A Service-Oriented Architecture for Mobile Cloud Computing

Proposition de recherche doctorale

Résumé du projet de recherche (Langue 1)

The objective of this proposed research is to build a Service Oriented Architecture (SOA) for mobile cloud computing. Recent development of mobile cloud computing [10] constructed a new service oriented framework that recruits mobile devices as service providers to build a sensing-based new application platform. In such a framework, each mobile device (usually an embedded device) is a service provider. First, an embedded device senses its surrounding information, such as wireless communication channel status, neighboring nodes information, environmental information (e.g., CO2 and pollution levels, etc.), personal information (e.g., medical and health information using bio sensors), etc. Second, the mobile cloud creates a dual computing model in that embedded devices can outsource its computing-intensive tasks to the cloud. In the above described mobile cloud framework, service oriented approach is a natural choice to support mobile cloud software development and service provisioning. To facilitate the mobile cloud computing, CNAM has developed a new OSGi-based SOA framework to design Android applications based on OSGi bundles. The proposed platform targets to develop a component-based software package that implements the service-component model with modularity and reusability capabilities. It makes Android platforms more dynamic by providing SOA features such as dynamic class-loading, versioning management, and dynamic bundle configuration avoiding the Android platform restart. On the other side, Arizona State University (ASU) had developed the mobile cloud computing infrastructure. The aim of this thesis will be to define a cooperating model based on SOA so that mobile devices can outsource intensive computing to the cloud. The proof of concept will establish an SOA-based service platform using Android-based systems developed at CNAM and incorporate the SOA-based service platform into the Mobicloud computing platform established at ASU.

Résumé du projet de recherche (Langue 2)

Cloud computing has a great potential to bring new mobile application scenarios, such as information search, data processing, data mining, network status monitoring, field sensing, etc. However, to realize these scenarios, significant research effort is required. Existing mobile Cloud service model is mostly one-directional. For example, consumer electronics (CE) devices usually use the Cloud as a computing and information resource, where applications, multimedia processing, data mining, and search operations can be outsourced to the Cloud; on the other hand, the Cloud has little control over CE devices. However, in the future mobile application scenarios, it is highly desirable for information processing to be pervasive, in which an application is dynamically spread over multiple, physically separate I/O devices, with data streaming between them. These devices are part of or controlled by one or more systems that contain middleware that provides the ability to use I/O devices on remote machines. It is often a challenge to deploy middleware on a range of CE in a safe, secure, and trusted way with minimum effort. This is because CEs are often embedded computers with a wide range of I/O devices, runtime libraries, operating systems, and outdated software components that do not include support for remote middleware installation. Using Cloud computing technologies, these challenges are addressable in that we can create transparency for the usage of the remote I/O resources. Thus, a systematic approach is required to study the capability of Cloud computing for mobile applications. Based on the above discussion, this proposed research will establish a dual computing model, in which each mobile device is a service provider and it depends on the computing on the mobile cloud and its own physical device. As a service provider, a mobile device can provide sensing services (context-aware for mobile devices and neighboring environments), computing service (mobile phones become more powerful, however with energy restrictions), communication service (serves as an information gateway), and storage service (needs to consider backup/restore, sharing, etc.). In the cloud, the dedicated ESSI is considered as an extended semi-shadow image (ESSI) for its corresponding mobile device. It provides the following services: (i) Security/privacy protection and trust management, (ii) presence services, (iii) data sharing services, and (iv) caching services. In addition to the service model, mobicloud needs to address the efficiency and security issues for mobicloud networking and communication. In mobicloud, each mobile device establishes a VPN proxy service through the mobile cloud. Several communication efficiency research issues needs to be addressed, such as: - "Efficient VPN service model for mobile devices to address how to maintain/resume/cache VPN connections. -" How to maintain the active and sleeping mode of the VPN? -" How to perform signaling between mobile devices and their corresponding ESSIs. To address the above presented research issues, the expected research outcomes will be: -" A dual computing model that supports dynamic services and resources allocation. -" A secure and efficient communication framework that integrates mobile computing and cloud computing. -" A Service Oriented Architecture based on a distributed OSGi for the dual computing model.
This thesis will be co-supervised by Samia Bouzefrane from CEDRIC Lab of CNAM (Paris) and Dijiang Huang from Arizona State University (ASU). The experiments that will be undertaken will be based on a mobile cloud infrastructure developed by ASU and that gathers nodes in ASU and nodes at CNAM.