모바일앱을 구현하기 위한 모바일 클라우드 도입

라이오넬[*] · 장종욱[*]

[*]동의대학교

Introducing Mobile Cloud Computing-Cloudlet for implementing mobile APP

Lionel Nkenyereye[*] · Jong-Wook Jang[*]

[*]Dong-Eui University

E-mail : lionelnk82@gmail.com,smartsma@naver.com

ABSTRACT

Virtualization lacks capabilities for enabling the application to scale efficiently because of new applications components which are raised to be configured on demand. In this paper, we propose an architecture that affords mobile app based on nomadic smartphone using not only mobile cloud computing-cloudlet architecture but also a dedicated platform that relies on using virtual private mobile networks to provide reliable connectivity through Long Term Evolution (LTE) wireless communication. The design architecture lies with how the cloudlet host discovers service and sends out the cloudlet IP and port while locating the user mobile device. We demonstrate the effectiveness of the proposed architecture by implementing an android application responsible of real time analysis by using a vehicle to applications smart phones interface approach that considers the smartphones to act as a remote users which passes driver inputs and delivers outputs from external applications.

키워드

mobile cloud computing, cloudlets, Mobile app, application architecture, wireless communication

Ⅰ. 서 론

A Mobile Cloud Computing (MCC) has been defined in different form of views in the literature [1]. The MCC is defined as a combination of cloud computing, wireless communication facilities, portable computing devices, and mobile Web and location aware-based services [2]. The implementation of mobile cloud application can be accomplished when the computation and storage are made available from the cloud but mobile applications affront some challenges such as latency, user interactivity [2]. Microsoft MAUI noted that some applications might encounter workable difficulties from nomadic smartphones, due to the high latency mobile cloud infrastructure connection [3].Existing cloud computing tools tackle only specific problems such a flexible virtual machine (VM) management [4]. Virtualization lacks capabilities for enabling the application to scale efficiently because of new applications components which are raised to be configured on demand. To effectively leverage the full activity of cloud computing, developers of mobile app shall adopt an application architecture designed with the cloud in consideration. There is also a need to enable safer interaction that defines a communication interface between mobile devices and application in cloud. It is feasible to address a mobile device's resource and carry out pre-processing via a nearby cloudlet.

This paper addresses those issues previously described by providing not only mobile cloud computing-cloudlet architecture but also a dedicated platform that relies on using virtual private mobile networks to provide reliable connectivity through Long Term Evolution (LTE) wireless communication.

Ⅱ. PROPOSED MOBILE CLOUD COMPUTING-CLOUDLET ARCHITECTURE

A cloudlet is defined as a trusted, resource-rich computer or cluster of computers that is well connected to the Internet and available for use by nearby mobile devices [5].

The cloudlet push prototype consists of five major components as shown in Table 1: KVM, Cloudlet Server, discovery service, cloudlet client, Vehicle on board diagnostics analysis application. Figure 2 summarizes the model of the smartphones-cloudlets Push prototype. The initial prototype in implementation of a face-recognition application proposed in [6] has been taken as a reference to design the proposed smartphones-Cloudlets in this paper

Ⅲ. EXPECTATION OF VIRTUAL PRIVATE MOBILE NETWORK TO PROVIDE RELIABLE CONNECTIVITY

After designing the mobile cloud computing-cloudlet architecture, it is very important to understand how an LTE- and the proposed architecture in this paper may fit together for mobile application.

Virtual private mobile network embraces the concept of virtualization and partitioning technology to dynamically establish resource management in order to share physical mobile network. The virtualization and partitioning mechanisms should be ef?cient such that the packet from two cloudlets based Virtual machines on roadside environment will be routed by one physical eNodeB, then sharing one S-GWs, finally the packet from two cloudlets will be get through over different P-GWs to target cloud computing server as is shown in Figure 2.

Table 1. Major components and their description of the cloudlet-push prototype

Component	Major functionalities
KVM	KVM set up the GUEST VM for each offloaded application
Cloudlet Server	HTTP server implanted using LAMP, Restlet Framework, PhoneGap[3], Open SSL[4], Jquery [5]framework
Discover Service	The Discovery implemented Avahi[6] of Zero Configuration Networking It spreads mobile application metadata (address server and port) of the cloudlet.
Cloudlet Client	An android application. It adds the mobile application while creating an HTTP connection in the local network.
Remote Vehicle diagnostic application	Real time processing consists of collecting data from the vehicle data, then uploaded via WiFi,3G/4G LTE and HTTP protocol Advanced queries based on SQL triggers predefined tasks to monitor faults

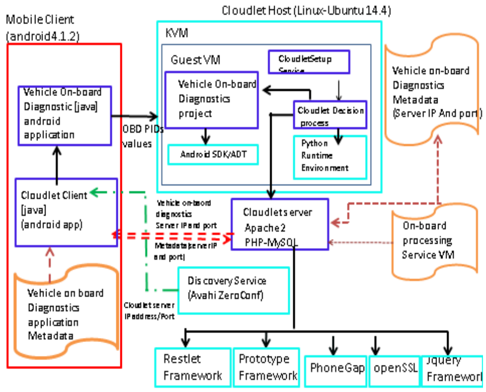

Fig. 1. Architecture of the smartphones-Cloudlet Push

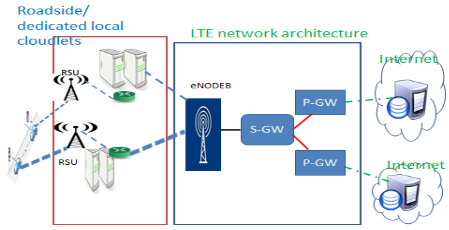

Fig. 2. creation of packet path in LTE based VPMNs

Ⅳ. CASE STUDY : REMOTE VEHICLE DIAGNOSTICS SOFTWARE AS A SERVICE OFFERED AFTER CAR MARKET

1. Data acquisition and storage

Once the connection with the android based smartphones is established, it starts request data and the action is performed in background services. Fig. 3 shows login before requesting engine performance and values uploaded into database. Vehicle OBD-II diagnosis data collected, along with the global vehicle identification number loaded from android smartphone's memory after the user has registered them within the application and vehicle location (latitude, longitude) that corresponds to the current position of the vehicle provided by the GPS are then saved onto the database locates to a remote datacenter in the format of JSON objects through HTTP protocol. Fig. 4 shows a screen shot while the car owner requests from the remote data center Diagnostics Trouble codes(DTC) saved during his trip.

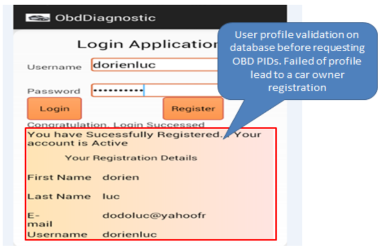

Fig. 3. Validation car user profile on cloud before requesting OBD-PID

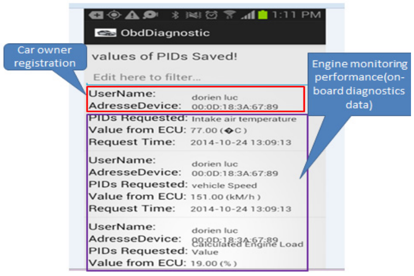

Fig. 4. Request of on-board diagnostics data saved on the cloud by the car owner

In this paper, we chose to set up a Wireless Access Point (WAP) at the cloudlet so that the mobile device based android can connect to the cloudlet. There is a need for an access point that establishes traffic between Wireless LAN and wired Local Area Network (WLAN). The Wireless Access Point in this paper is a NETIS WF2419 300Mbps Wireless N Router which is a combined wired and wireless device. It is compatible with 802.11b/g/n devices and provides a wireless. The nomadic smartphones cloudlet-based approach provides a much smaller interaction time which as shown in only if the number of cloudlet hops is more than 2 as shown of Figure 5.

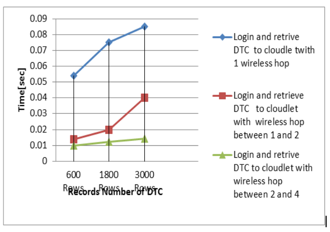

Fig. 5. Response time to cloudlet with wireless hops

The Fig. 6 reports the result of the latency measurement. The network delay was measured with values between 46 and 54 milliseconds. The login task on the cloudlet was reported a delay between 26 and 33 milliseconds, retrieval of stored data was evaluated with a value between 33 and 44 milliseconds. The network delay averages was measured just below 50 milliseconds.

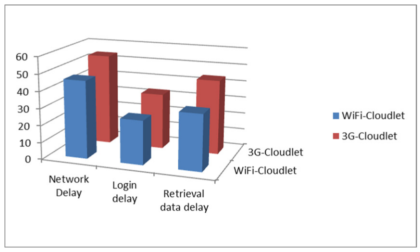

Fig. 6 Response delay in different tasks processing

According to the result from the implantation, it seems that Wi-Fi is preferable over the use of 3G, since Wi-Fi uses less power than 3G communication. Also it gives us about 22 milliseconds for both tasks running (login delay and retrieval data delay). The processing delay shows surely that using cloudlet-based virtual machines is entirely recommended in processing with less delay using Wi-Fi to cloudlet connection using Wireless Access Point.

V. CONCLUSION

In this paper, we have argued that concerns about uprightness of data from traffic and on-board diagnostics are a major step for vehicle owners, authorities and businesses looking to take up cloud computing, cloudlets, and nomadic smartphones that enable telematics services and others value-added services. We present a mobile cloud computing which enables data remote vehicle assignation service event processing through virtual machine based cloudlets. A remote vehicle diagnostics software as a service attests the concept of vehicle to cloud capable of collecting diagnostics data. Experimental results showed that the proposed model cloudlet architecture environment achieved the goals in reducing the communication latency when the nomadic smartphones process task takes place remotely.

Our next purpose is to implement a full prototype to evaluate others value-added services

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