Building secure mobile cloud network

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Abstract. Together with an explosive growth of the mobile applications and emerging of cloud computing concept, mobile cloud computing (MCC) has been introduced to be a potential technology for mobile services. MCC integrates the cloud computing into the mobile environment and overcomes obstacles related to the performance (e.g., battery life, storage, and bandwidth), environment (e.g., heterogeneity, scalability, and availability), and security (e.g., reliability and privacy) discussed in mobile computing. This paper gives a survey of MCC, which helps general readers have an overview of the MCC including the definition, architecture, and applications.

Introduction

Cloud computing is a novel way to provide customers with Information Technology services, but with virtualization technologies in the background. Cloud computing uses networked infrastructure; software and computing power to provide resources to customers in an on-demand environment. With cloud computing, information is stored remotely in a centralized server farm and is accessed by the hardware or software thin clients that can include desktop computers, notebooks, handhelds and other devices. Typically, Clouds utilize a set of virtualized computers that enable users to start and stop servers or use compute cycles only when needed (also referred to as utility computing) [1].

Mobile devices (e.g., Smartphone, Tablet Pcs, etc) are densely used in today's scenario and still get even more important since the usage of mobile Internet. The availability of cloud computing services in a mobile environment, also called mobile cloud computing （MCC）, might thus be a possible solution for the earlier mentioned lack of resources of mobile devices. "Mobile Cloud Computing at its simplest, refers to an infrastructure where both the data storage and the data processing happen outside of the mobile device. Mobile cloud applications move the computing power and data storage away from mobile phones and into the cloud, bringing applications and mobile computing to not just Smartphone users but a much broader range of mobile subscribers". [2]

ARCHITECTURES OF MOBILE CLOUD COMPUTING

From the concept of MCC, the general architecture of MCC can be shown in Fig. 1. [3]Mobile devices are connected to the mobile networks via base stations (e.g., base transceiver station (BTS), access point, or satellite) that establish and control the connections (air links) and functional interfaces between the networks and mobile devices. Mobile users' requests and information (e.g., ID and location) are transmitted to the central processors that are connected to servers providing mobile network services. Here,mobile network operators can provide services to mobile users as

AAA (for authentication, authorization, and accounting) based on the home agent (HA) and subscribers' data stored in databases. After that,the subscribers' requests are delivered to a cloud through the Internet. In the cloud, cloud controllers process the requests to provide mobile users with the corresponding cloud services. These services are developed with the concepts of utility computing, virtualization, and service-oriented architecture (e.g.,web, application, and database servers).
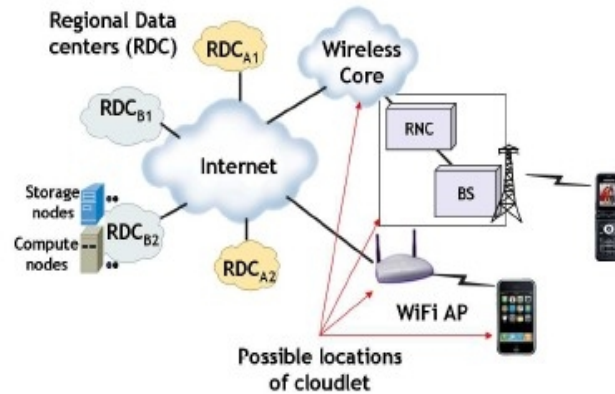

Fig. 1: Mobile Cloud Computing (MCC) architecture.

Such cloud computing is suitable and popular for small startups and medium-sized businesses, since the management of servers and many basic application services can be outsourced to the cloud. Its suitability for large organizations is still being proven in the marketplace, as each large company must investigate the price/performance tradeoff between building and managing their own private cloud or contracting out those services to a third party cloud as traffic scales to high volumes. A key consideration that factors into this decision is whether an organization wishes to store its private or proprietary data on a third party's cloud, and to what extent that cloud provider provides protection to ensure the privacy of such data. We envision that the future of cloud computing will be heterogeneous, and include many diverse clouds with different capabilities and protections, offered by different vendors. A large company that builds its private cloud may still bridge into a larger public cloud for some of its services. The diverse application-level services embedded within these various clouds will likely be merged in a seamless manner via interoperable standards based on Web services that span these heterogeneous clouds.

BASIC MOBILE CLOUD COMPUTING SERVICES

We envision cloud computing providers will provide a set of basic services for mobile computing. There are three types of services. The first one is what we refer as platform services, the second is application services, and the third is context-rich support services [7].

Platform services

Platform services include computing, storage, database, memcache, content distribution as shown in Figure 2. Currently all EC2 services accessible from mobile devices are considered platform services. Some of these basic services can benefit from application sharing. Take distributed memcache service for an example. Many application may create same or access same data sets. With a shared memcache service, it will be more likely to have a cache hit due to the larger cache size. It will reduce computation demand to re-generate the cached results. Of course, sharing bring forth the issues of security, privacy as well as how much storage each application should have. Out of the basic platform service, one can already build very useful applications. For example, with storage service, and computing service, one can build file backup service, and file

syncing service (keep all registered devices in sync of the user content). One can also build a data locker service [1]. In essence, the data locker protocol works with p2p protocols closely to service files on behalf of end hosts. It is particularly appealing in the mobile device context as it minimizes the usage of wireless access links [4].
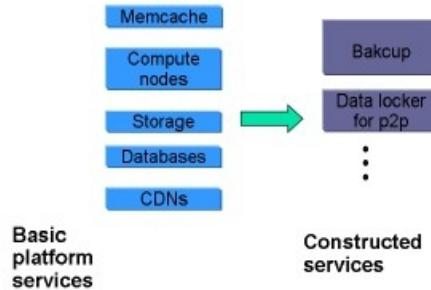

Fig. 2: Platform services

APPLICATION SERVICES

Public cloud provider can also offer a set of essential application services as shown in Figure 3. For example, people may not trust each individual applications and thus, may not reveal their location information [5]. This can hamper the development of location based services. If mobile devices are using the cloud services, then there is prior trusted relationship. Thus, a presence service can be an essential service so that any application that needs location information can talk to the presence service. The presence service will implement location privacy policies according to what are stipulated by the mobile subscribers. We recognize that different people have different level of privacy requirements. It is conceivable that some people may not want to sign up with a presence service. However, the presence service will facilitate the development of location-based services.
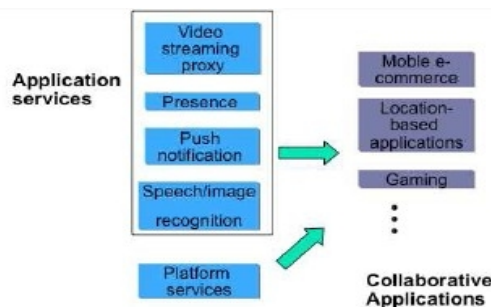

Fig. 3: Application services

CONTEXT-RICH SERVICES

We envision that many mobile applications will become more personalized, and more context aware, recognizing not only the location of the user and the time of day, but also a user's identity and their personal preferences. To support these mCloud services, we believe mCloud providers need to provide a set of context-rich support services. Application developers can use these context-rich support services as building blocks to build a large class of new mCloud services. We envision several context-rich support services such as context extraction service, recommendation service, and group privacy service..

Such contextual mobile applications would be composed as shown in Figure 4. This architecture fuses together multiple layers of cloud application services, as described in the

architecture [6], wherein mobile, social, and sensor networks supply streams of data into a distributed storage service. Data mining/ inference cloud services then operate on the assembled data to extract contextual clues. Finally, recommendation services in the cloud generate tailored multimedia output, either for the mobile device or for nearby multimedia devices such as LCD displays or loudspeakers[7].
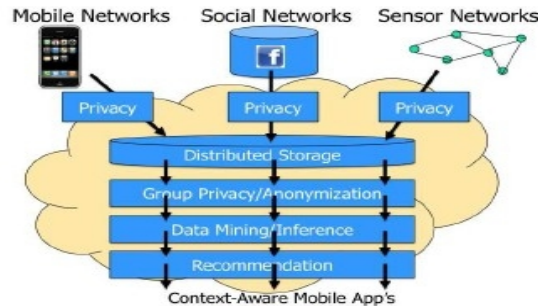

Fig. 4: Privacy, Data Mining, and Recommendation Services

BENEFITS OF MOBILE CLOUD COMPUTING

Mobile cloud applications move the computing power and data storage away from mobile phones and into the cloud, bringing apps and mobile computing to not just smartphone users but a much broader range of mobile subscribers. Mobile Cloud Computing will help to overcome limitations of mobile devices in particular of the processing power and data storage. It also might help to extend the battery life by moving the execution of commutation-intensive application 'to the cloud'. Mobile Cloud Computing is also seen as a potential solution for the fragmented market of mobile operating systems with currently eight major operating systems. Mobile Cloud Computing can increase security level for mobile devices achieved by a centralized monitoring and maintenance of software, It can also become a one-stop shopping option for usersof mobile devices since Mobile Cloud Operators can simultaneously act as virtual network operators, provide e-payment services, and provide software, data storage, etc. as a service[8].

A number of new technical functionalities might be provided by mobile clouds. In particular, provisioning of context- and location-awareness enables personalization of services is an attractive functionality. Mobile Cloud Computing might open the cloud computing business that is currently almost exclusively addressing businesses to consumers since they will significantly benefit from the above described options.

SUMMARY

As the limitation of cost, cloud computing environment is far more complicated and changeable, and since it should provide service such as Saas or Paas, the requirements of the infrastructure are more rigors. With the dynamic, shareable and large-scale characteristic in consideration, our algorithm allocates computing resource dynamically to the user assignment slices. According to the simulate results, we can see this algorithm performs well in the job of searching and allocating resources.

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