Profile for Effective Service Management on Mobile Cloud Computing

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Abstract. Mobile Cloud Computing has become as a new IT paradigm because of the growth of mobile device like smartphone and appearance of Cloud Computing environment. This mobile cloud environment provides various services and IT resources according to users' requests, so an effective management of service and IT resources is required. Hence, this paper designs a profile on mobile cloud service platform in order to provide distributed IT resources and services to users based on context-awareness information. As the profile proposed in this paper uses context-aware information, it enables to provide more accurate personalized services and manage distributed IT resources.

Keywords: Cloud computing, Context-aware, Profile, Intelligence Service, Mobile cloud computing

1 Introduction

The market of mobile recently has been evolving rapidly and cloud computing is spreading into mobile as well. That is why mobile cloud computing is becoming a new issue today. Cloud computing is the computing that provides virtualized IT resources as a service by using Internet technology. In cloud computing, a user lends IT resources (software, storage, server, network) as needed, uses them, get a support of real-time scalability according to service load, and pays as he/she goes. Especially the cloud computing environment distributes IT resources and allocates according to user's request, so there should be a study on technology that manages these resources and deals with effectively[1].

Mobile cloud computing creates a new chance for IT industry because it allows the superiority and economic of cloud computing to meet the mobility and convenience of mobile and draws a synergy effect for both. Also mobile cloud computing refers to an infrastructure that data storage and data processing is done outside mobile device by using cloud computing in the regardless of kinds of mobile devices. Mobile devices used in the mobile environment include personal information and enable to provide the environment that collects a variety of context-aware information. Users' demand on service types suitable for the individual situation has been increasing.

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So, context-aware reasoning technique has been studied to provide a suitable service for user by using user's context and personal profile information in mobile environment[2-9]. In this context-aware system, a formal context model has to be provided to offer information needed by application as well as store context and manage. However, there are some technical constraints for this context-aware model to overcome because it itself cannot be applied to mobile platform due to limited device resources, so the study on intelligent mobile service in mobile platform is still insufficient. Recent interest related to mobile cloud is personal smartphone. The study on physical support like connecting smartphone to personal virtual system on cloud and using computing resources unlimitedly is quite active, but the study on how to manage distributed IT resources effectively and provide intelligent mobile service through reasoning based on collected information and role as a medium of collecting context of mobile device is ignored.

Therefore, this paper designs a profile based context-aware knowledge on mobile cloud service platform and develops in order to the optimized mobile cloud service through recognizing the conditions of user and cloud server and reasoning on the basis of external context achieved from mobile or internal user's personal information and information of resources from cloud server and service use information.

2 Related Works

Mobile platform is mainly referred to mobile middleware what lets users operate the optimized contents or service on mobile and it provided a formed interface to UI and service by using RTOS (Realtime OS) and hardware function. There are Windows Mobile, iPhone, Android, Symbian, etc. as these mobile platform.

The object of awareness in this mobile cloud computing which differ from previous computing environment is not human, but device[10]. 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 mobile cloud computing, 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[11,12]. As mentioned above, user of mobile cloud computing was provided various services without human's recognition by mobile 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 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[13,14]. 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)[15]. 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[16]. 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[17].

However, these profile techniques not sufficient on mobile cloud computing. Therefore, this paper proposes profile in order to manage resources more effectively by using personal context information and do modeling context-aware information in mobile platform and reason.

3 System Architecture

In this paper, we suggested context-aware-based intelligence mobile cloud service platform for efficiently managing resource to use context-aware information.

Fig. 1. Suggested platform architecture

As shown figure 1, suggested system consisted of intelligence agent and intelligence middleware. Intelligence agent was responsible for understanding a variety of context-aware information and inferring it. And it consisted of sub-modules such as service module, context-aware preprocessor, personal profile, context-aware information modeling database. Intelligence middleware was responsible for providing services and efficiently managing IT resources by user's request on mobile cloud computing. Context-aware preprocessor on intelligence agent included process for collecting context-aware information and modeling it, inferring context-aware information, and responsible for understanding what user's situation was. Service module was responsible for sending context-aware information to intelligence middleware, providing services that suitable to user. Personal profile was repository which was stored personal information, such as service information by using user, user's ID, password. Context-aware modeling database was stored to information which was modeled by using ontology. Intelligence middleware consisted of interaction interface for communicating to agent, resource manager, service manager, Service catalog, Provisioning Rule Database. Resource manager responsible for effectively allocating and managing service information was required for processing user's request service, and consisted of monitoring module, provisioning module, and scheduler. Monitoring module crawled information of IT resource utilization. Provisioning module set up plan for providing best service to analyze context-aware information which was transferred by user and utilization information of IT resource. Scheduler was scheduled to utilization of service and resource by plan which was established to provisioning module. Service Catalog was stored service information for which user used, provisioning rule database was stored rule for providing best provisioning process to use context-aware information and utilization of resource.

Also, service module was responsible for executing service and using distributed IT resource to providing service to user, and consisted of sub-module, such that synchronization module. Synchronization module responsible for synchronizing resource which user was using on cloud computing.

4 Profile Structure

5.2 Definition of User Profiles

A user's profile specifies information of interest for an end user. So in this paper, the profile was consisted of user information part and service information part. User information part stored user's information such as user's name, inclination, hobby and Service information part stored services that they 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.

DTD of profile which we were suggested follow.

```
<?xml version='1.0' encoding='UTF-8' ?>
<!ELEMENT upsp_profiles (upsp)>
<!ELEMENT upsp(user_info, service_list?, device_info)>
<!ELEMENT user_info (username , password, hobby)>
<ATTLIST user_info userID ID #REQUIRED >
<!ELEMENT username (firstname , lastname)>
<!ELEMENT firstname (#PCDATA)>
<!ELEMENT lastname (#PCDATA)>
<!ELEMENT password (#PCDATA)>
<!ELEMENT hobby (#PCDATA)>
<!ELEMENT service_list (service*)>
<!ELEMENT service (service_name, service_provider, service_time,
service_frequency) >
<!ELEMENT service_name(#PCDATA)>
<!ELEMENT service_provider(#PCDATA)>
<!ELEMENT service_time(#PCDATA)>
<!ELEMENT service_frequency(week_info, access_time, location)>
```

```

<!ATTLIST service_frequency value CDATA #REQUIRED >
<!ELEMENT week_info (#PCDATA)>
<!ELEMENT access_time (#PCDATA)>
<!ELEMENT location (#PCDATA)>

```

5.2 Profile Manipulation

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 profile which using recently access time, access time, frequency of access, location value, weekend value. And the values stored in 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.

5 Conclusion and Future Work

In this paper, to provide users with suitable services and manage resources effectively by using context information in the mobile cloud environment, we were proposed to profile 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.

As a further research, we are needed algorithm of similarity assessment between current and past context, and technique that extracts context information and does modeling, the resources management technique that manages distributed IT resources effectively by using context information, and the part that examines the performance and tests after embodying the actual platform proposed.

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References

1. AMIT GOYAL and SARA DADIZADEH : A Survey on Cloud Computing, In: University of British Columbia Technical Report for CS 508(2009).
2. Hess, CK., Campbell, RH. : An application of a context-aware file system, In: Pervasive Ubiquitous Computing, Vol. 7, No. 6(2003).
3. Khungar, Sh., Riekkki, J. : A Context Based Storage for Ubiquitous Computing Applications, In: Proceedings of the 2nd European Union symposium on Ambient intelligence, pp. 55-58(2004).
4. Mayrhofer, R. : An Architecture for Context Prediction, In: Trauner Verlag, Schriften der Johannes-Kepler-Universität Linz, Vol. C45(2005).
5. Byun H.E., K. Cheverst : Exploiting User Models and Context-Awareness to Support Personal Daily Activities, In: Workshop in UM2001 on User Modelling for Context- Aware Applications(2001).
6. Byun, H.E., Cheverst, K. : Utilising context history to support proactive adaptation, In: Journal of Applied Artificial Intelligence, Vol. 18, No 6, pp. 513-532(2004).
7. G. M. Sur, J. Hammer : Management of user profile information in UbiData, In: University of Florida Technical Report TR03-001(2003).
8. Biegel, G., Vahill, V.: A Framework for Developing Mobile, Context-aware Applications. In: IEEE International Conference on Pervasive Computing and Communications (PerCom)(2004).
9. Gu, T., Pung, H.K., Zhang, D.Q.: A Middleware for Building Context-Aware Mobile Services. In: Proceedings of IEEE Vehicular Technology Conference (VTC) (2004).
10. M. Weiser. : Hot topics-ubiquitous computing, In: IEEE Computer, Vol. 26, No. 10(1993).
11. Barkhuus, L., Dey, A. :Is Context-Aware Computing Taking Control away from the User Three Levels of Interactivity Examined. In: Proceedings of the 5th International Conference on Ubiquitous Computing (UbiComp'03)(2003).

12. Elfeky, M.G., Aref, W.G., Elmagarmid, A.K. : Using Convolution to Mine Obscure Periodic Patterns in One Pass, In: Proceedings of the 9th International Conference on Extending Database Technology (EDBT)(2004).
13. G. M. Sur, J. Hammer, : Management of user profile information in UbiData, In: Technical Report TR03-001, Dept. of CISE, University of Florida, Gainesville(2003).
14. J. Zhang, A. S. Helal, J. Hammer. : Ubidata: Ubiquitous mobile file service, In: Eighteenth ACM Symposium on Applied Computing(2003)
15. A. Hinze, A. Voisard. : Location- and time-based information delivery in tourism, In: Advances in Spatial and Temporal Database(2003).
16. Annie Chen : Context-Aware Collaborative Filtering System: Predicting the User's Preference in the Ubiquitous Computing Environment, In : LoCA 2005, Volume 3479(2005).
17. Manuele.Kirsch-Pinheiro, Marlene Villanova- Oliver, Jerome Gensel, Herve Martin, : Context-Aware Filtering for Collaborative Web Systems: Adapting the Awareness Information to the User's Context, In : ACM Symposium on Applied Computing(2005).