

SELECTION ISSUES OF CLOUDLETS IN MOBILE CLOUD COMPUTING

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ABSTRACT. The article analyzes the advantages of mobile cloud technologies and problems emerging during the use of those. The network infrastructure created based on cloudlets at the second level of mobile cloud computing with hierarchical structure is analyzed. At the same time, the article explores the issues of satisfaction of demand of mobile equipment for computing and memory resources by using these technologies. The key factors affecting the efficient use of cloud services in mobile cloud computing are analyzed.

Keywords: mobile clouds computing, mobile equipment, computation and memory resources, cloudlet, virtual machines, cloud computing, communication channel, trustworthiness.

AMS Subject Classification: 65E05, 65E99.

1. INTRODUCTION

Mobile users have started to use the services of cloud computing technologies broadly in recent period. The article considers the issues of more efficient use of cloud computing resources by using Mobile Cloud Computing technologies widely used recently. The rapid growth of the use of mobile equipment (notebook, tablet, smartphones, etc.) technologies in the world and connection to the Internet via corresponding telecommunication technologies (GPS, 3G, 3G, Wi-Fi, etc.) has boosted the development of new technology – mobile Cloud Computing technology. It is known that, although the capacity of any mobile device (computing and memory resources) is limited, users employ these devices for the solution of problems requiring large computational and memory resources. For this purpose, cloud computing technologies are broadly employed. Thus, it is possible to eliminate the limitations of computing and memory resources existing in mobile user devices by using cloud technologies [6].

In comparison with traditional wired network, mobile computing networks encounter several problems: the loss of signal in wireless communication channel, low transmission capacity of a channel, security, delays while connecting to network, limited resources, low computational performance, etc. Moreover, the geography, climate, etc. of the location of base stations affect the quality of services (QoS) provided by mobile cloud computing.

2. PROBLEMS IN MOBILE CLOUD COMPUTING

One of the main problems of mobile cloud computing emanates from the limitations of features of mobile software and wireless network, as well as their capacity regarding computational and memory resources. These problems challenge the development of applications and their exploitation in mobile devices. The limitations in technical capacity of mobile devices in mobile cloud computing environment, the quality of wireless communication, the variety of applications are important factors affecting the evaluation of cloud computing. In order to facilitate a specific environment for Cloud Computing in mobile applications, various stages of mobile infrastructure

must be taken into consideration causing the overload of a network and transmission delays. By using cloud computing services, users can implement the solution of any problem. The recent decrease in the price of cloud servers facilitates the broad use of cloud computing services by mobile users. At present, numerous companies develop several software add-ons for mobile device users, which allows the broad use of mobile cloud computing by users [4].

Mobile devices in mobile cloud computing connect to cloud computing system via internet network with the help of base stations (GPS, 3G, 4G, Wi-Fi, etc.) and use the required services. At present, users extensively utilize three types of cloud services (IaaS, Paas and SaaS services). There exist some studies devoted to the analysis of separate characteristics of these services [9]. At present, millions of mobile users broadly utilize mobile add-ons (mobile commerce, mobile education, mobile health, mobile games, etc.) by using the services mobile cloud providers [3, 6, 8]. The developed mobile applications are not dependent on the operation systems of mobile devices and the type of a device. Hence, the number of users utilizing the services of cloud technologies is rapidly growing day by day.

Following advantages of mobile cloud computing services can be shown [2, 5]:

- (1) reduction in the energy consumption of mobile devices and the increase in the battery life;
- (2) expansion of computing and memory resources of mobile devices;
- (3) raising the reliability by storing user information in several reserve servers;
- (4) dynamic distribution of resources. It allows the user to receive required resources without ordering those in advance in designated time;
- (5) raising the transmission capacity of network;
- (6) cost-efficiency of services;
- (7) ease of use of information from any point of the world by allowing the storage of user information in clouds; etc.

The provision of high quality services of cloudlets near base stations depends on the technical capacity of computer equipment used in the development of those (the intensity of processor functioning, the number of cores and virtual machines, memory volume, transmission capacity of network, etc.). It is because the technical capabilities of cloudlets must allow the loading of software applications utilized by a user. On the other hand, it is possible to satisfy extensive computing and memory storage requirements by using traditional centralized cloud services. However, delays occur in these cloud services while obtaining results or data. Hence, it is more desirable that, software is located in cloudlets near the users utilizing them and the rapid solution of the issue is facilitated in real time regime

While using cloud technologies, the users base their judgment on following criteria [10]:

- (1) minimization of costs required for problem solution;
- (2) minimization of time of problem solution;
- (3) reliability of communication channels;
- (4) provision of the security of user information;
- (5) rapid and reliable delivery of data and outcomes to users.

So, the factors affecting the efficient use of cloud services in mobile cloud computing are as follows:

- (1) location of data centers of cloud computing system far from user;
- (2) overload of internet network;
- (3) occurrence of delays in network;
- (4) occurrence of interruptions in communication channels;
- (5) short lifecycle of batteries of mobile devices; etc.

The following strategies are considered to be employed for solving the above-mentioned problems [1]:

- (1) development of network infrastructure based on cloudlets;

- (2) locating the cloudlets in necessary locations in network;
- (3) locating the software applications in cloudlets close to users in order to reduce the number of delays;
- (4) selection of virtual machines in cloudlets corresponding to the requirements of users;
- (5) utilization of minimal communication channel between user and cloudlets; etc.

Hence, the satisfaction of multiple user requests and resource requirements with various volume and their location in optimal cloudlets and virtual machines are among topical issues. As the user requests demand various volume of computational and memory resources, the issue of appropriate allocation of requests in cloudlets used in network is deemed as a topical problem. Delays can be reduced by providing the solution of the user requests in closely located cloudlets and decreasing the number of communication channels between in the number of inter-cloudlet connections. Energy consumption, delays and interruptions can be reduced by the appropriate allocation of auxiliary (interface) and min parts of software applications utilized by users in mobile devices and cloud servers in a corresponding manner [11].

Therefore, the article proposes a solution of the issue of selecting virtual machines capable of providing the more rapid solution of a problem in accordance with user requirements by employing technical capacity of cloudlets and virtual machines created in cloudlets.

3. CONCLUSION

The article presented one solution for the allocation of mobile user requests in virtual machines created in cloudlets located near base stations of wireless metropolitan area networks (WMAN) in a balanced way by considering the technical capacity of those. The problems arisen from mobile cloud computing and their solution ways were analysed.

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