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CONCEPTUAL FRAMEWORK FOR CONTEXT-AWARE SERVICE DISCOVERY IN MOBILE CLOUD.

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Abstract

Mobile devices has some challenges with computing power, storage space, low bandwidth of the network, displays constraints and short battery life in spite of the rapid development in mobile computing. With the vast increase of mobile cloud computing, context-aware service discovery has become very important. One inherent solution to this challenge is to employ external functionality offered by service in addition to proper filtering of the service in order to get the most preference service required by the service consumer. A context-aware service discovery framework based on mobile cloud computing environment is proposed in this paper. Service discovery service has to come in considering the differences in service available and required as a result of device mobility and operation in changing and dynamic environment. The paper describes the architecture of the proposed context-aware service discovery, its components and future enhancement.

***Keywords**: Context-aware service, service discovery, mobile cloud computing*

1. Introduction and background of study

Mobile electronic devices such as personal digital assistant (PDAs), smart phones, and wearable computers, are rapidly increasing. Individuals will frequently own a collection of these mobile devices, yet these devices have some resources constraints which slow down the applications execution running on them. Applications executing on these devices must be made aware of currently executing applications in order to optimally use the limited resources [1]

Pervasive computing paradigm envisions an environment where most artifacts of our daily life are linked together and can communicate with each other. It goes beyond the realm of personal computers. It is an idea that almost any devices ranging from clothing to tools, appliances, car, homes, human body, and coffee mug can be imbedded with chips to connect the device to an infinite network of other devices.

Context is any information that can be used to characterize the situation of an entity [2]. In [3] we saw context as the set of environmental states and settings that either determines an application's behavior or in which an application event occurs and is interesting to the users. By context, we mean the information about a location, its environmental attributes (such as noise level, light intensity, temperature and motion), and the people, devices, objects and software agents it contains. Context-awareness is the capability of perceiving the user situation in its many aspects, and of adapting as a consequence the system behavior (that is the services, the data and the interface). Context-aware application must manage the context as one of its inputs, processing any user request according to the different context instances.

Cloud computing refers to applications and services that run on a distributed network using virtualized resources and accessed by common internet protocol and network standards. NIST [4] define cloud computing as a model for enabling convenient, on demand network access to computing resources that

can be rapidly provisioned and released with minimal management effort. The combination of cloud computing, wireless communication infrastructure, portable computing devices, location-base services, mobile web, etc has laid a foundation for a novel computing, which allow users an online access to limited computing power and storage space [5]. This combination of the cloud computing and mobile internet is referred to as a mobile cloud computing. ‘’Mobile cloud computing is a model for transparent elastic augmentation of mobile devices capabilities via ubiquitous wireless access to cloud storage and computing resources, with context-aware dynamic adjusting of offloading in respect to change in operating conditions, while preserving available sensing and interactivity capabilities of mobile devices’’[6]

1.1 Motivation

The motivation behind this work emanate from three trends in IT field, context-aware (CA), cloud computing (CC) and mobile computing with mobile internet devices (MIDs). Context aware is made up of the functional parts that perform the role of data gathering, context synthesis, context storage, context dissemination and coordination.

Cloud computing is an effective reuse paradigm where reusable services are deployed once and shared by many users which is widely accepted in both industry and academia [7]. Meanwhile, there is an increase in mobile internet computing with an advent of yet more powerful mobile computing devices such as smart phones and portable media player. In addition, there is a breakthrough in mobile cloud computing such as terminal restrictions and convenient data access, intelligent, load balancing and on demand service. Also, the cost of computational resources is high and these resources can be stored and accessed on demand in a cloud as pay per use model. These inherent benefits provide us the motivation to design a context-aware adaptation model for mobile cloud application.

Despite the poor performance of the mobile devices such as limited processing power and storage space, there is an unexpected effect as long as it meets cloud input and output data exchange.

Research challenges in mobile and context aware service development abounds. One of the inherent problems in context-aware service development is the context-aware service discovery. Service discovery has to do with the discovery of new services that matches the users need [8]. This paper addresses the service discovery issues inherent in context-aware services.

2 Related Works

A lot of work on context-aware service has been done. This section considered some of the related work to the proposed system that has been done.

Research on context-awareness has started with addressing the problem of mobility by hiding it to the user. The first real context-aware computing effort was initiated by Researches at Olivetti Research limited and Xerox PARC laboratory [9]. After then, several researches has been carried out on this topic and provided to this field. Early works tackled the problem by investigating the location-awareness, and till now, several context-aware applications were restrained in the scope of their analysis, using small pieces of contextual information and displaying ad hoc solutions for very specific needs.

La and Kim [10] proposed a context-aware mobile service framework that focuses on service provisioning based on context information. The author addressed the methods to adjust the priorities of server-based jobs in response or proactively to variations of the location context which lead to significant improvement of quality of service by reducing the usage of server’s resources. The work centered on monitoring there user’s contexts and to provide the right services for the context. Although they identified the cases of utilizing context information and derived several types of context-based adapters by analyzing types of gap, types of causes to the gap, and types of adapters for the given

cause, is no room on how the services are discovered in mobile cloud.

Lin et al [11] studied a context-aware offloading. They studied the decision engine in mobile cloud offloading system which decides whether to offload a given method to the cloud servers. A context-aware decision algorithm, called CADA, was designed to optimize the performance of the mobile devices with various optimization criteria including low energy consumption and high response time. It also enables the mobile applications to achieve better user experience and offers the cloud service providers more business opportunities. This algorithm only uses the location and time-of-day to make the mobile offloading decisions of individual methods but there was no room for entity or environmental attributes such as level, light intensity and temperature and how the context-aware service are discover in cloud environment.

Otebolaku et al [12] presented a run time model of an adaptation mechanism that monitors execution context of the Grid clients. It focused on modeling a context-aware solution to address the problem of high response time in Grid environment which is caused by some execution context variations. It evaluates the monitored contexts and decides on what configuration decision to take. The reconfiguration uses component based technology and CACIP model developed to take care of interaction between mobile client and Grid services as was presented. The overall impact of the work is to reduce latency in the interaction (that is to reduce the time between when a service request is made and when the service is delivered to the mobile client). This work presented here is a model of an adaptation in Grid particularly in mobile Grid environment and was not extended to cloud environment which is the focus of this work.

P. Pawar etal [13] presented an ontology based context-aware service discovery for pervasive computing environment. The work introduces the concept of persistent service discovery. The author built a conceptual model for context aware service discovery (CASD) in which every service and client may have one or more context sources. The context source is a service that provides context information to the associated client or service. The service and context source register with the service directory so they can be discovered. The CASD service is also a service and is discoverable by the client. The client request for a suitable service with the CASD service. Then the CASD retrieves the service matching service type specified by the client after querying the service directory. This mechanism promises simplifying the design of the client in pervasive environments as they need not actively search for the best service when the context changes. However, the work was not done in a cloud environment particularly mobile cloud which is the focus of this work.

3 Proposed Model

The previous section discussed some of the related work done on the context-aware services. It reveals the constraints inherent in the existing model such as miniaturization and power inefficiency of mobile device. There is a need to design a context-service discovery model that extends the existing framework to improve the same discovery performance.

The fixed network paradigm of interaction is not conducive for mobile and wireless interaction since it's based on persistent and stable connection between the communications entities. Mobile system however is vulnerable to unexpected disconnection due to environment fluctuations.

The model is formulated to address the problem of fluctuation of mobile cloud context.

The proposed architecture is made up of three components as depicted in fig1 and it is based on three subsystems namely; the context monitor, the evaluator and cloud service provider which are described as follows

Monitor:- This is a service that that supplies context information/parameter data to the associated client. The monitor: the monitor is comprised of the context source, context monitor, the persistent context store and the updater. The context source is modeled as service and register with service discovery service which provides persistent context store where context

information can be store. In the context store, there is an updater which updates the context parameter data that goes in and out of the persistent store. The context source thereafter distributes their parameter data to the subscribing client. The context monitor on the other hand receives and interprets context information from the context source. This process keeps and indexes context information in the persistent storage. They consume part of the parameter data receives and forward some to the context evaluator. The persistent context store serves as a temporarily storage of the context parameter data that is left unconsumed by the context monitor.

The evaluator: this component helps in receiving of the context data temporarily stored in the persistent store. It contains an event manager which is an entity that administers stores and retrieves and distributes context information.

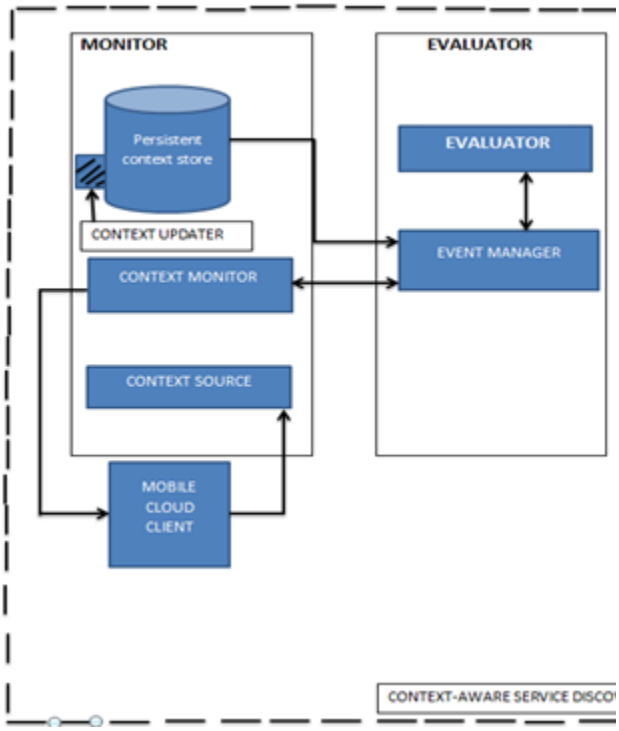

Fig 1. Context-aware service discovery architecture

3.2 Context aware service discovery operation

This section gives a brief description of the context aware operation.

The internet: it serves as a medium for delivering of mobile cloud service to themobile client

Cloud computing service: this service comprises of two main components, namely- data center and cloud controller.
Cloud controller: This component is responsible for processing mobile user request and providing mobile user with corresponding cloud service.
Data centre: This is the part of cloud computing service that provides the hardware facilities and infrastructure for cloud.

The mobile client which serves as a serves as a service consumer places a request for required context service with the cloud service provider through mobile internet device (MID) . The subscribers' requests are then delivered to the cloud service provider. In the cloud environment, the cloud controller receives and processes the mobile client request and responds to a mobile user with corresponding cloud services to the service type initiated by the subscriber's request. This service which is regarded as a basic service is then filtered in order to get the most preference service to the subscriber.

3.3 Context aware service discovery algorithm

Mobile client request for service

Mobile cloud service receives the service

Cloud controller processes the mobile client request in cloud environment and check if the required service is available

If the preference service is found,
It returns the service to the service consumer
Else
It returns preference service not found

4. Conclusion and Future Work

In this paper, we present a conceptual framework for context service discovery for mobile cloud application. We began by looking at the background of the study in the field of context awareness and cloud computing particularly the mobile cloud and stating the reason while choosing it and the motivation behind it. A review of some related work was carried out to point out some of the constraint inherent on the framework. A context aware service discovery model was then proposed to address the problem of the existing model. In the architecture, the context aware services are provided by cloud computing through the cloud controller and are termed basic service. It is then later filtered to get the most preference service required by the service consumer. We embarked on mobile cloud computing because it is one of the mobile technology paradigms in future computing. It provides the optimal service for mobile user since it combines the advantages of both the mobile computing and cloud computing.

The future work will focus on formulating a Mathematical model, designing and implementation of the framework using a pseudo code and to write a complete program using a Java programming language which will show how the context-aware service discovery is modeled for mobile cloud.

References

[1] Chu, D. C., & Humphrey, M. (2004). Mobile ogsi. net: Grid computing on mobile devices. In *Grid Computing, 2004. Proceedings. Fifth IEEE/ACM International Workshop on* (pp. 182-191). IEEE.

[2] Abowd, G. D., Dey, A. K., Brown, P. J., Davies, N., Smith, M., & Steggles, P. (1999, January). Towards a better understanding of context and context-awareness. In *Handheld and ubiquitous computing* (pp. 304-307). Springer Berlin Heidelberg.

[3] Chen, G., & Kotz, D. (2000). *A survey of context-aware mobile computing research* (Vol. 1, No. 2.1, pp. 2-1). Technical Report TR2000-381, Dept. of Computer Science, Dartmouth College.

[4] Mell, P., & Grance, T. (2011). The NIST definition of cloud computing.

[5] Kovachev, D., Cao, Y., & Klamma, R. (2011). Mobile cloud computing: a comparison of application models. *arXiv preprint arXiv:1107.4940*.

[6] Zhou, J., Chen, J., Li, L., & Zhang, Z. (2012, October). The Context Awareness Architecture in Mobile Cloud Computing. In *Computational Intelligence and Design (ISCID), 2012 Fifth International Symposium on* (Vol. 1, pp. 302-305). IEEE.

[7] Zhou, J., Chen, J., Li, L., & Zhang, Z. (2012, October). The Context Awareness Architecture in Mobile Cloud Computing. In *Computational Intelligence and Design (ISCID), 2012 Fifth International Symposium on* (Vol. 1, pp. 302-305). IEEE.

[8] Pauty, J., Preuveneers, D., Rigole, P., & Berbers, Y. (2006, April). Research challenges in mobile and context-aware service development. In *Future Research Challenges for Software and Services Conference* (pp. 141-148).

[9] Want, R., Hopper, A., Falcao, V., & Gibbons, J. (1992). The active badge location system. *ACM Transactions on Information Systems (TOIS)*, *10*(1), 91-102

[10] La, H. J., & Kim, S. D. (2010, July). A conceptual framework for provisioning context-aware mobile cloud services. In *Cloud Computing (CLOUD), 2010 IEEE 3rd International Conference on* (pp. 466-473). IEEE.

[11] Lin, T. Y., Lin, T. A., Hsu, C. H., & King, C. T. (2013, April). Context-aware decision engine for mobile cloud offloading. In *Wireless Communications and Networking Conference Workshops (WCNCW), 2013 IEEE* (pp. 111-116). IEEE.

[12] Otebolaku, A. M., Adigun, M. O., Iyilade, J. S., & Ekabua, O. O. (2007, June). On modeling adaptation in context-aware mobile grid systems. In *Autonomic and Autonomous Systems, 2007. ICAS07. Third International Conference on*(pp. 52-52). IEEE.

[13] Pawar, P., & Tokmakoff, A. (2006). Ontology-based context-aware service discovery for pervasive environments.