Review: On the Efficiency of Multimedia Cloud Computing to Save Smartphone Energy

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ABSTRACT
In spite of the dramatic growth in the variety of smartphones in recent years, the challenge of limited energy capacity of those devices has not been solved satisfactorily. However, in the era of cloud computing, the limit on energy capacity may be relieved off in associate degree economical method by offloading heavy tasks to the cloud. it is vital for smartphone and cloud computing developers to possess insights into the energy worth of smartphone applications before implementing the offloading techniques. In this paper, we tend to value the energy value of multimedia applications on smartphones that square measure connected to multimedia Cloud Computing (MCC). We have conducted an intensive set of experiments to measure the energy costs to investigate whether or not or not smartphones save energy by victimisation MCC services.

Keywords
Energy Costs; Power Consumption; Smartphone; Handheld Device; transmission Application; Cloud Computing; Multimedia Cloud Computing; Mobile Cloud Computing.

1. INTRODUCTION
Smartphones are getting progressively in style thanks to their capabilities and functionalities. Their little size and lightweight weight build them terribly straightforward to hold, and that they offer helpful services as they run PC-like applications. In like restricted battery energy, processing, and memory capability. However, the advances within the semiconductor and telecommunication Technologies are quicker than that of the battery capability. Therefore, Energy constraint, that is results of restricted capability of the smartphone battery, has not been solved satisfactorily. Transmission applications like video enjoying and diversion square measure significantly resource intensive in terms of process and knowledge transfer rates [1].

Consequently, they consume abundant energy and drain smartphone battery terribly quickly. In fact, those categories of applications square measure attracting much attention of smartphones users [2].As they require more resources, smartphones very often do not meet the expectations of users in performance and battery lifespan. For example, smartphones can play a slender multimedia file format thanks to their limited process and energy capacity. As a result, users require and demand additional advances in smartphones to enhance their capability for multimedia applications. Cloud Computing (CC) could be anew computing Paradigm that is promising in various aspects, such as nearly unlimited computing resources and availableness. It provides data centre resources such as process, networking, and storage capabilities to the end user with needed functionality. If CC provides a multimedia functionality, which incorporates storage, encoding, and play on-demand, then it is referred to as multimedia Cloud Computing (MCC) [3], [4], [5]. MCC can access any multimedia content on the net and provide it to a user in a desired file format once a user provides the targeted multimedia Universal Resource locater (URL).

Particularly, a heavy energy consuming application is offloaded to the CC for smartphone energy saving. Thus, MCC seems to be promising to fill the gap between smartphone performance limitations and expectation of the users by the Energy-as-a-Service (EaaS)service.

2. MOBILE CLOUD COMPUTING: FUTURE SCOPE ANDCHALLENGES
In near future because of MCC there will be no need of downloading and installing applications on the mobile handsets (smart phones, tablets, etc.) users can access them directly in the cloud and display through the mobile browser, it is analogous to Software-as-a-Service provisioning. Other predictions includes according to Gartner's 2010 key IT predictions for organizations, in near future mobile phones expected to overtake PCs as the most common Web access device worldwide by 2013. ABI Research predicts that there will be nearly one billion end users accessing the "mobile cloud" by 2014. Smart phone applications will move from the handset itself to the cloud-creating an ecosystem for new kind of smart phones-sometime termed "Mobile Cloud Phones" [6].

3. Energy-as-a-Service (EaaS)
In other words, we tend to investigate the feasibility of MCC to provide the Energy-as-a-Service (EaaS). Specifically, we tend to compare the energy costs for uploading and downloading a video file to and from MCC with the energy costs of encoding a similar video file on a smartphone. All the experiments were conducted on associate degree Android based mostly HTC Nexus One smartphone. Our results show that MCC provides the smartphones with several multimedia functionalities and saves smartphone energy from 30% to

70%.

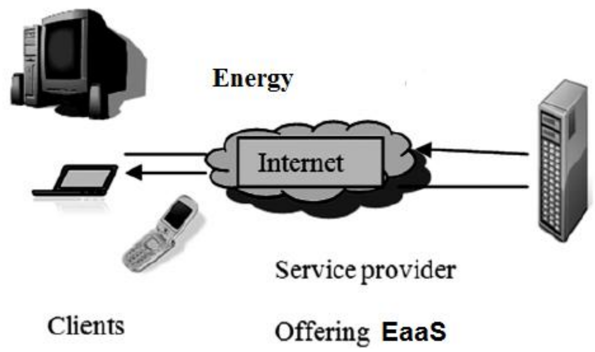

Fig. 1 Energy-as-a- Service (EaaS)

4. SYSTEM MODEL AND EXPERIMENTAL SETUP

Our system consists of 2 major parts: smartphones and MCC wherever each area unit coupled to the web, as represented in Fig. 2. The smartphones area unit connected to the web through a WLAN (i.e. WiFi) or a cellular information access purpose (i.e.3G-HSDPA). These smartphones give all of transmission functionalities to the top users. as an example, the user will play/recorded a video or audio, and show/capture photos. The multimedia functionalities partly or totally act with the corresponding MCC. On the opposite hand, the MCC may be a special type of cloud computing wherever its information centre provides the users with all wants of transmission functionalities like storage and process. Moreover, the MCC has the aptitude to cope with a good vary of multimedia system varieties and formats.

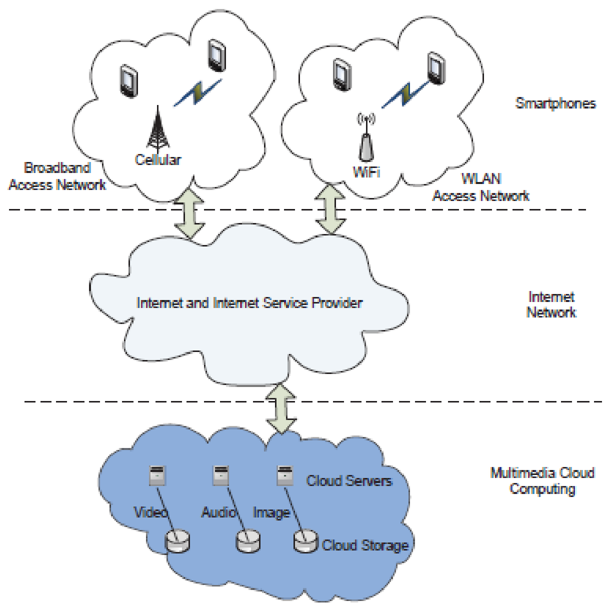

Fig.2. System model

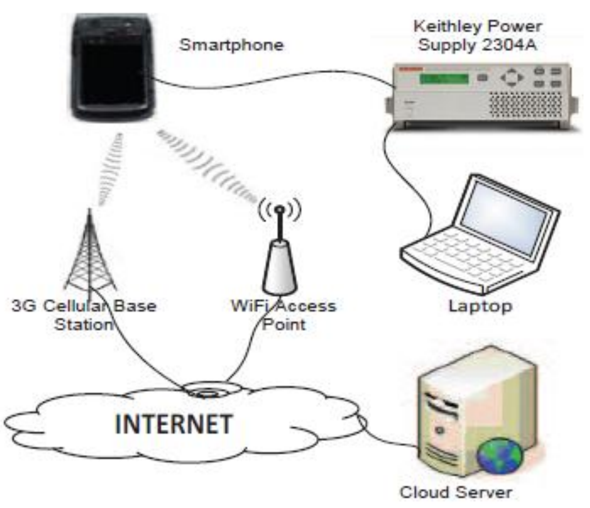

Fig. 3. Experiments setup

Based on our system, we have a tendency to setup our experiments as shown in Fig. 3. The setup in the main includes: (i) smartphone (i.e. HTC Nexus One) that runs desired multimedia system applications, store data, and transfer and transfer via the Internet; (ii) access point for our work WLAN and native net Service supplier (ISP) 3G; and (iii) high speed power offer (i.e. Keithley2304A) operating as A battery for the smartphone and recording the reading of voltage and current on a laptop computer.

5. EVALUATING THE ENERGY PRICES

In this section, we tend to gift the methodology of our experiments and the statistics of our experimental results. We conduct our experiments in 2 major parts: network connected application and cloud experiments. The subsequent subsections Give the small print of every of those elements.

.5.1 Methodology

We did an intensive comparison of energy price of applications on several smartphones [7], [8]. This comparison demonstrates that each one smartphones don't seem to be comparable with respect to configurations, however they exhibit constant quite energy price behaviour for every application. for example this, Fig. 4, which is from our add [7], shows the pattern of power consumption of some smartphones in downloading and playing transmission file. We choose robot OS as smartphone platform since it's the most important market share in the smartphone industry. we use robot based HTC Nexus One because it is popular, straightforward to access its battery contact pins, and packed with multimedia and communication functionality.

Hence, we use this smartphone altogether our experiments for the consistency of our experiments. The smartphones access MCC via the internet and therefore the smartphone applications that are connected to the cloud are considered to be a Network connected Application (NRA).For third house multimedia applications there are 2 situations in downloading the content from the MCC through the Internet :(i) Progressive transfer (ii) download-and-play.

We know that a smartphone may be a set of hardware and package. The hardware subsystems of a smartphone embody computer hardware, RAM, HDD, sensors, and network interfaces; the package includes the software system and applications. Energy is consumed in an exceedingly smartphone by these hardware parts, which are managed by the software system supported the wants of the applications. As a result, every application requires a specific amount of energy betting on the services that are required by every hardware part.

5.2. Network Related Application Experiments and Results

We conducted experiments to live the facility consumption and the obtained data rate for uploading and downloading over protocol and FTP protocols mistreatment the 3G and wireless fidelity interfaces. Download of video file. shows the ability consumption of the second part for the network interfaces.

5.3. Cloud Experiments and Results

The MCC needs a lot of analysis with regard to the services that it provides to smartphones, in our case the EaaS service. In fact, saving smartphone energy is important for all of the MCC services [9], [10]. To investigate whether or not smartphones save energy by victimisation EaaS service of the MCC, we tend to conduct more experiments on a true MCC. As we discussed within the introduction, video secret writing requires heavy processing that drain smartphone battery if it's done on the smartphone processor. Besides, the information exchange with the MCC over the net consumes energy for a smartphone to do the secret writing on the MCC. In these experiments, we tend to investigate The smartphones can offer the multimedia file to the cloud in several ways: (i) FTP or communications protocol file link, wherever the file exists on an online server; (ii) Cloud file access link, wherever the file exists on a cloud; and (iii) direct upload, wherever the file exists on the user device. Once the file is uploaded, desired output format is fixed and therefore the conversion request will start.

Finally, the MCC renders the regenerate file to the smartphone in several ways: (i) upload to FTP to communications protocol server; (ii) cloud storage; and (iii) email link. and live the energy costs of victimisation the MCC on HTCNexus One smartphone. These experiments area unit conducted on the secret writing service of the secret writing cloud computing (i.e.,www.encoding.com).

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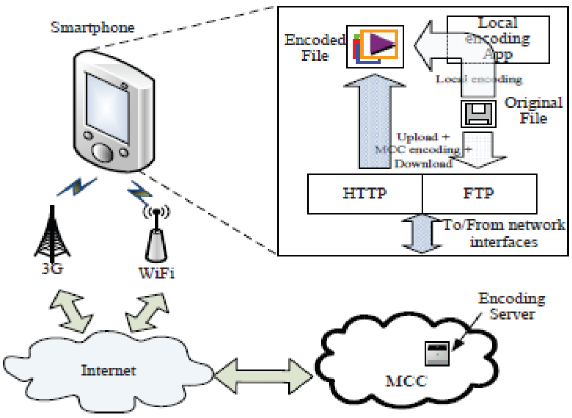
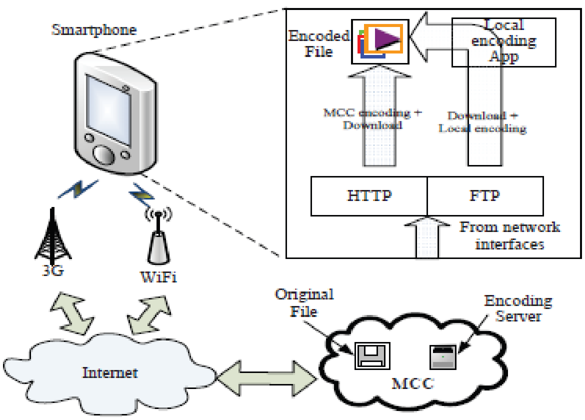


(a) Encoding scenarios where the original file exists on the smartphone



(b) Encoding scenarios where the original file exists on the MCC

Fig.4. Multimedia encoding scenarios

1) The first scenario is that the local encoding using the Smartphone's encoding application (i.e. local encoding in Fig.1 (a)).

2) The second situation is that the offloading technique by uploading the first multimedia file and doing the encoding by the MCC then downloading the encoded multimedia file (i.e. upload + MCC secret writing + transferrin Fig. 1(a)).

3) The third scenario is that the local encoding using the smartphones encoding application but when transfers the first file from the MCC (i.e. transfer + local secret writing arrow Fig. 1(b)).

4) The fourth scenario is that the encoding using MCC after load the original file from cloud storage then downloading the encoded multimedia file (i.e. MCC secret writing + transfer arrow Fig. 1(b)).We present here the overall energy prices for different network interfaces (i.e. 3G and WiFi) and web protocols (i.e. hypertext transfer protocol and FTP). In these results, if a network interface and an internet protocol ar used for uploading a file to MCC, an equivalent interface and protocol is used for transfer the reborn file. Therefore, there is no permutation between network interfaces and web protocols in uploading and downloading are bestowed here. this is because we tend to belief that the users tend to use an equivalent configurations at a time. Figure11 reveals the capability of MCC to produce EaaS service for smartphones. MCC provides at least 60 minutes reduction in energy if the 3G interface with hypertext transfer protocol is used. Additionally, this figure shows the result of various network interfaces and Internet protocols as we tend to expect.

6. DISCUSSIONS AND LIMITATIONS OF OUR APPROACH

Our experiment shows that the lobby performance highly depends on the network interfaces and protocols. In general, it is shown that 3G interface consumes additional power than the local area network interface. this implies offloading via 3G has to be done rigorously. Moreover, the FTP protocol consumes less power than the protocol. Recommending a single interface is troublesome as a result of each provides the end user a unique experience. for instance, 3G supports an oversized vary communication whereas local area network supports short vary. However, choosing interface decision depends on the lobby needs such as having a specific rate.

In our comparison experiments, we've been limited to the local applications that have fastened conversion parameters and produce an outsized file. For honest comparison, we have a tendency to customize the conversion parameters on the MCC to match the conversion parameters of the local applications. Therefore, the energy value of downloading the reborn file is sort of high. We should mention that the MCC will convert a typical video file on its size, format, and quality for mechanical man smartphone. Our experiments reveal that the MCC auto conversion parameters would reduce the downloading energy prices for the smartphone from 90th to ninety fifth where the custom configuration could save from half-hour to seventieth.

7. CONCLUSIONS

Our study clearly indicates that offloading heavy applications, namely transmission applications, from smartphones MCC is useful. MCC significantly reduces the energy consumption on smartphones by the EaaS service. Moreover, MCC enriches smartphones capabilities for transmission applications. At this point once the CC is in its baby state, the importance of evaluating the good thing about MCC to beat smartphone constraints motivates North American country to conduct this study. A large number of experiments has been performed for common network interfaces (3G and WiFi) and protocols (HTTP and FTP).

The location of the first file has been considered. We would conduct a lot of experiments on alternative transmission types like audio and pictures to generalize our finding. This study opens new opportunities to be investigated. Optimum algorithms, architectures, and implementations for this off loading technique is required to reach best offloading case. Finally, modelling the MCC to handle the offloading is important to implement economical offloading.

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