ABSTRACT

Evolving nature of computing has enriched the Information Technology industry to change rapidly for adaptation. One such adaptive technology that has revolutionized the world of connected people, is the way services are delivered through cloud computing. The customizable service delivery and affordable pay-for-use model of cloud computing have enabled the clients to rapidly adopt it. Likewise, pervasive and mobility driven handheld smartphones have quickly overthrown the traditional desktop computers as the most preferred choice of client’s communication device. However, accessing resourceful cloud services through resource constrained mobile devices has impaired the growth mobile-cloud integration by imposing numerous limitations. Hence there is a need to augment the mobile devices with additional capabilities to accept the cloud services. Therefore, a feasible software solution must be developed as a framework to build an efficient mobile cloud environment.

Many existing models have proposed to offload the computation to a cloud infrastructure and save considerable battery power of mobile. However offloading with remote cloud inherits all the existing issues of cloud and also introduces new challenges like client management, mobility, offloading decision, context aware processing, and mobile security. Therefore, the proposed offloading model establishes communication based on client aware attributes like capabilities and performance of client device, security profile and risk associated with the user, and application requirements of the user. In this research work, a three-tier Client Aware Cloudlet (CAC) framework is proposed to augment the mobile devices for accessing the computationally rich application with real-time processing and interactive capabilities.

The CAC framework initially identifies the decision criteria for offloading, by performing computational analytics for power and time estimation with the help of Computational Analytics Engine (CAE). The analysis decides whether to offload the task at the mobile end or at the CAC
server based on CAC offloading decision algorithm with the help of Client Awareness and Assessment Service (CAAS).

Interaction of heterogeneous mobile devices with the client aware cloudlet server can bring in various security issues. Hence every mobile client is verified with a set of security parameters like device profile, intrusion detection capability, access frequency, and availability of trust credentials. Thus the framework proposes a Client Aware Security Certification (CASC) service for risk assessment using Mobile Device Management (MDM) functions. Risk index is evaluated for each device using Analytical Hierarchy Processing (AHP) and a certificate of trust is issued. Based on this security clearance for low-risk devices, the offloading process is initiated for completion. An application recommendation service helps to serve those certified clients by suggesting the best service through the collaborative filtering process. It identifies frequently used, high ranking and trusted applications and loads it at the CAC based on client's preferences.

Finally, to address the problem of availability of services for uneven demand from mobile clients, a resource scalability algorithm is proposed for achieving fault tolerant capability of CAC server. In this process, a Client Aware Resource Manager (CARM) and Client Aware Migration Service (CAMS) are designed to balance the load and deliver the completed task to the user. Hence the cloudlet is built as a micro-private cloud by implementing it using the industry standard OpenStack cloud middleware.

The framework is tested for heavyweight processing applications namely video conversion and image processing application on an Android platform. Experimental results prove that CAC is better and efficient on service availability and undecidability factors with 50 percent reduced overhead time for frequent users. Qualitative comparison with existing offloading schemes found that the framework can help to build a comprehensive mobile cloud environment that can effectively make offloading decision dynamically with a focus on delivering a secure and quality service.