유비쿼터스 컴퓨팅에서 접근 제어와 프로파일 저장을 위한 D-PACs 설계

양명섭*, 양진영**, 장창복***

요약

사용자들은 무선네트워크의 발달로 이전 유선 네트워크보다 자유롭게 정보와 서시비를 사용할 수 있다. 이러한 이유로, 유비쿼터스 컴퓨팅에서 다양한 연구가 수행되어지고 있다. 또한 유비쿼터스 컴퓨팅에서 어플리케이션들은 무선 네트워크와 다양한 장치들에 의해 연결될 수 있다. 따라서, 정보 자원의 무모한 접근이 시스템에 문제를 야기시킬 수 있다. 그러므로, 접근 권한 관리가 필요한 시스템의 보안 정책을 통해 시스템을 채택하는 곳과 정보 자원 두부분에서 중요한 이슈이다. 하지만, 현존 보안 모델은 간단한 사용자 ID와 패스워드를 통해 자원에 쉽게 접근한다. 이러한 이유로, 우리는 자주 사용되는 서비시의 위치, 시간, 빈도 정보를 저장하고, 상황 정보의 추론과 판단을 통해 자원에 관하여 효율적으로 제어할 수 있는 온톨로지를 사용하여 자동화된 상황 인식 접근 모델과 D-PACs 시스템을 제안한다.

A Design of D-PACs for Access Control and Profile Storage on Ubiquitous Computing

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ABSTRACT

Users are able to use the information and service more free than previous wire network due to development of wireless network and device. For this reason, various studies on ubiquitous computing have been conducted. Also, applications in ubiquitous computing environment will be connected wireless network and various devices. According to, recklessness access of information resource can make trouble of system. So, access authority management is very important issue both information resource and adapt to system through founding security policy of needed system. But, existing security model is easy of approach to resource through simply user ID and password. For this reason, we suggest D-PACs(Dimension Profile and Access Control system), which stores location, time, and frequency information of often used services, and propose model of automated context-aware access control using ontology that can more efficiently control about resource through inference and judgment of context information that collect user's information and user's environment context information in order to ontology modeling.

Key Words : Ubiquitous computing, Recommendation System, Personal Profile, Access control Model, Access control

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Ⅰ. INTRODUCTION

Recently, with the IT technique growth, there is getting formed to convert to ubiquitous environment that means it can access information everywhere and every time, and the number of user's demanding information services, without time and location constraints[1,2]. For this reason, various studies on ubiquitous networks have been conducted. In this ubiquitous environment, context-aware information is collected by sensors located around users, and used to infer user's current situation, with personal information, such as user profile[3,4]. Because inferred context information is used to provide services appropriate for users, many academics are studying context-aware modeling, streaming data processing, service provision, context prediction, and context histories[5,6,7,8,9,10,11].

Also, recommendation techniques such as Case-based Reasoning, Collaborative filtering, Content-based filtering, Item-item filtering, have been studied in ubiquitous computing, on the web, and in other fields [12,13]. These techniques provide services with a way of using the personal profile and preference rating of users. However, previous techniques on ubiquitous computing have not considered privacy problems and recommendation correctness by context. Also, current ubiquitous computing service does not consider about security policy of resource. So it affects a field of studying context-aware security, and researchers have been lively studying contextaware access control model. Context-aware access control model have to provide suitable service or resource to user that is based on context information and personal profile.It is different from the existing security services that authenticate authority using simple user information. It can provide to restrict resource access by environment with synthetic data such as location, current user profile, time, devices. When user who has access authority and user who doesn't have access authority use the service same time, they would restrict even user who has authority. It is able to maintenance more stronger than resource security according to context information and another character. Since the ubiquitous computing presented, there are so many researches in local and international, but security research using context aware technique recently started. Also, the more ubiquitous computing and pervasive computing construct, the more important context aware security research is. Therefore, we suggested D-PACs which stored location and time, frequency information of often used service, and put the services which expected to use in any location on time to storage, and propose to automated context-aware access control model that is modeling user's information and surrounding user's context information accessing resource by ontology. So, we are able to provide more accurate service than previous techniques through techniques and systems and is available to adapt of active security-level about resource using inference engine.

Ⅱ. RELATED WORKS

If Ubiquitous is a word meaning "anywhere and anytime" from Latin. In this computing environment, user can access to network regardless of wire and

wireless environment, device. The object of awareness in this ubiquitous which differ from previous computing environment is not human, but device[14]. This means that information of awareness is to be personalized. Because inference power of computer was not enough to understand human's action and thought. But because they actively have to provide various service and information to aware human's behavior and thought, there is need of definition, how expressed human's behavior and thought to context information. Also, because human's behavior and thought was individually differ, how understand personal inclination is important problem. For this problem solving on ubiquitous, it was inferred context which was able to understand human's behavior based situation information which collected from various sensors. And they are provided service and information to user through the inferred context. Generally, situation which arose around human was able to collect from sensor, but personal inclination and thought was not. Therefore, they used the method of personal information storage for analyzing inclination, such as personal profile, history, diary[15,16]. As mentioned above, user of ubiquitous was provided various services without human's recognization by ubiquitous devices in anywhere and anytime. So, we have to infer context for provide the services to users correctly. Therefore, there are studying about technique of context inference to use personal inclination and information.

As it demanded personal inclination and information in context inference, using the user's profile for storing it, research about technique of profile was as follow: UbiData project was suggested data process and synchronization in ubiquitous environment and addresses these three challenges using an architecture and sophisticated hoarding, synchronization, and transcoding algorithms to enable continuous availability of data regardless of user mobility and disconnection, and regardless of the mobile device and its data viewing/processing applications[17,18]. Annika Hinze describe TIP (Tourism Information Provider) system, which delivers various types of information to mobile devices based on location, time, profile of end users, and their "history", i.e., their accumulated knowledge. The system hinges on a hierarchical semantic geospatial model as well as on an Event Notification System (ENS)[19]. Annie Chen proposed a context-aware collaborative filtering system that can predict user preferences in different context situations, based on past user-experiences.

Recommendation techniques, such as Case-based Reasoning, Collaborative filtering, Content-based filtering, Item-item filtering, were suggested[12, 13]. Annie Chen proposed a context-aware collaborative filtering system that can predict user preferences in different context situations, based on past user-experiences. The system uses what other like-minded users have done in similar context, to predict a user's preference towards an item in the current context[20]. Manuele Kirsch-Pinheiro proposed a context-based filtering process, aimed at adapting awareness information delivered to mobile users by collaborative web systems.

This filtering process relied on a model of context which integrates both physical and organizational dimensions, and allows representation of the user's current context as well as general profiles. These

profiles are descriptions of potential user contexts and express awareness information filtering rules to apply when the user's current context matches one of these rules. Given a context, these rules reflect user preferences. They describe how the filtering process performs in two steps, the first for identifying the general profiles that apply, and the second for selecting awareness information[21].

Method of Context-aware Access Control was studied such as RBAC, GRBAC. RBAC is access control model that is more popular in commercial area as alternative model of MAC(Mandatory Access Control) or DAC(Discretionary Access Control)[22, 23, 24]. The best feature of the RBAC is not directly allowed to user who is available for performance of operation about information that is assigned by role that is point obtaining access authority of user through assigned role to user. GRBAC(Generalized RBAC) model use subject role, object role, environment role in access control decision. And that added context information to existing role-based access control[23, 25].

Middleware Using Context-aware Security Method was studied such as CASA(Context-aware Security Architecture), SOCAM. CASA is suggested by Georgia Institute of Technology that is security platform of middleware level for security of which associated security with user bio information or location information[26, 27, 28].

SOCAM propose to OWL for context-information modeling in middleware and that is consisted of several components. Context Providers make abstraction for various context-information[29].

III. SYSTEM ARCHITECTURE

We have to infer what service is fit to user well for serving various services to user based context-aware information which arose in ubiquitous environment. Generally, we stored profile for using user's inclination and information. Also, because services that often used have high probability which continuously using, if the services stored in profile, we could reduce time of service using.

Therefore, previous technique which information and time of often using services stored in profile was suggested. But there are need to information of user's location and time for providing more correct services. For example, we assume that A service was used 10 times on a day, and if time of service using is 3 P.M, we should infer that the service almost would use to afternoon. And time and frequency of information is important in ubiquitous. But location information is very important also. Even if services was same, frequency of service was different each other. Therefore we suggest technique that providing the service which demanded by user to store location information with time and frequency in profile and that put the service in location on time to using.

The system, which we were suggested, is consists of Agent and D-PACs and User, service provider. And figure 1 shows how we structured D-PACs. Agent is responsible for communicating user and D-PACs, providing services to user. And D-PACs is responsible for finding services and predicting, analyzing profile information, collecting information from sensors. Service provider is responsible for providing services to user. User is used to service in ubiquitous.

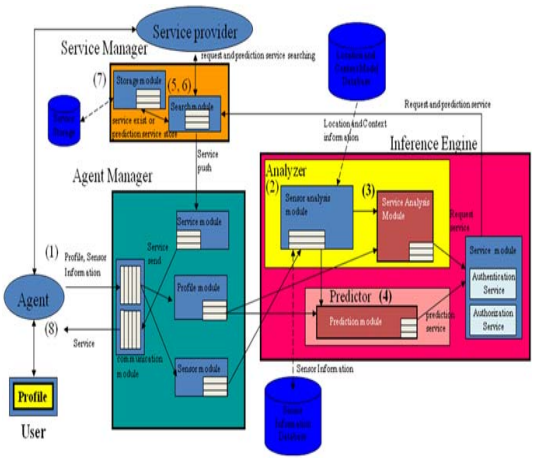

그림 1. D-PACs 구조
Fig. 1 D-PACs Architecture.

D-PACs was consists of 3 module, such as Service manager, Agent manager, Inference engine, and each modules consist of sub-modules. Service manager is responsible for finding the service and the predicted service which user will use in other place from service provider. And then stores the predicted services in service storage. If users request the predicted service to D-PACs, we will directly search it on service storage without searching works. So it is more quickly find service which user requested, and is able to provide it to user. Analyzer within inference engine is responsible for analyzing context with profile and sensor information to provide suitable service for user. And predictor estimates services which user is going to use service on other place. Context knowledge model database was stored location information anywhere user could stayed in a place and context model information how we infer to context. Sensor information database was stored sensor data which was received from D-PACs manager. Agent manager is responsible for receiving information from D-PACs manager on agent, and then send to inference engine. Also, it is send services which was find from service provider to service handler on agent.

In Service module, which included by authentication and authorization service, authentication service module performs that is both in charge of management and treatment in context information of subject and confirming identification about subject that accessible of context-aware access control system. Also, Authorization service provides service of assignment as dynamically about role of user through analysis of access policy and acquiring added information that is access location, access time, spatial area about context information of subject which is access of resource. And Authorization services perform for role of access control through comparison and analysis of security policy with both user role of activated user and activated context role in present. Authentication services perform for monitoring function of user's access control. Authentication services acquire context information by surround sensor or device besides access information of approached subject. And then, through comp'arison and analysis of context information about surround environment of accessed user is in charge of pre-processing about authority level of user who wants access. And, through authorization service is in charge of function that provide to data about authority of user to access. Context knowledge repository is storing both context information which analyze to data from authorization service and resource which want approach of user. User & Role, Constraint Policy, Context Knowledge Model represent either approval

or disapproval about including request of access to transaction list and each transaction and that is storing as type of rule about approval information. Context-aware access control model is using OWL(Web Ontology Language) for collecting and analyzing context information about surround environment of user's.

IV. PROFILE AND CONTEXT MODELING

4.1 Definition of User Profile and Context Model

A user's profile specifies information of interest for an end user. So the profile was structured user information part and service information part. User information part was stored user's information such as user's name, inclination, hobby and Service information part was stored services which we were used such as service name, service provider etc. structure of user profile was follow:

- User Information: User name, User ID, Personal inclination, hobby, etc

- Service Information: Service Name, Service Provider, Service context, Service frequency value, etc

Because profile stored how much the service information used, stored not only used service, but also information when, how, where used. Also, there are stored the information about what context used.

In this paper propose to automated context-aware access control model of concept such as figure 2 at below. Authentication service provides to authorization service that is user's ID after authentication through various context-aware information of attempted user about information access. Authorization service performs not only supervise for requirements about information access of user's but also decision of context information for all constraints by role. And then that provide context-knowledge model repository for location of resource that is accessible of user. User&Role repository is storing role about user's ID and authority policy repository is describing security policy. Context knowledge model is map of knowledge that provide to location of all information resource which is accessible according to role and context information. This method is limited by resource access along the surrounding environment in case of accessible user request to approach.

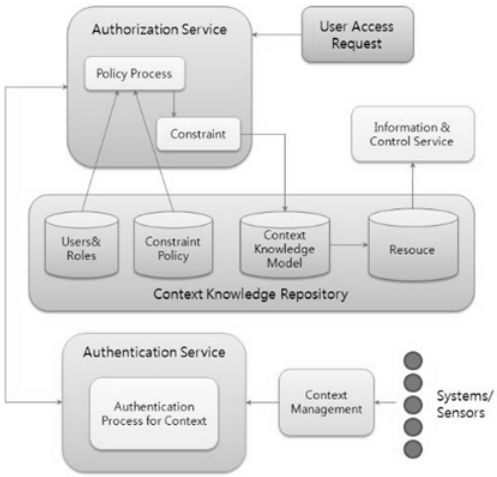

그림 2. 상황인식 접근 제어 개념
Fig. 2 Concept of context-aware access control

Context-aware access control model is divided with authentication service, authorization service and context knowledge repository.

And proposed model defines basic information, location, time, device of user through using owl.

Figure 3 show owl source code and figure 4 show appearance of source through protege from owl source code.

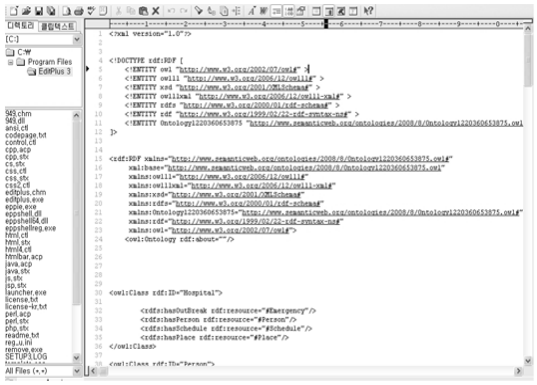

그림 3. OWL 소스 코드
Fig. 3 OWL source code.

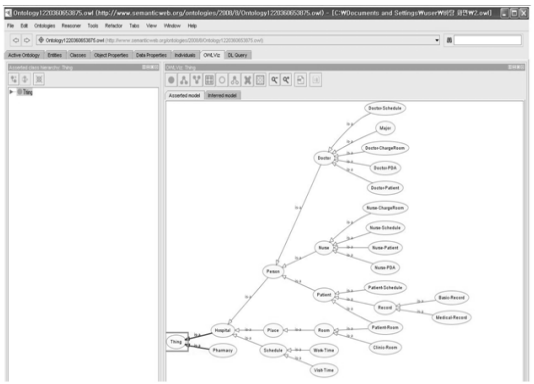

그림 4. Protege 어플리케이션에서의 온톨로지 모델링 속성
Fig. 4 Ontology modeling attribute in Protege application.

4.2 Profile Manipulation of D-PACs

We assumed that the services will use this place and time next time, if service was demanded in specific location and time. So, we used the information of time, location, frequency to provide services to user more correctly and suggested D-PACs technique which using recently access time, access time, frequency of access, location value, weekend value. And the values stored in D-PACs profile.

- Recently access time(t): This value stored time when service used recently, and use for finding service which not used for a long time.

- Access time(a): This value have to 24 from 0, and if service was used on 1 P.M, it's value has 13.

- Frequency of access (f): This value stored frequency of service how many user used the service.

- Location value(l): This value have unique number of place where service was used. For example, if user used A service in house and office, location value of A service which used in house is 1, other is 10.

- Weekend value(e): This value have to 7 from 1, if service used on Monday, weekend value is 1. Generally, people's life pattern was repeated per week. So we use the value for analyzing service frequency of user per week.

In case of using the service, we need location information where service used for inferring user's inclination and context efficiently. So, we simply classified location information which has a unique value, such as the following:

- Home : Bathroom(1), bedroom(2)

-Office : Lobby(3), elevator(4), floor(5), office room(6), conference room(7)

- Other : Street(8), Car(9), etc

And we represented frequency of access to 3-Dimension graph which have three-coordinate values(access time, location value, weekend value).

For example, if user demand A service at 7 A.M, Monday on bathroom, an then weekend value(monday is mean 1 in the location model) has 1, access time has 9, location value has 1. So frequency of A service is represent at coordinate (7, 1, 1) and has 1 value. If user will demand A service at same time and place, frequency of A service which has coordinate (7, 1, 1) will become 1 by increasing. Also, we find location information of service which has most high value of frequency which place on responding coordinate among it, and put it in service storage which user will use the service. And then user can use the service which they demanded more quickly.

Analyze and recommend what service is fit to user based inferred context to use the information of location, time, weekend in user profile. And we find service which frequency value of service is the highest. And if requesting service is existed in service storage, we could not need the searching process. Because we are already stored the information of service in service storage, we just have only to request it from service storage, and then provide the service to user. So, we are able to reduce the searching time of request service. Predict what service is going to use based inferred context to use the information of location, time, weekend in user profile. And we find service which frequency(f(f)) of service that appeared on prediction time(j) after current time(t) is the highest.

4.3 Access Control of D-PACs

Also, we define to sequence about resource access at the below.

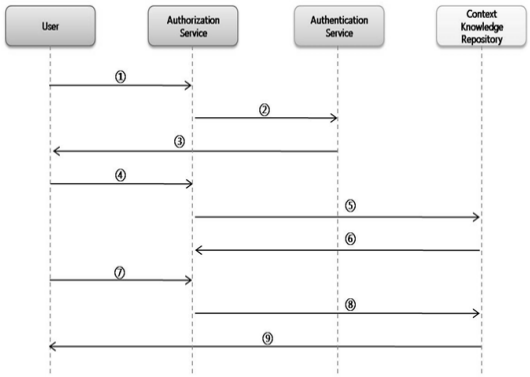

그림 5. 상황 인식 접근 제어 모델의 수행 구조
Fig. 5 Performance architecture of Context-aware access control model.

① user make an approach to authorization service for authority of authentication to access in resource. User utilize for application in order to access of resource.

② Authorization service call up authentication service for authorizing of authority about user in present. Authentication service is collecting context information of user's surroundings about approach of resource in present.

③ For user's role to request of approach of resource and context-aware service that ask for context information.

④ Acquired information by context information of user's surroundings transfer to authorization service module and authorization service module transmit information about receiving of acquired information to authentication service module.

⑤ Acquired authorization service module by context information of user's surroundings try to access of resource that is approach to context knowledge repository for performing access control and role assignment of user.

⑥ It request data of access policy and information about role-assignment of user from context knowledge repository. Authorization service is granting access authorization by access policy and role of user who want to approach of resource in present.

⑦ User request to service through acquisition of access authority about assigned role.

⑧ Authorization service module make request to service and authorization service module make an approach to suitable resource in level of access authority through level of authority and role by assigned resource of requiring to user.

⑨ Context knowledge repository can be approached to suitable resource about level of access authority by assigned of authority, security policy and context of user in present.

V. CONCLUSION

In this paper, we suggest to D-PACs which stored location and time, frequency information of often used service among various services, and put the service which will expect to use in any location. The system used a profile made in the form of an XML document, and classified information, which was used by users when context arose with elements such as location, time, date(week), and frequency. If the user is located at a specific place, our system provide service to the user through location, time, date(week), and frequency information, which is stored in the user's profile. The processing of similarity assessment between current and past context was very simple and fast, and more accurate than previous techniques. Therefore, we can reduce the recommending time of service, and are able to provide more accurate service.

Meaning of Ubiquitous computing environment where is available to use for computer conveniently and naturally in common life which is without constraint of location or time. Thus, in distributed computing environment such as ubiquitous environment, user is efficiently available to use and to share of resource between user and other user. Also, we need to access control model to control that is available to access of user that is possible to access in case of sharing resource. And, for using of efficient resource that need to access control model which is able to control of approach to user without authority. Therefore, in this paper is proposed to model that have advantage of which active authorization is more possible then existing access control model as adding a function of authorization about collaborative resource control about other subject in different with RBAC and xoRBAC. Proposed model, in this paper call automated context-aware access control model, will be making system of active access control that is based on suitable context-aware in ubiquitous environment. We assign to role of access authority about information resource and user to assign of suitable role. And then, we provide to service that can be available to information resource through valid access authority of user who is suitable. Also, for active access control based on context-aware, we use to context role by quantificational expression which is relationship between context information. For using information resource, we will be implementing active access control based on context-aware that is estimation of

validity about acquired access control through checking satisfaction of security policy about context role in present(although user have a assigned role). And, For adapting service along to context transition, we will provide to service which must provide to user in specified context with security policy through aware of automatically about transition of context role.

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