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Dynamic Context Awareness of Universal Middleware based for IoT SNMP Service Platform

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Abstract: This study focused on the Universal Middleware design for the IoT (Internet of Things) service gateway for the implementation module of the convergence platform. Recently, IoT service gateway including convergence platform could be supported on dynamic module system that is required mounting and recognized intelligent status with the remote network protocol. These awareness concepts support the dynamic environment of the cross-platform distributed computing technology is supported by these idea as a Universal Middleware for network substitution. Distribution system commonly used in recent embedded systems include CORBA (Common Object Request Broker Architecture), RMI (Remote Method Invocation), DCE (Distributed Computing Environment) for dynamic service interface, and suggested implementations of a device object context. However, the aforementioned technologies do not support each standardization of application services, communication protocols, and data, but are also limited in supporting inter-system scalability. In particular, in order to configure an IoT service module, the system can be simplified, and an independent service module can be configured as long as it can support the standardization of modules based on hardware and software components. This paper proposed a design method for Universal Middleware that, by providing IoT modules and service gateways with scalability for configuring operating system configuration, may be utilized as an alternative. This design could be a standardized interface provisioning way for hardware and software components as convergence services, and providing a framework for system construction. Universal Middleware Framework could be presented and dynamic environment standardization module of network protocols, various application service modules such as JINI (Apache River), UPnP (Universal Plug & Play), SLP (Service Location Protocol) bundles that provide communication facilities, and persistence data module. In this IoT gateway, management for based Universal Middleware framework support and available for each management operation, application service component could be cross-executed over SNMP (Simple Network Management Protocol) version 1, version 2, and version 3. The way of SNMP extension service modules are conducted cross-support each module and independent system meta-information that could be built life cycle management component through the MIB (Management Information Base) information unit analysis. Therefore, the MIB role of relation with the Dispatcher applied to support multiple concurrent SNMP messages by receiving incoming messages and managing the transfer of PDU (Protocol Data Unit) between the RFC 1906 network in this study. Results of the study revealed utilizing Universal Middleware that dynamic situations of context objects with mechanisms and tools to publish information could be consisted of IoT to standardize module interfaces to external service clients as a convergence between hardware and software platforms.

Keywords: context awareness; dynamic java; dynamic network; IoT gateway; universal middleware

1 INTRODUCTION

The IoT industry's ongoing transition from service-centered to deliverable network requires the use of auxiliary devices with interface for application integration, execution, and management. The complexity of these costs, decentralized and distributed computing systems presents significant import for external modules. Network protocols are increasingly requiring communication modules to offer context awareness systems that are dynamically, residential, remote interface way, service-oriented, decentralized, energy-efficient, and customized. The dynamic context awareness system with such network management properties must be capable of adjusting its behavior at run-time in response to its perception of its environment and its own state in the unit of effective adaptation. Looking at an emerging trend in network Forensic, internet, and network services grows in the IoT industry of infrastructure, more and more inefficient networks are exploited for temporary purposes. The dynamic context awareness of network forensics has provided researchers insufficient enforcement systems with such as dynamic service platform.

Dynamic Context Awareness should be designed in service deliverable component architecture that is a distributed residential system from the local area network to the broadband network. In the dynamic network system of service awareness, considering distributed system that proposed an implementation model for dynamic run-time context object [1]. Universal Middleware models of CORBA (Common Object Request Broker Architecture), RMI (Remote Method Invocation), and DCE (Distributed Computing Environment), which are representative distributed computing technologies, are implemented by network infrastructure management conventionally based on interface modularization for standardized application service module [2].

While the benefits of convergence solutions have been partially acknowledged in prior research in relation to SAAS (software as a platform) computing system, and edge, more about context object awareness have also converged to another applicable service of an additional component by internal and external network environment [3]. IoT (Internet of Things) and network resources have been transferred to deliver from the service platform as a management protocol. However, not all the device interfaces initialized by such information have been tracking handled [4].

IoT research and standardization have been done for activities and technologies including UPnP (Universal Plug and Play) / DLNA (Digital Living Network Alliance), and PUCC (Peer-to-peer Universal Computing Consortium) that uses Universal Middleware. There has not been concern about networking in a distributed BCN, peer-to-peer/overlay networking management module to important things and add-on valued for a suitable platform for internal network among facility devices over heterogeneous service. Recently, peer-to-peer studies on the peer-to-peer metadata module, and a general middleware platform were researched and described [5]. These devices include desktop, home gateway, mobile phones, tablet computers, cloud servers, and others [5, 28, 29].

The implementable methods that support this model are representative of OSGi (Open Service Gateway initiative), Android platform, and ASP.NET Core, and there is a difference in the method of constructing a cross-platform centered on the operating system [6]. The majority of cross-platform support for the real-time operating systems can be easy to establish a correlative networks. Universal Middleware provides a service platform for integration way of the deployment of modules and services. This service module can be dynamically loaded and consume services applications that take advantage of the dynamic updating components without the required add-on process. The activation services make the application context object of network module available in the activation services.

In particular, RMI provides a standard interface suitable for the convergence of IoT devices and reliability applications for remote diagnostic management between application services in context object classes supported by Java environments [7]. An application service module for the Facility Device was configured based on Universal Middleware for porting to the residential gateway [8]. Remote diagnostic and device application context specific situations were possible with some MIB (Management Information-Based) customization for SNMP. Explain the dynamic service model and MIB for SNMP customization scenarios that can be adopted. Commonly, The number of nodes that this platform can support or the capabilities of SNMP managers are frequently constrained, making it difficult to use advanced features for more complex networks with tens of thousands network nodes. This MIB database based on Universal Middleware design is a text MIB file that itemizes and describes all contexts on a particular device that can be queried or controlled using SNMP. Globally, each MIB item could be assigned an object identifier domain for SNMP.

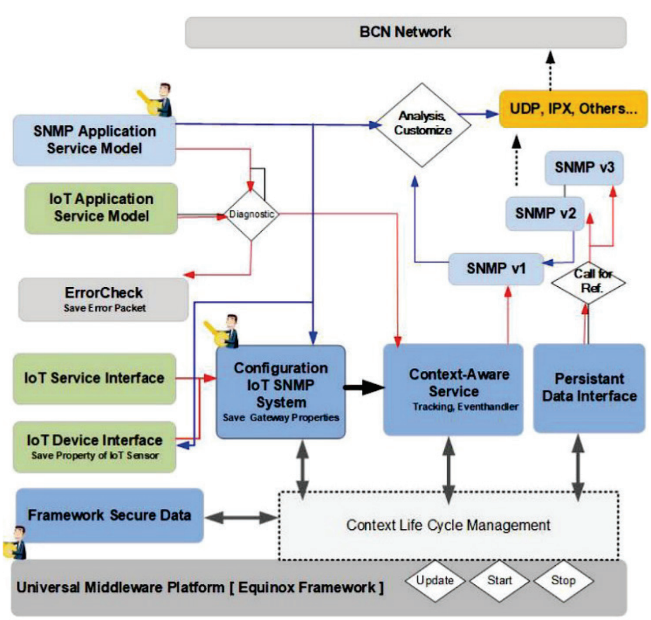

Figure 1 IoT SNMP service platform based on universal middleware

Practically, Eclipse's Equinox framework could be supported deliverables through the bundle context object that deployed standardize modules for transfer network, application components, and various data schema as a provider-centered system design [9]. It is possible to construct a mesh-scenario service between the communication module and the data module for configuring such an IoT environment, which is effective in systems whether it is a dynamic situation for devices or a dynamic situation on a platform.

Fig. 1 describe for IoT service platform depending on the device interface driver with standardized remote way diagnostics use case model. A common IoT application service model based on context bundles that depend on the framework of Universal Middleware. This diagnostic means to catch the SNMP Application Service model on UDP (User Datagram Protocol), IPX (Inter-network Packet Exchange), and other BCN (Broad Cast Network) areas. In addition, version 3 of the SNMP context also depends on the Security service context, as it offers enhanced security. As the SNMP context is used on another IoT-SNMP service platform, the Universal Middleware should be installed for the SNMP management process [10]. The above mentioned properties of the SNMP agent were recognized by this process. The generator is used dynamically for SNMP service implementations built upon this MIB.

In order to configure a scenario-based IoT module that is dynamically configured, concurrency must be provided on the Universal Middleware platform [11]. Until now, there have been studies on models and terminal system modules for implementing SNMP-based network management functions, but there are limitations in applying them to different versions of the operating environment. In this paper, existing methods with these limitations support multiple distributed structures and support them in the form of deliverable bundles, so it is possible to configure a scenario between the internal and the external BCN network of the IPX [12]. By implementing dynamic content based on a life cycle linked with SNMP, service attributes of a terminal may be stored and analysed in real-time. Chapter 2 shows the design of a Universal Middleware platform with dynamic context, and Chapter 3 shows that MIB information containing service attributes is tested through virtualization consoles of multiple devices to implement the proposed method and exchange it normally in a distributed environment.

2 DYNAMIC CONTEXT-AWARENESS OF UNIVERSAL MIDDLEWARE

2.1 Universal Middleware Platform for Context-Awareness

The name and modeling techniques for the contextual recognition procedure are configured differently for each application system. The structure of the contextual media constituting the system is generally composed of a modeling technique for the problem area and an inference technique suitable for the constructed model. In the existing situation recognition system, the basic configuration method consists of the development of middleware or intelligent situations, such as a module that interprets input information, a module that models the interpreted information and determines the situation, and a module that processes the defined situation according to the application system. By applying Universal Middleware on a network basis suitable for IoT environments, this study designed existing internal services as a dynamic context module that can organically configure devices and service interfaces while maintaining independence from the infrastructure associated with the external network, BCN area. Therefore, even when the existing built system is maintained, the system burden is reduced for managers, and modules can be effectively added for users to dynamically use the service. [13]

Universal Middleware could be provided a system model that extends to the external network interface with tracking and event handler. The scalability of the communication network module, application service module, and data module for each standard module is controlled by these external systems, which also offer convergence services for device interfaces. The system implementation specifications of this model were applied based on the Java-based Equinox framework supported by the Eclipse development environment [14].

An IoT device or the network administrator provides an interface to the management device through an SNMP agent. Fig. 2 shows that virtual information is shared by MIB, a database of performance statistics, and parameters directly related to the current operation of the device, including dynamic management object context. In addition, SNMP provides notify, command, and response, a mechanism by which administrators can communicate with agents, and consists of a dictionary store. IoT service-type information for an object context could be used based on MIB. These MIB resources get the information of device interface context object between SNMP Protocol Service and SNMP Agent.

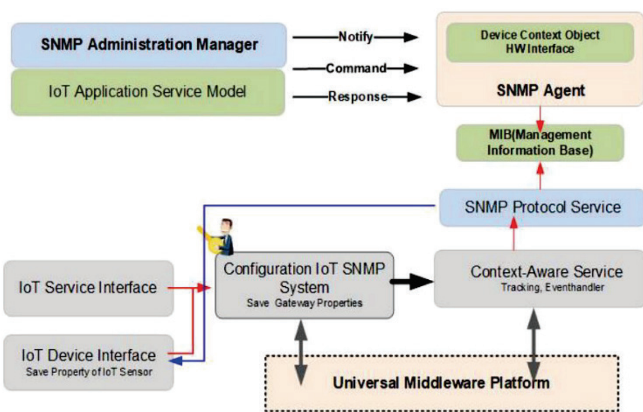

Figure 2 SNMP MIB information with service agent on universal middleware

Dynamic modules of objects for dynamic context awareness in the framework provide a device vendor-independent standards-based approach to Java Virtual Machine for CDC (Connected Device Configuration)-based applications and infrastructure [15]. Universal Middleware platform model communicates local area network and is distributed object system over the communication to provide a residential end-to-end architecture, and supports stable and evolving technical specifications for the open-source projects [16].

IoT service-type information on the object may be used based on the MIB information. Various manufacturing devices can be supported for RFC 1212, RFC 1213, RFC 1513, RFC 1757, and RFC 2021 remote monitoring as defined in the Internet RFC standard [17]. Thus, the private MIB for network components is available on the delivered context-object on the framework. The MIB resources can also be loaded and describes the entirety of all SNMP objects that are available in the network on context bundles, including addresses within this structure are set meta-data of the manufacturer [18]. It could be transferred to allow and distribution service consumers by the network manager, only the manufacturer number has to be registered.

2.2 IoT Convergence Service for SNMP

SNMP application of IoT service on the platform executes the commands issued by the agent that is to communicate messages and to store the MIB database. In this case, an SNMP service model designed according to the RFC 2571 method was suggested to process message contents differently for each version. Firstly, IoT Convergence Service for SNMP Service should be exchanged with handle messages to the network domain [19]. Secondly, the clustering module's convergence method offers security services that authenticate and encrypt messages. Thirdly, from the module to the others controls the access to distributed object context.

IoT SNMP Service declares separate convergence model for version 1 and version 2. Version 3 of SNMP implements that SNMP version 2 application bundles are designed according to RFC 2571. These platform models offer services that the network gateway's SNMP entity's convergence module is connected to [20].

Table 1 Management object context of MIB ID tree structure

Item	Format	Comment
Format	serviceNumber.identfierName.identfierName	Unique
Network Access Property	iso.org.dod.internet.private, console.1001.mySNMP.myUID.aaa.bbb	Last No. Service Instance Object
Configuration Property	Vector String <address>:<port>:<type>:where:	Trap Listener
	SNMP port(Primary/Secondary)	Platform Port
	Physical Name of SNMP Agent	System Location
	Domain Node Full-Name	Domain Name
	Contact Operator Name	System Operator
	Access Version 1, 2 or other future	Community Name

The IoT service domain should be to have a private identity that unambiguously identifies the entity the platform is running on the real-time execution environment. The converged module of platform is constructed dispatch including message processing, security, and access management. Thus, Tab. 1 describes IoT convergence service for SNMP contains a MIB tree control system with items that could be building scenario based. MIB ID should be assigned to context for identifying the object of the following format in Tab. 1.

IoT MIB service format is used by network managers to access the properties of the device type that the service represents that hold properties. To access the properties of a particular service uses the notifications to inform the manager that a predefined event has occurred and the generation of the agent assigns time-stamp fields, object ID, and variable [21].

2.3 Evaluation of Building for Dynamic Context-Awareness

Evaluation of Building for Dynamic Context Object is based on the installation and test environment of a framework that implements Equinox and commercial engine of Universal Middleware. Use the equation editor to show each equation. Thus, a Universal Middleware-based SNMP platform was established for application service bundles for dynamic context awareness experiments [22]. An application service bundling operation for object context applied to the module standard in the Equinox framework supported by the Eclipse 2021 IDE (Integrated Development Environment). For multiple supports of IoT service devices, a configuration management service bundle that supports SNMP version 1, version 2, and version 3 were configured on the platform [23].

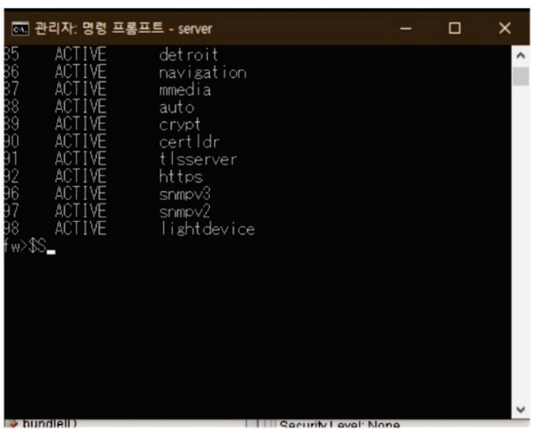

Figure 3 SNMP application service of equinox framework JDK 1.5

Fig. 3 shows the execution monitoring of IoT Service Platform Engine and SNMP services running on a Windows 10 compatible with Equinox framework based on JDK 1.5 JVM (Java Virtual Machine) as an active state [24]. Commonly, SNMP architecture supports a device service with a control module in each version of the architecture by adding DDS (Device Driver Subsystem) to the module for controlling different devices. Context-Aware SNMP apps send messages to the BCN network in XML (Extended Mark-up Language) format which removes the length restriction [25]. The first recognition experiment case is about an SNMP-based IoT convergence service. Fig. 4 shows the experiment and results of setting and changing MIB information after installation of SNMP version 2 and version 3 in a multi-support environment on a service platform that applies Universal Middleware.

Subsequently, Fig. 4 shows a process for setting and driving a service gateway according to the SNMP version on the console after driving for platform evaluation. This evaluation system is used for managing the SNMP MIB framework management network, and configuring service context through the object configuration service through SNMP. The role of the configuration module runs to all awareness of the context object mentioned above itself and should connect to the framework. Also, in order to run with the SNMP management service, there is a need to have connection information about SNMP [31]. In this application test, MIB information constructs a standard interface for lighting devices, an IoT service scenario, to confirm the applicability of multiple preferences for each version 2 of the application service. It is possible to set the authority for the person in charge of the operation, and domain name for reading, writing and notification [26].

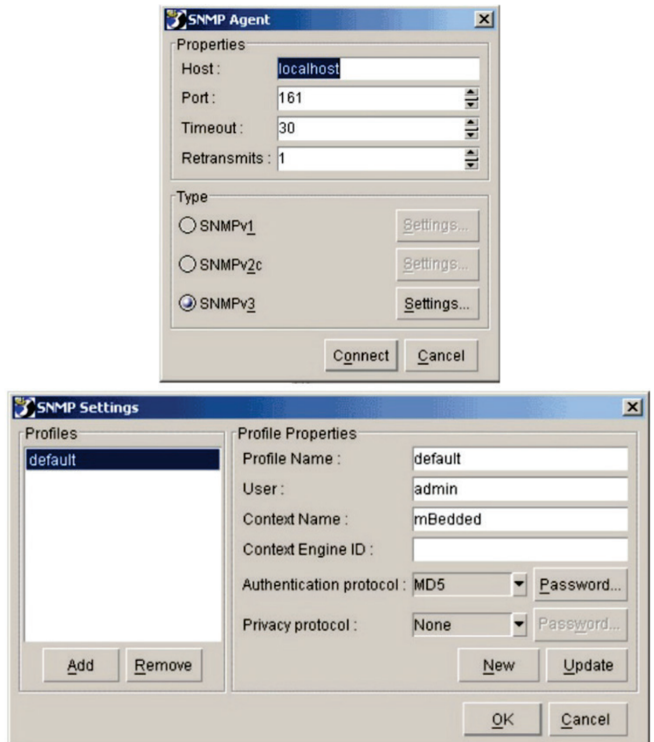

Figure 4 Connecting and setting for process of SNMP

Externally, security services could be extended in version 3 with Trap libraries to connect a multi-platform based on dynamic situations. SNMP agent uses trap notifications to inform the manager that a predefined event has occurred.

The second experiment was Fig. 5 shows MIB information. A number of IoT modules configured on the framework have been configured, and the MIB information of the lighting device for the SNMP service and the configuration levels are configured differently according to versions 2 and 3.

In addition, system Lister information, including access manager information, domain information, and port number, can be additionally set to dynamically expand the interface so that it can be easily configured when linking services between inside and outside the framework.

Fig. 6 shows MIB for Dynamic Query Execution of Context Awareness. The condition of dynamic information located for each function of the device indicated by the MIB is changed, and status information can be checked in real-time through activity information. In addition, through an internet address and trap nodes information, it is possible to check the complex service status with notification functions including the failure status of the device.

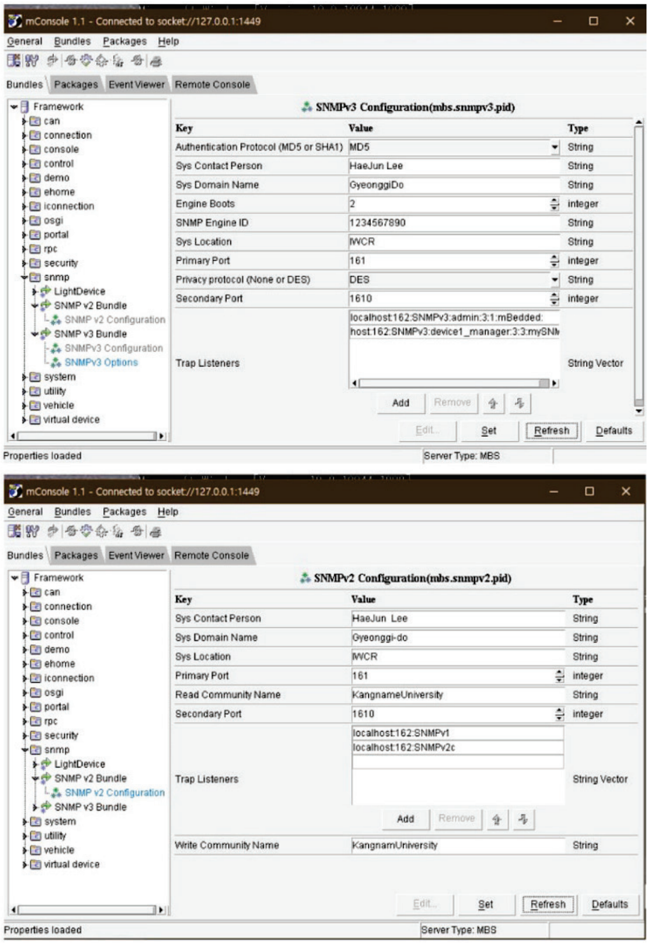

Figure 5 IoT SNMP multi-support of facility device interface

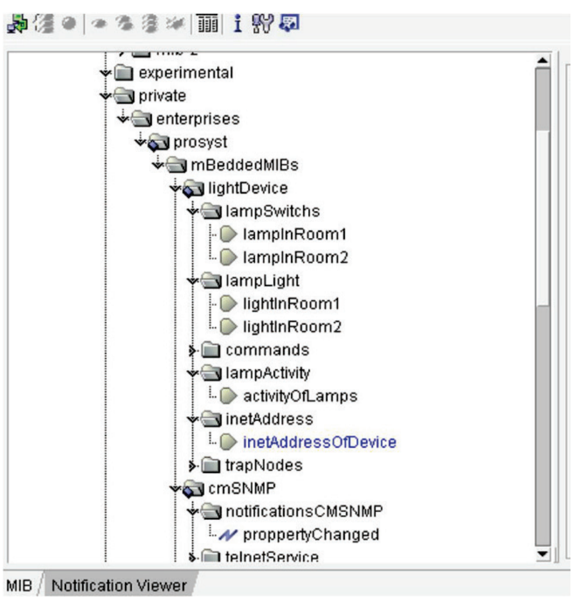

Figure 6 Query execution of dynamic context awareness

Fig. 7 shows one of result of property information about a device address with the object type. Supplementary, IP information, access information of the service, state, and additional system details may be confirmed.

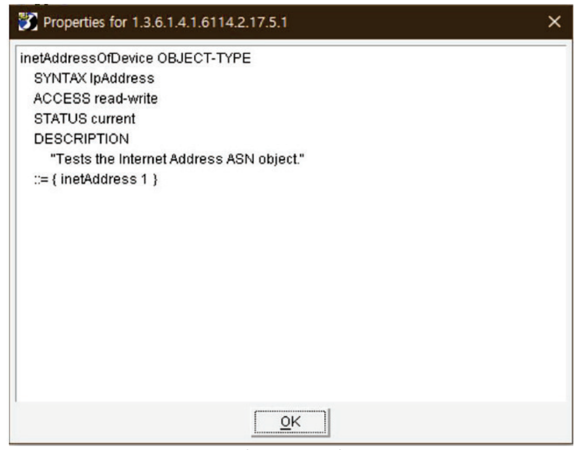

Figure 7 Result of property information network

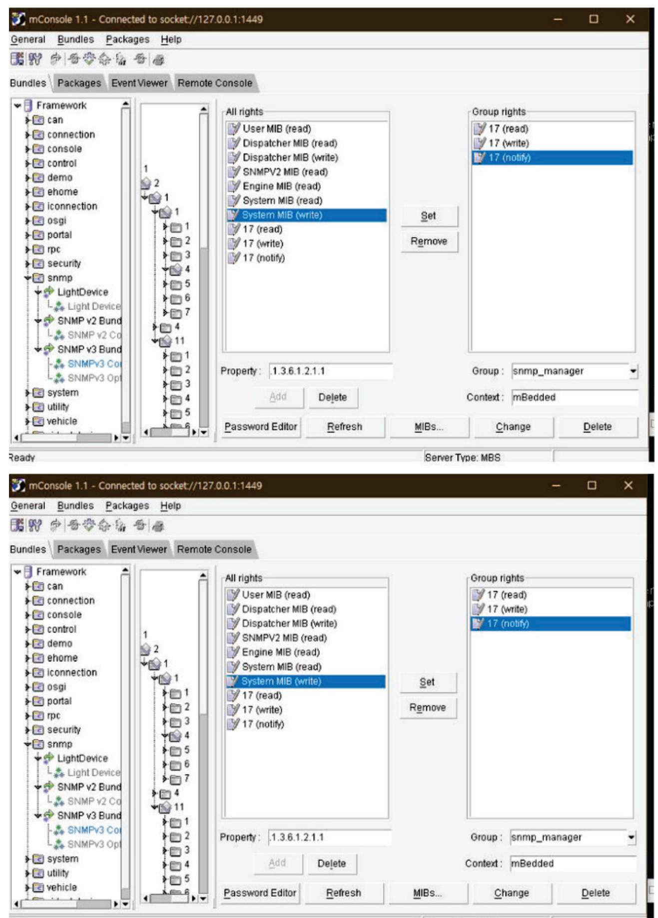

Figure 8 Query execution for dynamic recognition of situation

Fig. 8 shows the dynamic situation recognition query execution experiments and results configured based on IoT service device for lighting devices control [27]. IoT application service in this platform standard SNMP MIB information configured that based on constructed by assuming various dynamic situation recognition scenarios.

This facility device configuration should be installed as a common interface modularization for integrated network management. An application context registers the SNMP context object. The manipulator in a manner so that the SNMP service agent is notified of its existence and refers to the Light Service and registers it as a node in the MIB. In this way, SNMP Manager should be sending commands to the device, which the Light device represents. The Light device implements SNMP Manipulator. This interface is instantiated by listener services which then calls the MIB service object.

3 CONCLUSIONS

The IoT convergence service gateway is continuously expanding that should be supported for implementation of IoT facility devices and interface environments. Integration of IoT systems should be unified into a service represented in a dynamic situation recognition system based on distributed objects. A context awareness object configured based on Universal Middleware is easy to handle internal and external situations of a terminal with a standard interface for a communication module, a data module, and an application service module. Previously, various studies on contextual computing have been conducted, but part of the dynamic service linkage method based on Universal Middleware has not been performed. Practically, it is challenging to standardize the integration of module information provided by previous versions and contemporary device interfaces, in addition to integrating several network services. In response, in this study, a scalable platform was constructed based on the part that can objectify common resources for each SNMP version through Universal Middleware and the method that can be configured in the form of a life cycle process. Due to the constraints of the construction environment, this study could not demonstrate the use of service configurations with UPnP, DLNA, etc., which are part of the expansion of external systems, but if it is expected that usability for commercial devices can be secured, it is easy to configure convergence services.

According to the following, the standard interface of Universal Middleware could be handled with the event and tracking from context object through IoT service gateway. First, communication query, Second, data result, lastly, application service. First, like the lighting device shown in the standard communication module on the framework, it is possible to check SNMP configuration information at the same time as MIB information on the device's authority, dispatcher, engine, system, etc. Second, user tracking data may be used through Income information due to a query result on the framework. Third, it is possible to dynamically recognize situations between application service modules. Thus, by dynamically configuring these three standard service modules, you get the resources to configure the services for administrators and users as a simple and clear dashboard.

A context awareness object configured based on Universal Middleware is easy to handle internal and external situations of a terminal with a standard interface for a communication module, a data module, and an application service module. In particular, MIB Data information for each version based on SNMP enables efficient management of devices that require future scalability from basic information such as device settings, service configuration, domain configuration, and operator.

Through the evaluation of the system built based on the IoT SNMP platform design presented in this study, it was confirmed that instance objects that can be supported by dynamic system construction can be optimized and used as an enterprise-scale system. In this system, the SNMP agent service creates instances of the following assistant context objects. As the result, there are three kinds of context awareness classes. First, Device-Context properties maintain the property nodes of the facility device service in the configuration database. Second, Device-Base hosts all the nodes as fields that are inserted in the MIB tree. It provides methods for retrieval and modification of these fields. Third, Device-Trap, his is an SNMP trap, these reports changes in the value of the device nodes. Lastly, Device-Function such as turning on, off, and the other service functions.

In conclusion, the MIB information of dispatcher supports the dynamic incoming of numerous concurrent SNMP messages and manages the transfer of PDU system. As a future research plan, there is a need to assign the IP address of facility devices, solving the problem of returning to residential device service. Actually, dynamic awareness of context objects with mechanisms and gateway to optimization to publish residential information could be consisting of IoT interfaces to external service clients.

The configuration of dynamic modules that can be mounted on IoT service gateways discussed so far provides scalability to cover a wide range of service areas. In particular, it is expected that applying a platform designed based on Universal Middleware will contribute to the simplification of services suitable for the process of the IoT service. Optimization of dynamic service design is to grasp the propensity of service content, which was inherently complicated, rather than the expansion of network resources. It is necessary to use Universal Middleware to build situational recognition technology suitable for dynamic service design while maintaining hardware independence of network equipment, and it is expected to be applied as an example for the expansion of related research.

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