M2M Devices

There is no defined standard technology that exists at present regarding remote management of M2M devices. However, standardization are being promoted by entities under the leadership of telecommunications carriers in order to establish regulations for remote management protocols of communications equipment in home and mobile networks, etc. When considering the expansion of M2M service domains, it is preferable that remote management of M2M devices could be established via a technology that could be integrated into these conventional control protocols. Therefore, conventional protocol technology researchers have begun to study interoperability in the context of M2M devices.

This chapter introduces the standardization of the remote management of M2M devices for home and mobile networks, and also discusses the trend toward the standardization of embedded system technologies for gateway devices.

3.1 Remote Device Management for Home Network Devices

The Broadband Forum (BBF) is an influential organization that promotes the standardization of remote management of home network devices. BBF was established under the name of “DSL Forum” by fixed line communications carriers and device vendors as an industrial standardization organization that has been addressing the standardization of broadband communications technologies targeting home networks. BBF has developed TR-069 [2] , a common protocol “CWMP (CPE WAN Management Protocol),” which connects configuration management servers and managed devices. Subsequently, BBF has been promoting modeling of the data for major devices to enable their control and management.

Fig. 2 illustrates the operation and management concept of home networks employing TR-069. At present, data models are defined mainly for devices to be employed for “triple play” services such as home gateways and set-top boxes, etc. However, a technology that allows proxy style remote management for non-TR-069 devices is under study. Furthermore definitions of the management data models for in-house information equipments, home appliances and sensors will eventually offer opportunities to implement device operation and management via M2M platforms that cover a wider range of network applications.

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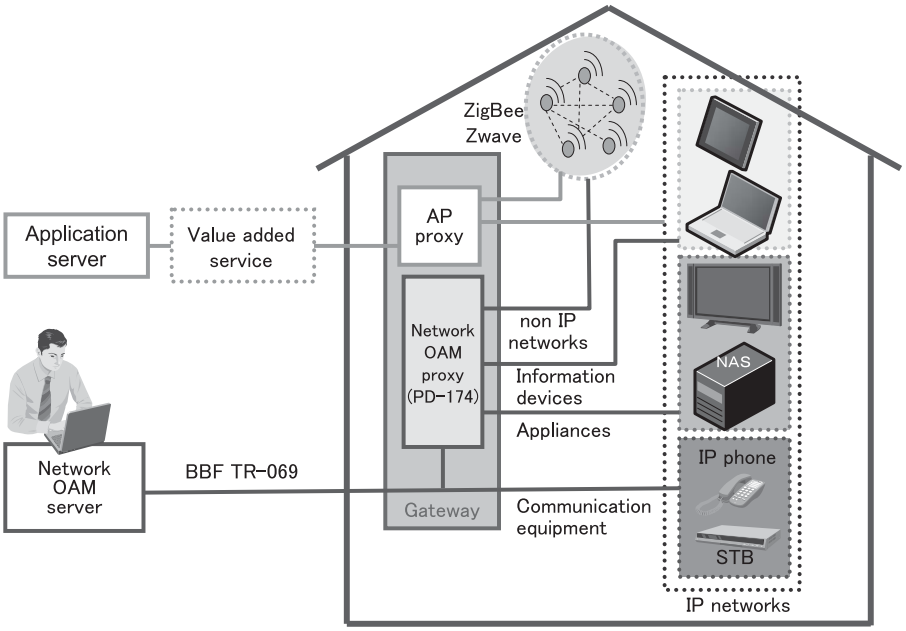

Fig. 2 Operation management image with TR-069.

Since the middle of FY2010, BBF has started to investigate technologies to deal with M2M services. BBF is also currently promoting the examination of issues to be expected when BBF technologies are employed in the M2M services, and intends to continue its researches into technologies aimed at dealing with the identified issues.

3.2 Remote Management of Device with Mobile Networks

The Open Mobile Alliance (OMA) is a leading organization that examines device management technologies for mobile networks including mobile phones. OMA has been established via the consolidation of the WAP (Wireless Access Protocol) Forum and the Open Mobile Architecture initiative. Currently the OMA is an industrial standardization group constructed by companies such as mobile carriers and vendors of communications equipment and terminals. OMA releases various standard specifications mainly for mobile services, and also develops OMA DM (Device management), a protocol of remote management for mobile terminals, like BBF that provides a similar function for home networks.

While assuming further development of the M2M market, OMA formed the M2M Task Force in 2010 to discuss the standardization of the technical specifications to be employed in the future. The White Paper reported by the Task Force contains various requests; M2M device support employing OMA DM, minimizing protocols to deal with low capability M2M devices and API provisions corresponding both to M2M networks and ETSI M2M architectures. Under their recommendations, working groups that specialize mainly in DM protocols are promoting standardization of the remote management of M2M devices via mobile networks.

3.3 Embedded Technology for M2M Gateways

The Open Services Gateway Initiative Alliance (OSGi Alliance) promotes the standardization to embed the above mentioned remote management protocols on gateway equipment. OSGi Alliance is an industrial standardization consortium. Its member companies such as telecommunications carriers, communication equipment vendors and system vendors collaborate with each other to distribute Java-based programs and to prepare a suitable environment for the execution of these programs.

The Residential Expert Group (REG) provides the OSGi embedded technology that targets home network services and it also promotes application interface standardization to deal with TR-069 and OMA DM.

At the moment, newly-released specifications from REG are under examination, and the interface for the M2M device management targeting ZigBee modules is being discussed as one of the main issues.

4. Standardization of Platform Architectures

The European Telecommunications Standards Institute (ETSI) that formulates the standard specifications of the telecommunications market in Europe established a TC (Technical Committee) in January, 2009 to start the standardization of M2M platform architectures. In order to support multiple services, TC aims to construct a service platform that does not rely on specific network technologies and is planning to regulate the functional requirements of the platform and interfaces.

Fig. 3 shows the entire M2M architecture and its scope, which ETSI TC M2M is handling. While defining three domains, namely, M2M Application, M2M Network, and M2M Device, platform functions (capabilities) and interfaces among those domains are to be standardized.

The requirements will be examined by employing use-case analysis, and it is expected to complete the first release of a specification that aims to regulate basic architectures and functions by the end of this fiscal year.

With regard to M2M device management, a management interface that integrates the management functions recommended by BBF and OMA is being analyzed. A collaborative study is being promoted by encouraging liaison between these organizations and in holding workshops.

5. Standardization Activities for M2M Device Remote Management Technologies

M2M involves a wide variety of technology domains including devices, networking and applications, etc., and various organizations in each domain are promoting the standardization of M2M related technologies. Some areas are overlapped between different organizations, so that activities intended to coordinate the overlapped domains among organizations have already started. However, so many organizations are involved that is proving a difficult task to formulate the entire activities of all these entities.

NEC is promoting the platform technology standardization particularly with regard to the M2M device remote management technology that plays an important part in achieving a wide adoption of M2M services for domains such as energy,

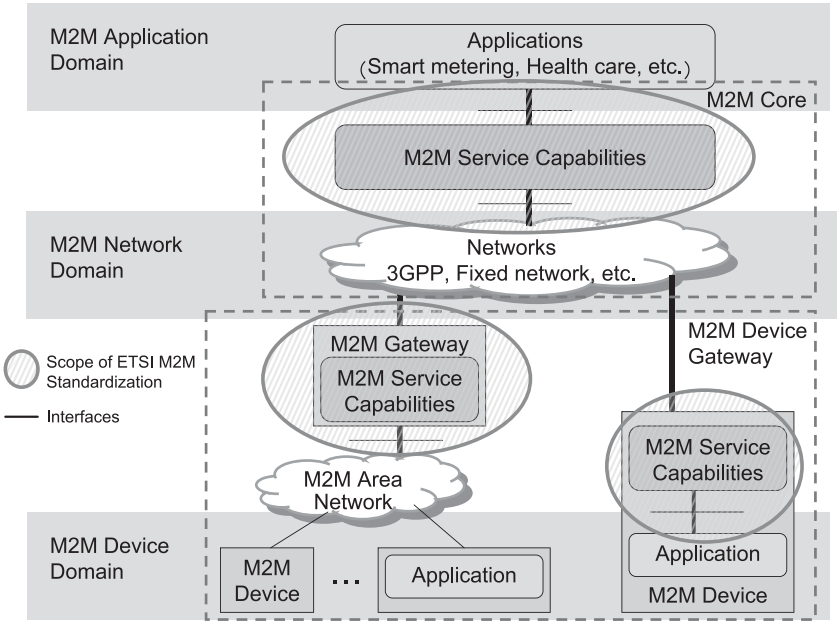

Fig. 3 The ETIS M2M system architecture.

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environment and medical care that construct core societal infrastructures. We approach the standardization organization introduced in this paper positively by proposing innovative technologies.

In 2010, NEC proposed a work item to study requirements for M2M services in BBF and now elaborating documents containing the technical requirements and issues to be solved so that technologies recommended by BBF will deal with the M2M services. On the other hand, in OMA, NEC proposes GwMO (Gateway Management Object) and its architecture that achieves the device management via gateways by employing OMA DM frameworks. NEC is also leading technical specifications in OMA. Furthermore, in OSGi Alliance, NEC is authoring RFPs (Requests for Proposals) asking for proposals for applications interfaces to support M2M device management as one of the next main functions to be released from REG.

6. Conclusion

As explained above, the remote management technology of M2M devices and the standardization trend of architectures for M2M platforms have already been introduced.

This paper focuses mainly on the standardization organizations in the communications domain. However, there is some discussion regarding the promotion of the standardization of service platforms to accomodate and link multiple M2M services upon communications platforms by involving the cooperation of the service providing industries. In the future, it will be essential to monitor standardization trends beyond those of the communications domains.

*ZigBee is a registered trademark of ZigBee Alliance, Inc.

*Z-Wave is a registered trademark of Sigma Designs, Inc.

*3GPP is a registered trademark of the 3rd Generation Partnership Project.

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