DESIGN AND EVALUATION OF MOBILE OFFLOADING SYSTEM FOR WEB-CENTRIC DEVICES

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Abstract:

Nowadays mobile phone is very important part of human life. Smartphone are the most usable devices which provide the personal computing environment. As the high need of the smartphone the many types of application are coming in the market, mobile applications are increasing. The mobile application developer has to first concern mobile platform and after the user requirements which must be sophistically done. User need an interface which is interactive and it is challenge to the developer to reduce the design complexity and increase the performance of the application of the software and enhance the compatibility of the different Operating system, A lightweight process is the main target on the web which would use for mobile devices and for the mobile application there are two types of characteristics that smartphone have first is restrict power supply and low end hardware. If the application has the high graphics quality and that application have the more consumption of CPU time and space that will affect the whole system of mobile and it may cause that other application will not work correctly by that reason the developers have to face that challenge to make an application to compatible to a specific platform and also have to reduce the battery power consumption. For design the offloading system the system should be compatible to the other platform or external link because offloading may be use cause of the specific hardware system or handling a particular task. In this paper, we consider about the mobile offloading system on the smartphone which have the different platforms which is delegated system for web centric devices environment. In this we would know about the web-centric technology how it is use on the android, iOS and windows platform. In this we use a server or a system which have the java-script base code and the other programming language may involve in it. The mobile application will work as the client machines which have the lightweight code to make compatible and the heavyweight code will run on the server machine. We take one of the web applications to measure the performance of the client machine. The performance is also depending on the uploading and downloading the data and what is transfer rate of the data. We will evaluate the

website loading time, running time and response time by the browser and enables a high workload application to run on the low end mobile system. Therefore, we also measure the network connectivity using in the mobile phone like 1G,2G,3G,4G technology in this 3G and 4G have the faster data transfer speed that is in category of high performance for the mobile that is more affect the power consumption of the mobile phone. In addition, these methods reduce the complexity of the mobile operating system and also reduce the power consumption of the device.

Keywords:

Java, Android, Long Term Evolution(LTE), WCDMA (Wideband Code Division Multiple Access), 1G, 2G, 3G, 4G, Compiler, Interpreter, Energy Consumption, Batteries

A. Introduction

The mobile devices change the aspect of the mobile computing and mobile personal computing environment. Mobile devices complete the user needs and our computing needs. User wants a fast performance of the user and mobile computing use the different network including W-CDMA, LTE and IEEE to increase the performance of the mobile network which is based on the web centric devices. And it also decreases the overhead of the client server architecture on the web or network architecture environment. Now Days mobile application are becoming more large and using the high graphics and support the complex applications, for example games are the main complicated application which consumes the phone memory and need the more runtime memory of a device also use high level mathematical computations which is makes c.p.u more consumable and busy with a specific single application and makes the operating system to more consumable on the mobile device along with these requirement these application are still restricted to the hardware resource in the mobile computing environment.

As a solution of those issue, several research projects propose offloading systems their offloading system based on the operating system of the mobile devices, and this may lead to non-trivial development overhead in the change or upgrades of operating or runtime systems. In mobile devices use many operating system such as android produce by the Google and ios produce by the apple and RIM produce by the blackberry and this is cause by the mobile web application developers. Mobile service providers need the different platform to enhance the mobile performance by that reason most of browser provides in-built application with web browser that browser provides common environment between the different mobile platform. As the next generation web standard, most of JavaScript base devices are using for the client processing and has represented as the universal language on the web which also include the java servlet and jsp and php for the server language and HTML 5 and CSS using for the front view of the

mobile devices. We produce the mobile offloading system using the cost of the devices, which is challenging for the low-end system and front end system. To reduce the complexity of the CPU and to extend battery lifetime. To resolve the issue of the limited resources JavaScript function to an offloading server. By using the offloading system, the low end or low capability devices are able to support the complicated and high computational web resources. The basic idea behind offloading system to separate the application into two parts in which the complicated part and the low computation part. While the client process by the low-end code then the client machine sends the request to the server and then server compute that request and then resent on the client machine. That process does not affect the CPU and process with a low consumption of the mobile runtime memory. This reduces the CPU utilization and energy consumption of the mobile device. This offloading system requires the data connection and data traffic over the network for exchanging the data between the callee and caller. The key contribution of our paper is new offloading method that increases the performance of mobile devices by reducing CPU utilization and saving the energy. To evaluate offloading system, we perform experiments by using web based languages.

B. Background and Related work

There are server major different projects on the issue of computational power and the cost of CPU utilization in mobile computing enviornments.one is the clone Cloud project. Which uses computer or data centre on mobile devices by cloning the entire image of a mobile device using cloud computing. This method use to provide more power-efficient and reliable but it requires pre-processing on the client side which is increase the utilization of the CPU and also increase the cost of mobile devices can also lead to excessive network traffic from the cloud network to the device and also need the third-party storage to store data over the network.

Another project is MAUI, in this provides a code offload based on the annotations by a programmer to maximize energy savings. This code use at runtime which should be remotely executed by an engine using current constraints of the mobile devices. This method is not adoptable on various mobile operating systems. In our approach is reliable, concise and platform independent which runs on the server machine or browser level.

In LG U-plus Korea's companies launched a cloud platform for games in which user can access games that can be play on the mobile using the cloud. That is use the cloud for storing data on the web for games which is provided by the developers and publishers for the users who don't need to download in the mobile and does not have space in their mobile. This approach needs fast streaming of the data of the network storage. This service is limited in its ability for adaptable on all mobile devices our offloading system as effective in terms of platform compatibility and

design simplicity. There is another project comparing to offloading system like automatic detection schemas for offloading system such as it is very important to design and partitioning and offloading approach incurs network overhead from transmission delay and cost. Static partitioning is not suitable if there are frequent bandwidth fluctinons in the mobile communication. Dynamic portioning results in high overhead due to continuously determining partition. In this study, we focus on platform-independent offloading system.it is possible to build platform independent offloading system.

In Chen,et al. (2004), the authors suggest several guidelines to how a function or component is considered for the remote execution. These are the following rules suggested by the author (1) A component that is uses the local access like IO devices including the storage devices, camera and the GPS devices should not be offloaded.(2) A statefull or a simple component should not be offloaded unless its state can be migrated.(3) A process that use or invokes other methods should not be offloaded. (4) A process which is not suitable for the offloading that application should not base on the offloading system. The function that access global memory with the other function should not be offloaded in our system. Power Consumption is major concern in the mobile devices. Prior work (Rudenko et al., 1998; Flinn and Satyanarayanan,1999) explores about the power consumption using the remote execution for reduce the power consumption and remotely execution use mainly using the term cloud computing but using more devices it causes the network traffic. In this paper,the authors discussed about the critical factors to reduce the overhead of devices using the offloading system.

C. Design and implementation of mobile offloading system

In the offloading system, we are using the client server architecture in this the heavy part of the application runs on the server and the lower weight code runs on the client side using the remotely access of the server side.
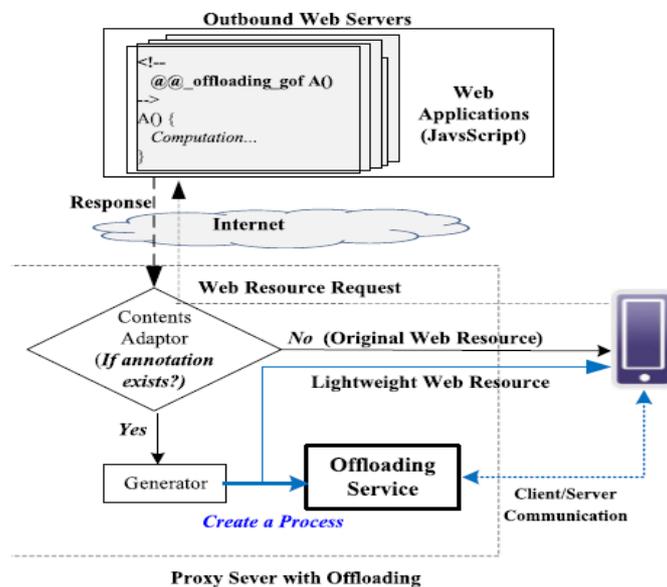
1. Platform independent mobile offloading system.

In this the offloading system as the mobile framework that increase the CPU performance by reducing the response time and CPU utilization

In the architecture use the built-in proxy which is basically for the client to process the request to the server.

2. Code division in client-server model:

If the content adapter proceeds for request, it communicates with the server to retrieve the web application code. Content adapter detects the offloading code in the web and it creates a server process that delegates the client work on the client server.
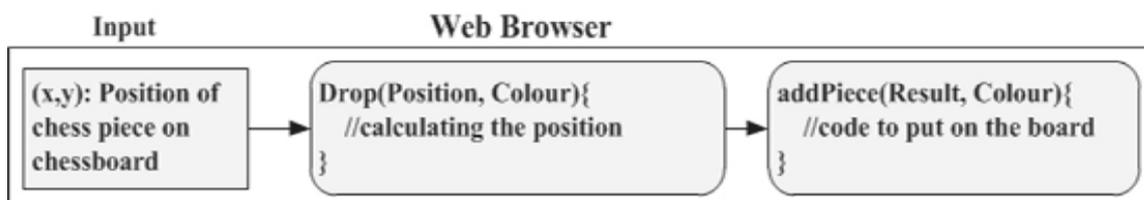
3. Implementation of offloading system

We using the java language for implementation of the offloading system this can be based on the proxy server system. In offloading system mainly have two parts one is for annotations and one part provides the offloading services. The first part or the annotations part provides information about that the page need to be offloading or not and the second part provide offloading if the offloading service detect the code for offloading then the server run that the code on the proxy server to offloaded the code.

4. Fault Tolerance

Mobile offloading system based on the client-server architecture. If the system does not connect we have to manage the situation when the offloading server is in the offline condition or unavailable. If the server is not reliable the offloading server may not response to the client and client can send another request and many requests comes from the client this time if a server have duplicate request, then the process may be fail in this situation this architecture may require the application reloading if a network failure happens while the application is running.

D. Case Study

In this we experiment on a web page which is written in JavaScript language that have the heavy computational code from the public web-sites there we can perform offloading on the page which have the heavy code. Light weight code does not affect the more CPU time and does not have annotations for perform the offloading on the page. For this reason, the system of offloading of a page is based on annotation by using it have a chance to utilize the code or

Input	Web Browser	
(x,y): Position of chess piece on chessboard	Drop(Position, Colour){ //calculating the position }	addPiece(Result, Colour){ //code to put on the board }

system in offloading system.

For case study, we are using the program is Gomoku it is a game which is turn based in this a winner have to make a row which can be vertically, horizontally or diagonally. This game is using the JavaScript for implementation of this game. This game has the main computational part which is the empty position on the board that have calculation while| server or a system playing from the other end. Then the system calculates the other maximum score to find the next position for making a line from the system. In this we trying to use our system at the head of the web page to do part of the game into the client server architecture. In our system, we divide the code into parts which have the higher and lower part of the code which means the higher weighted code will run on the server machine and the lower weighted code will run on the client and the browser side of the client system. In the above diagram this is the workflow of the instruction which is runs on the web browser. As the input by the user is the position of the piece on the chessboard web browser calculate the position of the piece and code is put on the board. On the server side performing these codes which have a thread which will calculate the position of the piece. By these features of the JavaScript will cause to run the function in asynchronous mode.

E.   Performance evaluation

In this section to prove the performance gain and the change of our work we design it on the base of various scenarios. The test is based on the different specifications and the offloading server. The client are connected to the server using HSDPA and LTE networks.

Our experiment compares the cases execution and client based. Client devices communicate with the server using different network interface. In all scenarios, the web browser serves the same interface whether the program is offloaded or not. We also concentrate on bases of the performance and resource consumption.

1.   Response time

On the basis of application evaluation, the response time is the main factor of the performance evaluation. If a user creates one event. We try to decrease the response time will be short to good performance. We research about how the response time can decrease in the offloading system of the application.

2.   Resource utilization

Resource is the main factor to complete the requirement of the application other main factor in performance evaluation are to measure the network traffic caused by the offloading and other factor of the CPU that is using by the application.

3. Power Consumption

In the mobile device, the power consumption is also a major problem. We also analyse the battery power consumption with different method in order to reduce the power consumption when using the offloading system. For the power measurement, we use a Monsoon power monitor FTA22D for the power management of the mobile device. The monitor flows the voltage of a lithium battery set to 3.69 to a mobile smartphone and gives the solution a robust power measurement solution. In the game we run the five in a row game by the client based method and the offloading system on the direct network connection and Wi-Fi connection and also compares the energy consumption of the device in each method.

4. Discussion

In this section, we find several issues of our system in this a network failure is the general problem for all server-client based applications the main problem with our offloading system is the network failure in which the first option as the solution is reload the page that have the JavaScript code. In this the application, will restart to cover the loss of the computation. The other way to recover the losing factor by redirecting the original code when the client server has the network problem.

F.   Conclusion

In our offloading system that is helpful to reduce the CPU work and calculation that reduce the performance cause by the other task on a single system. Our system provides the efficient way to increase the system performance. In this we have a server which is a proxy server the proxy server will detects the heavy computational code or function which have the more time to execute on the client system and this functions codes from the outbound web servers by programmer annotations. Annotations detects the heavy code of the application then it generates the server side calculation that will not shows on the client system and then the client will receive only the output which is calculated by the server the client code is responsible for carrying out the call method for the offloading object.

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