Task Offloading Framework to Enhance the Computing Capabilities of Smartphone and Devices using Cloud

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ABSTRACT

Over the last couple of years, the number of smartphones and devices (i.e., smartphones tablets, laptops) has become popular among people, more than other computing devices. Mobile phones became standard among individuals, and their range is ever growing due to the computing practicality they have over on the far side primary speech communication. However these devices have limited resources, like restricted battery life, space for storage, and processor performance. To beat these limitations task offloading from smartphones and devices to cloud could be a trustable practice to uphold the computing power of smartphones and save their battery life. However, task offloading introduces a communication energy required for those devices. To create task offloading beneficial, challenge is to totalize the energy needed in communication activities of task offloading. Actual energy estimation considering different parameters of smartphone can promote these devices to create the proper choices on whether or not to perform task offloading instead, supported the energy needed for the communication activities. Only if the offloading procedure consumes less power than processing the task on the phone itself, then the task is offloaded to the cloud. To perform efficient offloading practice, we have a presumption of actual and current configuration parameters like Battery power level, RAM, CPU Uses, File Size and Network Type(WLAN,3G,4G) and its uploading downloading speed of smartphones as well as devices. Parameters make smartphones capable of effectively estimating the energy rate of task offloading.

Keywords *— Mobile Computing, Cloud Computing, Smartphones , Offloading Decision, Energy Saving, Battery Level, RAM, CPU Uses, File Size and Network Type.*

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1. INTRODUCTION

Today's Smartphones have great configurations like RAM, CPU's, storage, sensors and camera, and are also rich in user interfaces, speakers and colorful displays. Smartphones are changing routine life and has made us connected 24*7 to our professional as well as regular life and work. It is with us continuously and made our life easy because of its huge number of applications that makes it incredible and makes possible to perform every task which we perform on computers, it's the era far ahead of the initial use as cell phone only for making voice calls. It's fast speed and advanced applications counting games, video, time, contact organizing and e-mails, and obviously lots of social media services. In the professional aspect smartphone perform tasks like computers for example creating reading and editing word, pdf, ppt, video, audio and many types of files. Expect these smartphones have some limitations like battery life, processing capacity and memory and these same issues are with other smart devices.

Over the last few years, fast progresses in semiconductor technology have alleviated some constraints. Though, the limited battery power limitation has not been satisfactorily addressed [1].

Portability, memory space and battery power are the main uniqueness of a smartphone. The functionality and form-factor are dependent on each other as more powerful a smartphone is, bigger battery it needs. Processing speed and memory capacity is inversely proportional to battery power which limits phones either for laptops and tablets [3]. With powerful operating systems, memory and processors (e.g., Android, Windows Mobile, Apple iOS, BlackBerry, and Symbian), smartphones are intelligent to execute advance applications that are as like to PCs and laptop applications [1]. Need to reduce the power usage and increase capabilities of smartphones has been involving efforts from many researchers. Task offloading is a promising practice to lessen energy consumption in smartphones. Using, Cloud Computing (CC), the energy inadequacy on smartphones conceivable eased off by offloading heavy tasks of smartphones to the cloud. For example, a smartphone can upload a text file to a cloud and request to encode the file into a pdf format for smartphones with less energy consumption than doing the encoding on the device itself. Task offloading will become essential for the Information and Communication Technology (ICT) in the coming future because of Cloud Computing and will be a leading hand for mobile computing. To make the offloading helpful, parameters and comparison between actual and current stages of smartphone or device configuration gives the energy cost of offloading for a given task i.e., whether to perform locally or push it to cloud.

1.1 SCOPE of OFFLOADING

Expanding the capabilities of smartphones and devices is promising by offloading heavy task to the cloud. Projected energy estimations with the current state of the parameters fixed for system helps smartphones to make accurate offloading decisions. Furthermore, our techniques not only help for task offloading but also opens new door for energy solutions that necessitate predicting the power consumption.

2. LITERATURE SERVEY

The offloading has been designed for some purposes such as load balancing, get better performance, and save power. Previous work is also related to power saving of handheld devices but with different approaches.

A. P. Miettinen and J. K. Nurminen, ”Energy Efficiency of Mobile Clients in Cloud Computing”, [3] Presented use of cloud computing in Mobile energy efficiency and analysis of the critical factors affecting the energy consumption of mobile clients in cloud computing.

G. P. Perrucci, F. H. P. Fitzek, and J. Widmer, ”Energy Consumption Entities on the Smartphone Platform”, [2] Energy consuming entities of a mobile device such as wireless air interfaces, display, mp3 player and others are introduced.

K. Naik, ”Software Based Energy Saving Methodologies for Handheld Wireless Communication Devices”,[4] Approach is the offloading to a web proxy, where a proxy works as an intermediary machine between a web server and a mobile device. The mobile device sends a web request to the proxy and the proxy delivers the content to the mobile device after performing the desired modification to the content, such as multimedia coding. A proxy can enable a handheld device to save energy in a number of ways, for example: reduce the volume of contents to be downloaded by user devices.

I. Kelenyi and J. K. Nurminen, ”CloudTorrent - Energy-Efficient BitTorrent Content Sharing for Mobile Devices via Cloud Services”, [5] Proposed a strategy to save energy of handheld devices using CC. In their strategy, cloud servers are used as BitTorrent clients to download torrent pieces on behalf of a handheld device. While a cloud server is downloading the torrent pieces, the handheld device switches to sleep mode until the cloud finishes downloading the torrent pieces and starts uploading the torrent file in one session to the handheld device. This strategy saves energy of handheld devices because downloading torrent pieces from torrent peers consumes more energy than downloading a single burst of torrent pieces from the cloud.

3. PROPOSED SYSTEM OVERVIEW

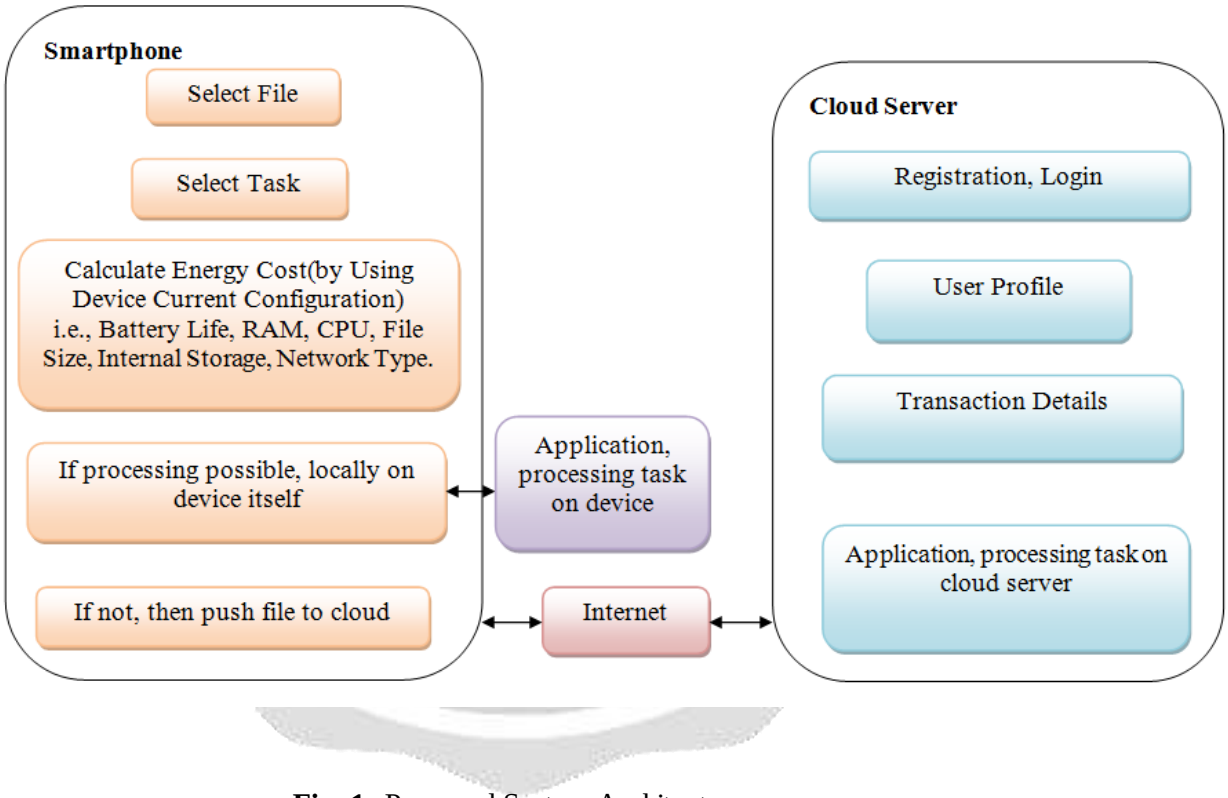


Fig. 1: Proposed System Architecture

Task offloading is a strategy where portable handheld devices i.e., smartphones and other devices have limited energy, so to enhance there working, cloud is used. System consists of two main elements smartphones (i.e., user equipment) and Cloud Computing (CC), both linked to the Internet, as depicted in Fig.. The smartphones are connected to the Internet through a WLAN access point or cellular data network. These smartphones provide each and every mobile computing functionalities to the users via special applications. On the other side, Cloud Computing part consists of cloud data center and cloud provider, which are available through the Internet. Cloud provides the users (e.g., smartphone users, tablets,laptops) with all of the Cloud Computing functionalities that are required for device computing.

The offloading practice, smartphones access the cloud through the Internet. Expanding the potential of smartphones is promising by offloading heavy task to the cloud.

System starts working from selecting file from smartphone which we have to process, then selecting task we want encode the file into. System then calculates the Energy Cost(by Using Device Current Configuration) i.e., Battery Life, RAM, CPU, File Size, Internal Storage, Network Type. If phone has maximum battery, free RAM, CPU, the system recommends local processing, on phone itself. If the parameters lack then it recommends cloud processing. When file is pushed to cloud, login window appears where new registrations can also be done for new users. Only a registered user can use the facilities and password and user names are used as authentication entries. User profile appears where there are options of task which processes file on cloud application. Smartphone then automatically downloads the processed file on the device for user. The projected energy cost with respect to the parameters mentioned above let smartphones to make accurate offloading decisions. Furthermore, our techniques not only help for task offloading but also opens new door for performing every task from cloud through smartphones. Same architecture will appear even device changes as to calculate energy cost and proceed further, only user equipment changes instead of smartphone there can laptop other device and cloud side will be same.

3.1 IMPLEMENTATION DETAILS

Algorithm for Task Offloading

On local device (User Equipment)

1. Initialize Task
2. Input File for local Application
3. Analyze resource constraints for (Local device) on the basis of current configurations
   a. Battery Level
   b. Network Type
   c. RAM, CPU
   d. File Size
4. Analyze resource constraints for (Cloud Device) on the basis of current configuration
   a. Energy
   b. Computations
   c. Visualization
   d. Storage
   e. Bandwidth
   f. Network type

5.Do task analysis on the basis of resource constraints

if Local Device is able to perform task for given input efficiently then

Perform task on local device

Return result

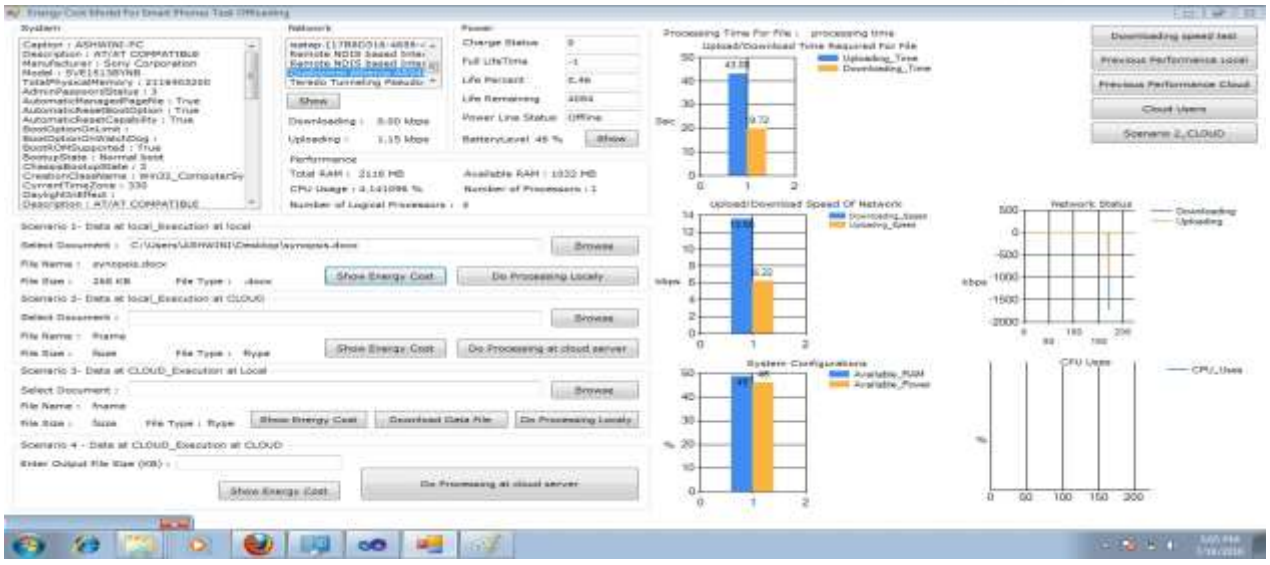
else (If performance of local device is not efficient for given input at present state)

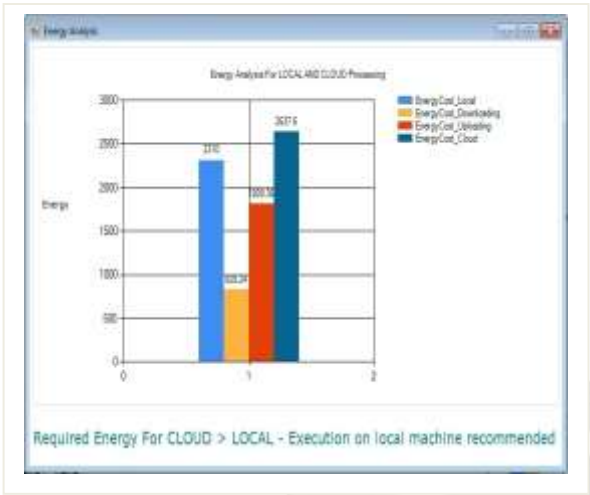
offload task to cloud server

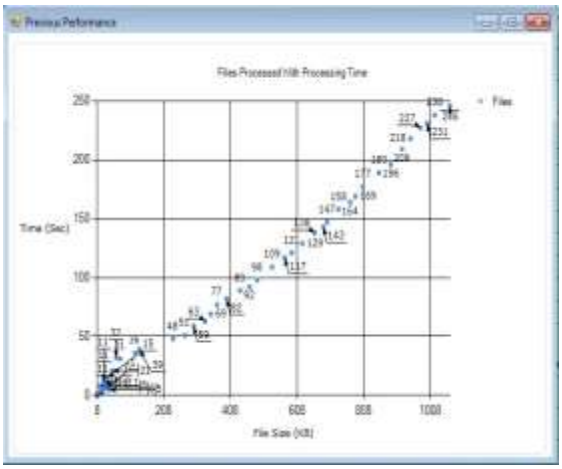
return result to local device

6. Stop

5. RESULTS







	A	B	C	D	E	F	G
1	SrNo	RAM	CPU	Upload	Download	Fsize	Ptime
2	1	1.2Gb	3.44	2.1kbps	2.5kbps	39	15
3	2	992Mb	7.12	2.0kbps	2.2kbps	77	31
4	3	1.19Gb	2.2	1.8kbps	2.6kbps	122	36
5	4	1.32Gb	5.67	1.8kbps	2.1kbps	298	59
6	5	1.12Gb	5.31	2.1kbps	2.5kbps	332	63
7	6	1.05Gb	9.48	2.2kbps	2.4kbps	349	69
8	7	1.2Gb	12.62	2.43kbps	2.8kbps	368	77
9	8	1.22Gb	17.3	2.7kbps	2.3kbps	397	82
10	9	1.24Gb	8.26	2.65kbps	2.5kbps	437	89
11	10	1.25Gb	3.5	2.86kbps	2.1kbps	533	109

These are the mobile app and laptop system snapshots where we have shown our experimental results. We have calculated current configuration of RAM, Battery, CPU, File Size to calculate power and Upload speed, Download speed and previous local processed files to calculate energy cost. At last it gives required energy graph where it gives right recommendation whether to perform task locally or to offload task to cloud.

6. CONCLUSION

Expanding the potential of smartphones and devices is promising by task offloading to the cloud. Though, estimating the power consumed in task offloading is essential for making task offloading advantageous, which take place only when the power consumed in the offloading method is less than the power consumed without it. Thus, the main challenge in task offloading is estimating accurately the energy consumed throughout different parameters in task offloading. In this technique, we developed a system which checks current configuration of local device and gives decision where to process the task. We considered the particulars of the smartphone for making accurate decisions. Furthermore, our models not only facilitate task offloading but also opens new door for power solutions that are needed for calculating the energy utilization. Here, we experimentally confirm those models by conducting a set of testing's on smartphones and devices and compute the energy inspired throughout task offloading. Experimental outcomes reveal that our energy judgment models can estimate energy cost with adequate precision. The models just required to recognize the amount of transferred data and some system parameters, and they can present good inferences of energy cost.

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