

An Efficient Privacy-Aware Authentication Scheme With Hierarchical Access Control for Mobile Cloud Computing Services

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Abstract—In the last few years, mobile cloud computing (MCC) gains a huge development because of the popularity of mobile applications and cloud computing. User authentication and access control are two indispensable security components in the MCC environment. To the best of our knowledge, they are generally designed in different procedures. Access control can be executed after the authentication completes successfully. In order to improve efficiency, this article constructs an integrated scheme of authentication and hierarchical access control using self-certified public key cryptography (SCPKC) and the Chinese remainder theorem (CRT) for MCC environment. The proposed scheme can achieve mutual authentication while determining the access rights of mobile users without storing any access control list in the MCC service provider side. Besides, we also give a dynamic adding or deletion of MCC service provider to efficiently address potential changes in the hierarchy. The security of our proposed scheme is proved by the random oracle model. Compared with recently related multi-server authentication schemes for the MCC environment, the proposed scheme not only adds a new function of hierarchical access control but also has better computation and communication efficiencies. Therefore, the proposed scheme is more suitable for real-life MCC applications.

Index Terms—Multi-server, authentication, access control, chinese remainder theorem

1 INTRODUCTION

As the mobile applications and cloud computing have been developed for decades, a new revolutionary technology, named mobile cloud computing (MCC), has attracted a great deal of attention from researchers in the academic and industrial fields. This computing paradigm combines advantages with both mobile computing and cloud computing including portability, high-efficiency, flexibility, and scalability, etc [1]. As a result, many kinds of mobile cloud service systems, called MCC service provider (MCCSP), provide services via the wireless communication technologies, such as iPhone's iCloud, Google's G Suite, Baidu's Smart Cloud, etc. These services bring a lot of convenience to mobile users, who can access to MCC services from anywhere at any time.

To prevent a malicious adversary from accessing the MCCSP, a series of privacy-awareness authentication schemes based on multi-server authentication technology [2] have been proposed for MCC environment (e.g., [3], [4], [5], [6]). Compared with the traditional single server authentication schemes, the multi-server authentication schemes for MCC

environment can only register once with the registration center (RC). Thus, a mobile user can access multiple MCCSPs with a single credential. Although such schemes for the MCC environment have many advantages than traditional authentication schemes, to the best of our knowledge, almost all of them are only as means of achieving authentication and have not considered the hierarchical access control strategy. Conceptually, hierarchical access control can be explained as diverse access authorities. In most practical application scenarios, mobile users are generally assigned to different access rights, and an unauthorized user cannot access data exceeding its permission. Take the video cloud service system as an example, it usually divides users into five different levels: 'level 1, trial user', 'level 2, monthly VIP', 'level 3, quarterly VIP', 'level 4, semiannual VIP' and 'level 5, annual VIP'. The trial users are only allowed to access a small number of free videos. Monthly VIP, quarterly VIP, semiannual VIP, or annual VIP represents that users enjoy unlimited access for a month, a quarter, a semi-annual or a year, respectively. Generally, authentication and access control are two different procedures. Most existing authentication schemes only judge whether the mobile user is legal or not, and cannot accurately distinguish the corresponding access right. To achieve hierarchical access control, there must be some additional access strategies. If MCCSP can complete authentication while determining the corresponding access right, the efficiency of the MCC service system will be greatly improved. Therefore, an integrated scheme of authentication and hierarchical access control is an interesting research subject in the MCC field.

At the first glance, attribute-based encryption (ABE) [7] appears to be a good solution to this problem, which provides fine-grained access control and the access right can be

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