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Energy Economical Resolution for Heavy Computation Using Cloud

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***Abstract*— In spite of the dramatic growth inside the variability of excellent phones in recent years, the challenge of restricted energy capability of these devices has not been resolved satisfactorily. However, inside the age of cloud computing, the limitation on energy capability is mitigated off in a cheap manner by offloading vital tasks to the cloud. It is a necessity permanently phone and cloud computing developers to possess insights into the energy worth of excellent phone applications before implementing the offloading techniques.**

In this paper, we tend to tend to live the energy worth of transmission applications on sensible phones that square measure connected to Energy as a Service Cloud (EaaSC). We have conducted Associate in nursing comprehensive set of experiments to measure the energy costs to analysis whether or not or not or not sensible phones save energy by victimization EaaSC services. Specifically, we tend to tend to perform all the massive or vital computations on cloud rather than on sensible phone. Energy consumption comparison was performed by victimization protocol and FTP web protocols with 3G and Wi-Fi network interfaces. All the experiments were conducted on Associate in nursing automaton based totally HTC Nexus One sensible phone. Our results show that EaaSC provides the sensible, great & nice phones with easy transmission usefulness and saves good phone energy up to 60% to 90%.

All huge computations square measure performed in EaaS Cloud therefore sensible phones needn't need to be compelled to try and do the computation regionally. By that it scales back the battery drain of excellent phone.

***Keywords*— Energy as a service, energy consumption, EAASC**

I. INTRODUCTION

CLOUD computing is recognized as an alternate to ancient info technology [1] owing to its intrinsic resource-sharing and low-maintenance characteristics. In cloud computing, the cloud service suppliers (CSPs), like Amazon, area unit ready to deliver varied services to cloud users with the assistance of powerful data centres. By migrating native information management systems into cloud server, users will relish high-quality services and save vital investments on their native infrastructures. One among the foremost elementary services offered by cloud suppliers is information storage. Allow us to take into account a sensible information application. A corporation permits its staffs within the same cluster or department to store and share files within the cloud. By utilizing the cloud, the staffs are fully discharged from the difficult native information storage and maintenance. However, it conjointly poses a big risk to the confidentiality of these keep files.

Specifically, the cloud servers managed by cloud suppliers don't seem to be absolutely trustworthy by users whereas the information files keep within the cloud is also sensitive and confidential, like business plans. To preserve information privacy, a basic answer is to write information files, so transfer the encrypted information into the cloud [2]. Sadly, coming up with associate degree economical and secure information sharing theme for teams within the cloud isn't a straight forward task owing to the subsequent difficult problems. First, identity privacy is one among the foremost vital obstacles for the wide preparation of cloud computing. While not the guarantee of identity privacy, users is also unwilling to affix in cloud computing systems as a result of their real identities can be simply disclosed to cloud suppliers and attackers.

On the opposite hand, unconditional identity privacy might incur the abuse of privacy. For instance, a misbehaved worker will deceive others within the company by sharing false files while not being traceable. Therefore, traceability, that allows the cluster manager (e.g., a corporation manager) to reveal the $64000 identity of a user, is additionally extremely fascinating. Second, it's extremely suggested that any member during a cluster ought to be ready to absolutely relish the information storing and sharing services provided by the cloud, that is outlined because the multiple-owner manner. Compared with the single-owner manner [3], wherever solely the cluster manager will store and modify information within the cloud, the multiple-owner manner is a lot of versatile in sensible applications. A lot of concretely, every user within the cluster is ready to not solely read information, however conjointly modify his/her a part of information within the entire file shared by the corporate.

II. EASE OF USE

Cloud provides more energy efficient solution. In traditional systems large number of servers was present which were having very low utilization & high energy consumption. Traditional servers provide sub-optimal energy efficiency. Cloud based system contains small number of servers which are having high utilization & low energy consumption. Cloud reduces the energy consumption of a server by 70 to 90%. So cloud reduces energy consumption of servers.

For large number of servers, the large number of cooling system is also required. These cooling systems do the direct energy consumption. Study says that, even for large corporate data centres 0.5watts of indirect power is needed for each watt of direct power consumption. The energy consumption for cooling is much more reduced in cloud. Google's data centre needs 0.13 watts power for direct power consumption.

III. RELATED WORK

We concentrate on the approaches that involve task offloading to servers on the net. We reason the approaches into 3 major classes: (i) exploitation cloud computing [6], [7], [8]; (ii) exploitation power-aware internet proxy [6], [9]; and (iii) exploitation native powerful servers [10], [11], [12], [13]. During this paper we tend to adapt the CC approach for offloading multimedia system applications. Kelenyi et al. [6] projected a technique to save lots of energy of handheld devices exploitation the CC.

In their strategy the cloud 765 servers square measure used as a Bit Torrent shopper to transfer torrent pieces on behalf of a mobile hand-held device. Whereas the cloud server downloading the torrent items, the mobile hand-held device switch to sleep mode till the cloud finishes the torrent processes and transfer the torrent move into ammo to the handheld device. This strategy saves energy of smart phones because downloading torrent items from torrent peers consumes more energy than downloading a 1 burst of items from the cloud. Kumar et al. [7] study the energy price of offloading mobile computation to the cloud for saving energy on mobile devices. The price of communication and computation is studied to point out the impact of every of those factors on offloading price

In [6], the energy price has been studied for three cloud computing services: software system as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS). This study considers the whole energy consumption on the user finish, networking, and information centre for all cloud services. A comparison is provided during this work between the system parts to point out the impact of every half. Xiao et al. [14] gift a study of energy prices of exploitation mobile YouTube (m.youtube.com) on mobile devices (Nokia S60) for 3G and WLAN network accesses. During this study, the authors take into account 2 strategies of downloading and enjoying video: progressive transfer and download-and-play. Energy cost information is collected by the Nokia Energy Profile application that itself runs on the mobile device to live this and voltage of the device battery.

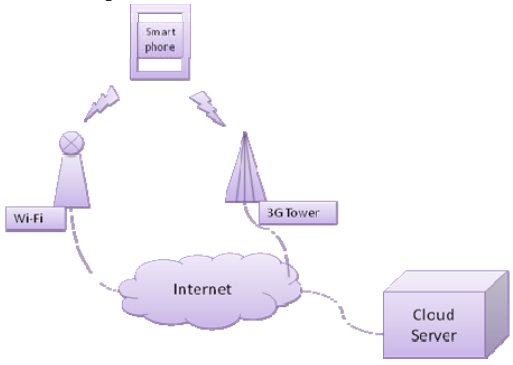
The analysis reveals that 3G consumes 1.45 times additional energy than WLAN. Moreover, for each network access, the network traffic is that the same for each progressive transfer and download-and-play. In general, the download-and-play consumes additional energy than progressive download as a result of the network modules still stay active for a short time when the transfer is finished. Evaluating of smart phone energy price or power consumption is not new one; but, this subject is a section that has become progressively necessary. This is often mirrored in current researches [15], [1]. specifically, these recent work, as well as our work, square measure samples of the work that have conducted experiments on AN automaton platform for several reasons as we describe in Section IV-A. However, to the most effective of our knowledge, there's no work on the analysis of energy cost of offloading multimedia system applications on smart phones and investigate the offloading to CC. Study says that the energy consumption of a smart phone while downloading task from cloud using 3G network with HTTP protocol is 11.3 µJ/B. It consume maximum amount of energy to perform such an operation. If we perform uploading operation using Wi-Fi network with FTP protocol is 1.08 µJ/B. The other details of energy consumption are as follows.

IV. EXPERIMENTAL SETUP

Our system contains two significant elements: cell phones along with Cloud wherever every single spot model combined for the internet, since delineated throughout. Your cell phones spot model linked to the World Wide Web or internet via a WLAN (i.e. Wi-Fi) or cell phone expertise accessibility intent (i.e. 3G-HSDPA). As shown in fig. 1, we have created one cloud server to perform the similar operation that we had performed on smart phone. These cell phones allow every one of sign benefits for the word of advice customers. For instance, the person will fire a large query which will fetch thousands of records from the database. One database will be created in SQL Lite which will have thousands of records and it is present in smart phone.

We are considering the smart phone which is based on android technology. For better results we are considering the latest version of android operating system (E.g. Jelly Bean). When the query is fired from the smart phone to fetch thousands of records then we will measure the energy consumption of a smart phone to perform the operation. The time consumption and memory consumption will also get measured. The time consumption will be measured from the time required to run the query and to get the fetched data i.e. to get the output. Your multimedia systems benefits component or totally behave while using related MCC. On the reverse hands, this MCC is actually a specific sort of cloud calculating wherever the expertise centre affords the customers along with most needs regarding sign benefits such as storage along with method.

Furthermore, this MCC provides the understanding to manage a sizable range regarding sign varieties along with formats. Your build mainly includes: (i) mobile phone (i.e. HTC Nexus One) which extends sought after sign apps, retail store information, along with transfer along with transfer by means of the online world; (ii) accessibility place for our scientific discipline lab wireless geographic area network along with local net Support supplier (ISP) 3G. We can also set up a cloud server with the help of wamp server. With the help of wamp server we can create a local server machine and can connect a smart phone to the server to perform the experiment.



V. EVALUATING THE ENERGY COST

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. We conducted experiment in two different modules. First is to fire a database query on a database to perform large computations and give multiple entries of rows as a result. And in second module we give a request to play a multimedia file to play. The subsequent subsections give the small print of every of those elements. We did an in depth comparison of energy price of applications on many smart phones [16], [17]. This comparison demonstrates that each one smart phone don't seem to be comparable respect to configurations, however they exhibit a similar quite energy price behavior for every application. Let's say this, [16], shows the pattern of power consumption of some smart phones in downloading and playing transmission file. We elect automaton OS as smart phone platform since it's the largest market share within the smart phone industry. We tend to use automaton primarily based HTC Nexus One because it is popular, straightforward to access its battery contact pins, and choked with multimedia and communication practicality. Hence, we use this smart phone altogether our experiments for the consistency of our experiments.

We have created a database which is having three different tables in it namely as "city", "country" and "countrylanguage". The database contains around 5411 numbers of rows in it. In this module we also are having two different scenarios. These scenarios are depending on the location of the database. In first scenario the database is present on smart phone itself and in second scenario the database is present on the cloud.

Now we are considering the database present on device itself and we have written a select query to fire on the database present on both locations. First we fire a query on the database which is present on the smart phone. This query will fetch near about 5000 row of records to make it as a heavy or large computation. We will calculate the energy cost, memory space and time required to perform the computation. Depending on the basis of memory and time we will calculate the energy cost. To calculate the energy cost the formula is given in equation and the result is shown in the fig.1

In second scenario we consider the database present on cloud. And if we fire a query to fetch near about 5000 rows of records on the database present on cloud then the result is shown in fig.2. We can also select three different queries to perform different computation. The queries are 1) Find all cities 2) Find all countries and 3) Find all the countries and its corresponding cities.

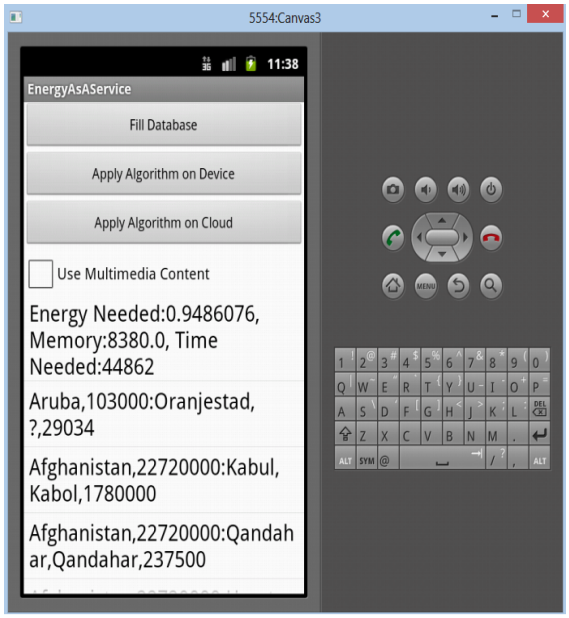


Fig. 1 Energy cost when computation performed on device.

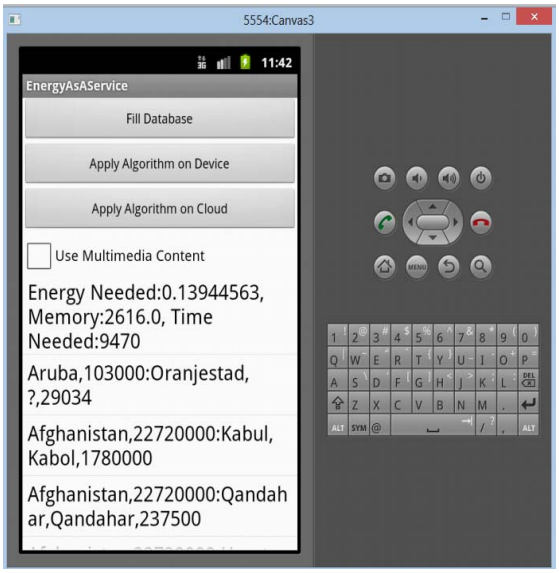


Fig.2 Energy cost when computation performed on cloud.

For general smart phone battery usage, we tend to study the ability consumption rather than energy as a result of the ability provides a decent insight the device consumption despite the file size or the time needed to complete a task. However, the full energy is used to point out a comparison between specific tasks as we tend to see next. This is often as a result of the full energy is additional purposeful metric to match one specific task dead on 2 completely different processing rates. Additionally, we tend to live the speed of the network interface to demonstrate the obtained rate at the user level. The smart phones access cloud via the net and therefore the smart phone applications that are connected to the cloud are considered to be a Network connected Application or Network Related Application (NRA).

At the beginning of learning third house, network interfaces (i.e. 3G and Wi-Fi) are thought-about as a result of every of those interfaces have its own characteristics, like writing overhead. As a result, each network interface consumes unequal level of power and provides completely different knowledge rates. Yet, the net protocols (i.e. communications protocol and FTP) ought to be taken under consideration for NRA. In different words, the network interfaces and therefore the used protocols are the most important factor that impacts the energy prices of these applications. Thus, we tend to examine the energy prices of common network interfaces and web protocols for the smart phones.

VI. NETWORK RELATED EXPERIMENTS AND RESULTS

We conducted experiments to live the facility consumption and the obtained rate for firing a query on smart phone as well as on cloud, over protocol and FTP protocols exploitation the 3G and WLAN interfaces. Study says that the FTP protocol supports higher rate with less power consumption than the HTTP protocol. By this aspect, the FTP protocol is a lot of economical for task offloading. From the energy saving purpose of read, the performance metric for network interfaces and protocols is that the energy consumption per byte. The typical energy consumption per computer memory unit obtained from our experiments.

We conducted experiments to live the facility consumption and the obtained rate for the execution of a query over HHTP protocol and FTP protocols exploitation the 3G and WLAN interfaces. We have a tendency to notice that the facility consumption of this stage is analogous for the enjoying once the file is on the device local storage. In the progressive transfer situation, we have a tendency to piece the media consumer to play as there square measure enough knowledge to begin. After we live the energy prices, the phases of this situation can be simply distinguished as 3 phases.

The primary part occurs once the consumer starts to transfer the maximum amount knowledge as possible, that causes fluctuations within the power consumption. The battery drainage will be measured to compare it with the other scenario. The second part happens once the consumer fires a query on a database which is present on cloud then all the heavy computation will perform on cloud instead of smart phone. Finally, the last part is to compare both the scenarios & show that if you offload the heavy task to cloud then it will save 30% to 70% of energy of your smart phone. If we compare the energy cost on device as well as energy cost on cloud on the basis of formula derived as follows.

$$Energy = \left(\frac{End\ Memory - Start\ Memory}{End\ Memory} + \frac{End\ Time - Start\ Time}{End\ Time} \right)$$

$$Energy\ Saving = \frac{Energy_{Device} - Energy_{Cloud}}{Energy_{Device}}$$

$$Energy\ Saving = \frac{0.9486076 - 0.13944563}{0.9486076}$$

$$Energy\ Saving = 85.29\%$$

The above calculation shows that cloud computation can save 85% of energy of smart phone.

VII. CONCLUSION

My work will clearly indicate that offloading serious applications, specifically multimedia system applications, from smart phones to EAASC is helpful. EAASC considerably reduces the energy consumption on smart phones by the EaaSC. Moreover, EAASC enriches smart phones capabilities for multimedia system applications. An outside range of experiments has been performed for common network interfaces (3G and Wi-Fi) and protocols (HTTP and FTP). The placement of the initial file has been thought of. This paper provides a good vary of comparison between operation execution on smart phone and on cloud with network interfaces and net protocols. Optimum algorithms, architectures, and implementations for this offloading technique are required to succeed in best offloading case. Finally, we can say that we will save approximately 60% to 90% of energy of smart phone, so cloud providing energy as a service to the smart phone by performing all heavy computation for it.

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