MOBILE CLOUD COMPUTING AS FUTURE FOR MOBILE APPLICATIONS

C Shravanthi[1], H S Guruprasad[2]

[1]PG Scholar, Dept. of ISE, BMSCE, Bangalore
[2]Professor and Head, Dept. of ISE, BMSCE, Bangalore

Abstract

In recent years mobile applications and mobile devices are developing rapidly. With the growth of the mobile applications and cloud computing concepts, cloud computing has becoming a potential technology for mobile services. Mobile cloud computing integrates the cloud computing into mobile environment and overcomes the problems related to performance, environment and security. The paper presents the survey on mobile cloud computing applications, challenges, existing solutions and approaches to overcome the challenges.

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1. INTRODUCTION

Cloud computing refers to the use of networked infrastructure software and capacity to provide resources to users in an on-demand environment. With cloud computing, information is stored in centralized servers and cached temporarily on clients that can include desktop computers, notebooks, handhelds and other devices. Cloud computing exists when tasks and data are kept on the Internet rather than on individual devices, providing on-demand access. Applications are run on a remote server and then sent to the user.

Mobile cloud computing is the form of cloud computing in combination with mobile devices. Mobile devices are increasingly becoming an essential part of human life as the most effective and convenient communication tools which is not restricted by time and place. However, the mobile devices are facing many challenges in their resources (e.g., battery life, storage, and bandwidth) and communications (e.g., mobility and security).

1.1 Advantages of Mobile Cloud Computing

- Mobile devices allow users access to cloud services anywhere and anytime.
- Mobile cloud services can give information about a user's location, context, and requested services to improve user experience.
- Each mobile device has storage, computing, sensing, and power resources which are advantageous.
- Mobile computing can help to overcome some problem of Cloud Computing such as solving the problem of WAN latencies by using cloudlet.

Weiguang Song et. al. [1] summarize the core concepts of Mobile Cloud Computing [MCC] by developing a basic idea model of Mobile Cloud Computing. Major problems faced by MCC are discussed such as stability of wireless connectivity, tackling the unnecessary battery usage etc. Also, few possible solutions are suggested. Qureshi et. al. [2] discusses about the mobile cloud computing technology and proposes the implementation methods for Mobile Cloud Computing solutions such as General Purpose Mobile Cloud Computing (GPMCC) and Application Specific Mobile Cloud Computing (ASMCC). Certain barriers such as network availability and bandwidth are focused. Two aspects of security issues such as mobile device security and cloud security are addressed. Le Guan et. al. [3] addresses the challenges in Mobile Cloud Computing design such as network latency, limited bandwidth and availability. In order to analyze Mobile Cloud Computing technology, a concept model is proposed which includes context management, resource scheduling, client and transmission channel. A Cloud architecture of Mobile Cloud Computing is described for organization of Mobile Cloud Computing systems. Application partition and offloading and various context aware services are explained briefly. Dejan et. al. [4] addresses several mobile cloud approaches. An overview of various possibilities of Mobile Cloud Computing is given. Native and web applications are too extremes of mobile applications. The cost model of elastic mobile cloud applications is described.

Han Qi et. al. [14] discuss Mobile cloud computing (MCC) as a development and extension of mobile computing (MC) and cloud computing (CC) which has inherited high mobility and scalability. The proposed system in the paper explains the principle of MCC, characteristics, recent research work, and future research trends. Proposed system analyzes the features and infrastructure of mobile cloud computing and also analyzes the challenges of mobile cloud computing. Ashwin

et. al. [17] focuses on the capabilities of the mobile and cloud landscape. New class of applications called Cloud Mobile Hybrid [CMH] applications and a Domain Specific Language [DSL] are defined. The proposed system define Cloud-mobile hybrid as a collection of application that has a Cloud based back-end and a mobile device front-end. Using a single DSL script, proposed system is capable of generating a variety of CMH applications. These applications are composed of multiple combinations of native Cloud and mobile applications. The proposed system also reduces the complexities of the platform. Dejan et. al. [19] discuss about the mobile communities which introduce new requirements compared to traditional online web communities. On the other hand, cloud computing is emerging as computing concept that gives the computational resources on demand and abstraction of technical details from the clients. The paper proposes Mobile Community Cloud Platform (MCCP) as a cloud computing system that can influence the full potential of mobile community growth. An analysis of the core requirements of common mobile communities is provided. The paper presents the design of cloud computing architecture that supports building and evolving of mobile communities.

Harshit et. al. [11] presents a middleware for distributing computation over mobile ad-hoc networks. Mobile adhoc is used as an alternative for cloud in its absence. Synergy is mainly used for energy conservation when the cloud is not available, the battery life of mobile devices becomes dead hence mobile ad-hoc is used as an alternative. The proposed system has two applications such as prototype implementation of Synergy and integrates OpenCV with it. Al though this is not stronger than clouds, this must co-exist to improve the mobile computing accessibility. Vinod et. al. [20] discuss about the cloud computing which enables the work anywhere anytime by allowing application execution and data storage on remote servers. This is useful for mobile computing and communication devices that are constrained in terms of computation power and storage. The goal of the paper is to characterize under what scenarios cloud-based applications would be relatively more energy-efficient for users of mobile devices.

Hung et. al. [7] analyzes the performance of many mobile applications which are weak due to lack of computation resources, storage, and bandwidth and battery capacity. To overcome this, application is rebuilt using the cloud services. The proposed system explains a framework to execute the mobile application in cloud based virtualized environment with encryption, and isolation to protect against unauthenticated cloud providers. Results show the execution of mobile application by offloading the workload with efficient application level migration method via mobile networks. The migration of application form one device to another is easy and quick in the proposed system. Ricky et. al. [10] builds an elastic mobile cloud computing infrastructure by introducing eXCloud system. eXCloud is a middleware system which allows resources to be integrated and used dynamically. In eXCloud, a Stack-on-Demand (SOD) approach is used to support computation mobility in the mobile cloud environment. The proposed system evaluation shows that stack-on-demand model enhances state of the art by increasing the computation and reducing migration overhead and latency. Ricky et. al. [21] discuss that mobile cloud computing allows mobile applications to use the large resources in the clouds. In order to utilize the resources, migration of the computation among mobile nodes and cloud nodes is necessary. Therefore, a highly portable and transparent migration approach is needed. The paper uses a Java byte code transformation technique for task migration without effecting normal execution. Asynchronous migration technique is used to allow migrations to take place virtually anywhere in the user codes. The proposed Twin Method Hierarchy minimizes the overhead from state-restoration codes in normal execution.

Milos et. al. [5] discusses the Biometric applications such as fingerprint identification, face, or iris scanning. These applications actually work in a laboratory setting where the client computer has unlimited access to the throughput and computational resources of the network. The problem focused here is on the battery power of the device and the throughput of the communication channel of the client node to the cloud. The paper explains the mobile cloud computing technique for biometric applications such as fingerprint identification, face recognition and iris recognition. Debessay et. al. [6] analyzes and studies the impact of cloudlets in interactive mobile cloud applications. In order to study the impact, cloudlet network and service architecture is proposed. This architecture focuses on file editing, video streaming, and collaborative chatting. The performance gains with the usage of clouds are shown by simulation results. NKosi et. al. [8] discusses mobile devices which are used in Health information delivery access and communication challenges like power, bandwidth, and security. The proposed system explains how cloud computing can be used in mobile devices to provide sensor signals processing and security. The system described in the proposed system uses an NGN/IMS system with cloud computing to reduce the burden of organizing and also for improving the functions of existing mobile health monitoring systems. The interaction between health service provider, IMS network operator and cloud computing service providers should be regulated so that identity management and security verification is performed. Saeid et. al. [12] describes the reviewed and synthesized smartphone augmentation approaches. Generating high-end hardware is more expensive, energy consuming and time-consuming. Conserving local resources through Cyber Foraging and Fidelity Adaptation are feasible and widely acceptable approaches but they lack in providing data security. Reducing resource requirements is achieved through cloud computing and mashup technology.

Peng et. al. [9] propose a framework of Operational Command Training Simulation System based on mobile cloud computing. The system combines cloud computing and mobile computing, which includes infrastructure, platform, support, application and middleware layer. The detail design of middleware layer has been explained in the paper. The problem of the mobile terminal with limited resources has been solved, and the distribution and interoperability of simulation systems were enhanced. Yan Gu et. al. [13] focuses on the fundamental issue in the mobile application platform which is the deployment decision for individual tasks when the battery life of the mobile device is a major concern for the mobile user's experience. The proposed system explains the deployment scheme to offload expensive computational tasks from thin, mobile devices to powered, powerful devices on the cloud. The proposed system is implemented and various experiments on the Android devices for individual components. Chun et. al. [15] discuss about the mobile applications which are providing functionality on mobile devices. Also, mobile devices provide strong connectivity with more powerful machines ranging from laptops and desktops to commercial clouds. The proposed system in the paper presents the design and implementation of CloneCloud. CloneCloud is a system that automatically transforms mobile applications to get benefit from the cloud. CloneCloud uses a combination of static analysis and dynamic profiling to automatically partition an application. Keerthi et. al. [16] discusses the services provided on the mobile devices which are increasing day by day. One of the important services among them is the Location Based Service (LBS). LBS depend on the geographical position of the user to provide services to the end users. A mobile device lacks in providing resources. Mobile device should get resources from an external source, such as cloud computing platforms. The main goal of the proposed system is to provide dynamic location-based service.

Srinivasa et. al. [18] makes a comparison on various existing web based operating systems. An overview about proposed system is given along with the architecture. Proposed platform is created by MeghaOS cloud architecture and web browser which serves as both application server and end user. MeghaOS offers services such as Account manager, File manager, Message exchange etc. Many optimization approaches are described. Chit et. al. [22] propose a Mobile Computing Applications Platform [MCAP] which is a cloud-enabled platform for defining, developing, and deploying applications on smart phones, tablets, and in-vehicle computers. Core services provide support for location, user profile, notification, authentication, content management, and device management. COTS technologies for mobile computing and wireless networking are used to create a low-cost and sustainable program. Yu-Jia et. al. [23] proposes a secure frame-work where the location information of mobile terminals is used in a cloud computing environment. Various cloud capabilities have made many application providers start migrating the data stored in original databases to outsourced databases. The paper gives the security model for location-based services and explains the use of distributed storage and International Mobile Subscriber Identity (IMSI) as user identification to secure the location data. An enhanced privacy and authentication mechanism for the security framework is also proposed.

2. CONCLUSIONS

This paper surveys the challenges, scope, approaches and solutions in the area of Mobile Cloud Computing. The paper focusses on Energy conservation in mobile devices, migration issues, application development platforms and the various mobile cloud computing applications.

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