

A Mobile Business Application's Performance Architecture in Mobile Computing Environment

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Abstract:

An interest in cloud computing is transforming and developing information technology continuously for business and personal needs. Most e-commerce companies are migrating and converting services and applications for the rich resources provided through cloud platforms. This is a new business era that helps change the cloud. A process, state, or concept is defined as transformation. Through a dynamic process, it shows the technological transformation as the world changes and adapts to external and internal forces. Companies invest their capital in developing IT infrastructure, maintaining, and updating hardware, and software, and improving their services. The cloud-based transformation is an excellent method for establishing a fresh service-oriented, value-effective, adaptable, and adaptable tech. Switching from the IT infrastructure to services as a pay-per-use business model is done using the IT service model. The latest trends in cloud computing technology and next-generation models are rented.

Moreover, m-commerce applications are based on mobile execution performance, which is the major concern of e-commerce industries. As we know, there are three major obstacles of mobile devices natures: (1) Resource constraint device (2) Client mobility and (3) High energy consumption, and this is major m-commerce applications performance challenges. When doing complicated computer work, the device battery will run out quickly and need to be charged again and again.

We want to provide an overview of the concept, process, and research area of offloading computation for the energy efficiency of smartphones. The issues and challenges in computing offloading for mobile cloud environments are discussed.

Keywords: Smartphone, M-Commerce, Mobile Cloud Computing, Offloading

1. Introduction

1.1 Computing Service Evaluation

Data that can be accessed online from anywhere is called cloud computing. Data is stored locally so that users can access it easily. Keeping data on home or work networks doesn't mean it's in the cloud. The information needs to be accessible via the internet, and it requires meticulous organization. Sitting at home and using the internet as a consumer and for business is different because there is an option to subscribe to the application and access the internet, a software as service (SaaS) It is called platform as a service (PaaS) because the companies can customize their applications as well. In the market, Infrastructure as a service (IaaS) plays a vital role. Pay-per-use is the method by which giant companies Google, Amazon, Oracle, Microsoft provide their infrastructures (cloud data center) [1].



Figure 1: An Abstract View of Mobile Access to the World in Cloud Environment

The last couple of years have seen CC become the talk of the business world. This technology has grown into a multibillion-dollar industry in a short time, with Microsoft Azure, Amazon Web Services, Oracle, VMware, IBM Cloud, Salesforce, Alibaba, and others serving around 3.6 billion users worldwide, representing 45 percent of the global population [2].

1.2 Mobile Cloud Computing

Data storage and processing happens on the mobile device in mobile computing. A wireless connection is used to access the mobile devices' processing power and data storage. Cloud computing aids mobile users by providing an infrastructure platform and software at a lower price with adaptable uses [3].

Cloud computing, mobile computing and wireless communication are integrated into MCC, giving mobile users a huge storage capacity and high-speed processing power. The MCC offers numerous advantages that enhance business possibilities at a lower price, bringing about numerous advantages across the globe.

1.3 Mobile Commerce (M-Commerce)

It refers to business conducted on a small device like a mobile phone. It is an extra element added to e-commerce. Different [4] e-business activities are carried out through portable handheld devices like mobile phones, tablets etc. at any time through wireless and cellular network technology [5]. E-commerce employs mobile commerce and wireless communications. Mobile e-commerce helps people find different functionalities such as location and purchase transactions.



Figure 2:M-commerce applications [6]

Low bandwidth, network problems, and low speed are some of the problems that M-commerce faces. Payments and mobile transactions, mobile messaging, and mobile ticketing were performed by the m-commerce applications [6].

1.4 Mobile Cloud Computing in Business Management

Adding mobile and cloud computing to business can boost its power and effectiveness. 4G mobile services are essential for mobile-related issues, and CC in m-commerce conveys a lot of problems. The development of e-commerce is based on CC, which helps to solve the issues of scalability and provides on-demand services to the customer [7]. Activities like shopping, mobile recharging, ticket booking, billing requirement process, advertisement, and data sharing can be performed easily using MCC.



Figure 3:M-commerce applications services in mobile cloud computing [6]

The MCC is used in m-commerce for e-banking, e-advertising, and e-shopping. It utilizes expandable processing power. A high volume of traffic is adjusted to the security as users simultaneously use it. M-commerce is a business strategy that utilizes mobile devices to conduct transactions. The mobile commerce fulfilled their duties in line with the demand for mobility (mobile payment transactions, mobile messaging, and mobile ticketing).

Table1: Worldwide public cloud services forecast [8]

Public Cloud Service	2020	2021	2022
Cloud Business Process Services (BPaaS)	46,131	50,165	53,121
Cloud Application Infrastructure Services (PaaS)	46,335	59,451	71,525
Cloud Application Services (SaaS)	102,798	122,633	145,377
Cloud Management and Security Services	14,323	16,029	18,006
Cloud System Infrastructure Services (IaaS)	59,225	82,023	106,800
Desktop as a Service (DaaS)	1,220	2,046	2,667
Total Market	270,033	332,349	397,496

Table2: Worldwide public cloud service revenue forecast [9]

	2018	2019	2020	2021	2022
Cloud Business Process Services (BPaaS)	41.7	43.7	46.9	50.2	53.8
Cloud Application Infrastructure Services (PaaS)	26.4	32.2	39.7	48.3	58.0
Cloud Application Services (SaaS)	85.7	99.5	116.0	133.0	151.1
Cloud Management and Security Services	10.5	12.0	13.8	15.7	17.6
Cloud System Infrastructure Services (IaaS)	32.4	40.3	50.0	61.3	74.1
Total Market	196.7	227.8	266.4	308.5	354.6

1.5 Research Motivation

Technology has played a significant role in our lives over the past decade. Business functions are improving through Internet. It is used for different works that why people have decided to start a business in this area. As we can see in figure 1-4, It is showing the cloud computing market size by industry, 2016-2027 growth in the U.S [10].

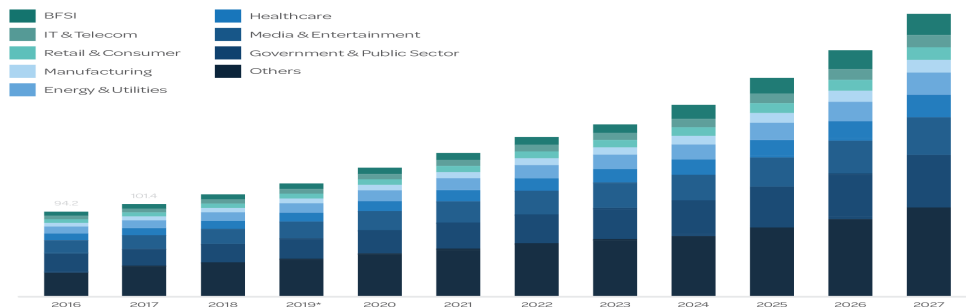


Figure 4: U.S cloud computing market size by industry, 2016-2027 [11]

Figure 1-4 clearly shows that the cloud computing companies' market proliferated in different business sectors. The goal of the companies is to improve their performance by acquiring new technologies available in the market and trying to merge them. Small businesses can benefit from mobile cloud computing because they can use different kinds of tech that weren't accessible earlier because of financial constraints. Due to this, they can compete with small and well-giant enterprises [12]. MCC provides a rich environment for the business globally through efficiency for the small and large enterprises with less investment and better performance. Some challenges are present, and this prevents the full-fledged implementation of MCC in m-commerce business model.

2. Offloading process in mobile cloud environment

Mobile devices can use cloud computing services on mobile applications. The most important part of the energy is used by mobile cloud applications like health care, education, social networks, and gaming. The main goal of offloading is to make mobile devices work better by using cloud services discuss in figure 5.

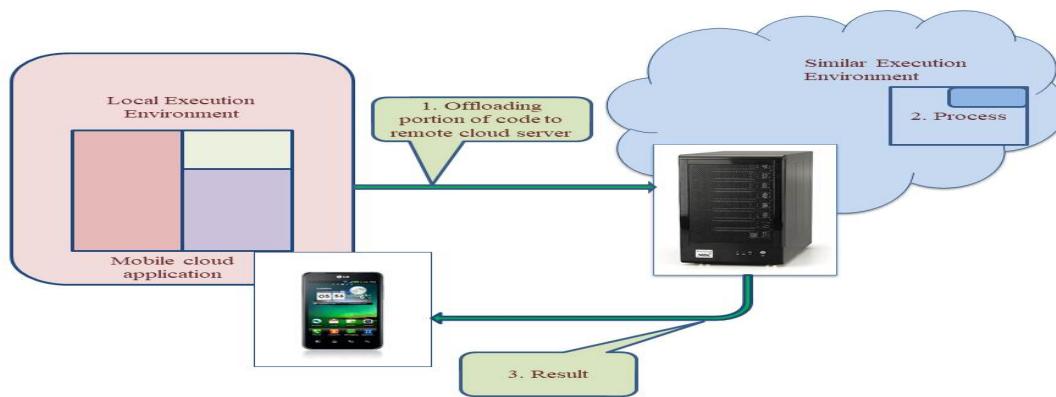


Figure 5: Offloading Process in MCC environment

Cloud off-loading process is explained as follows.

Separating the programs into distinct sections is the initial step. A particular fulfillment points of mobile applications that consumes most of the local energy is chosen for the offloading decisions. A mobile client requires a protective environment for an offloading system. As a result, every mobile gadget gets its own virtual machine created by a single server. The implementation begins after loading the feasible applications.

Finally, the part that was taken away goes back to the mobile apps and is added back into the original process. Cloud computing can save energy and battery life.

It's not new to give the server work that requires a lot of math. All the efforts to save energy reduce the normal response time of mobile applications. Cloud computing can make mobile devices last longer.

The four fundamental questions that determine the deficiency of an offloading system are: -

- 2.1 What to Offload:- Annotations or an automated method are needed to divide the program before it can be transferred. The next step involves determining which part of the code should be transferred.

2.2 When to Offload:- The decision to offload depends on many things like how much data can be sent, how big it is, and how much energy it needs to run the code and make mobile apps work better. The code should be implemented on-site when the mobile clients have enough resources to complete the task. This app on your phone can speed up the process of moving things to the cloud and avoid congestion on the internet.

2.3 Where to offload: The selected servers in which the code must be offloaded are listed.

2.4 How to offload: - There's a program for scheduling code offloading operations in it.

2.5 Offloading Mechanism

- Application partitioning- the first step is application partitioning which is essential for the competition of offloading [13]. It divides the application into off-loadable and non-offloadable components that hold the smartphone and move it to the cloud. It has two ways:
- Granularity – coarsely ground systems with some large and few components that consider as large sub-components.

Finally, grand systems consider smaller components in which larger ones are composed. This method leads to significant energy and saves time because the sub-parts profit from remote execution or offload.

- Determination of the partitions
 - Automatic partitioning- This is done through a partitioning process such as dynamic profiling.
- a) Offloading decision
 - Static decision – the programme is divided during its development manually.
 - Static decisions have low cost during implementation because the programme does not have to decide whether programme parts will be implemented
 - It is suitable when the parameters can be predicted accurately in advance.
 - b) Dynamic decision – for competition intensive tasks (energy and time), Dynamic decision is best for these factors
 - Time factor equation
 - Energy factor equation
 - c) Interoperability factors – network speed, latency decision due to switching networks (WIFI, 3G, 4G, LTE,) [14] which leads to these factors.
 - d) Mobility & fault tolerance – Mobile devices suffer frequent location changes to connect with the servers. They rely on wireless networks. Two reasons are there in a smartphone environment, network tolerance solutions need access, energy and time overhead. On the other hand, on mobile tasks, when a mobile loses its connection, there is no confirmation that it will be recovered on time; this usually happens due to mobility reasons, a time could pass until the network is recovered.
 - e) Serialization and non-serialization process – it is performed when sending the information to the server, and when receiving the answer from it, data structures into a format which can be stored.

- f) Virtualization -offloading services helps to run random task design for smartphones on one or more virtual machines, increasing utilization and flexibility, which makes offloading more feasible.

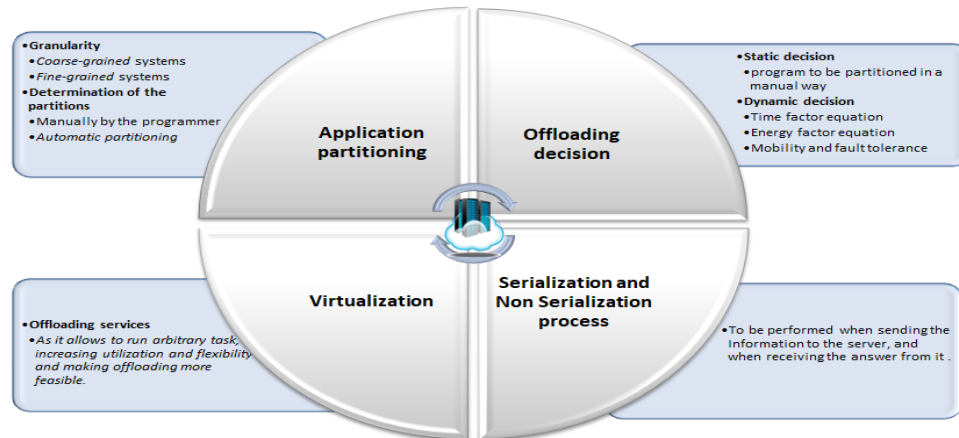


Figure 6: Mobile applications offloading mechanism

3. Computation Offloading Challenges in Mobile Cloud Environment

Figure 5 shows that different criteria are used to select mobile, network, and cloud environments. The efficiency of MCC classification may have diminished if one of the environments fails to carry on with the offloading procedure. Furthermore, each environment of the MCC pattern has different sub-technologies that are completed [15].

The new mobile network, which will be ready by 2020, can handle many new apps and provide good service. It also has an ordinary core that supports different radio access technologies [16]. The current radio access technologies will be used in 5G to transport a lot of data. Also, the new 5G technology can be used for unlimited access and can meet different needs in terms of speed, response time, data rate, and cost [17]. 5G will let people share information anywhere and anytime, which will help many different groups. Some of the areas are healthcare, business, and offloading computations in MCC [18]. Additionally, 5G will ensure contentment among users by tailoring services to suit their needs. In MCC, it's difficult to find a good connection between different wireless networks, cloud services, and the needs of mobile clients [19]. However, it is possible to find a good connection between these things. Innovation and needs change when we focus on users instead of services. The goal of MCC is to establish a connection between the quality of services, the user's experience framework, and cloud services.

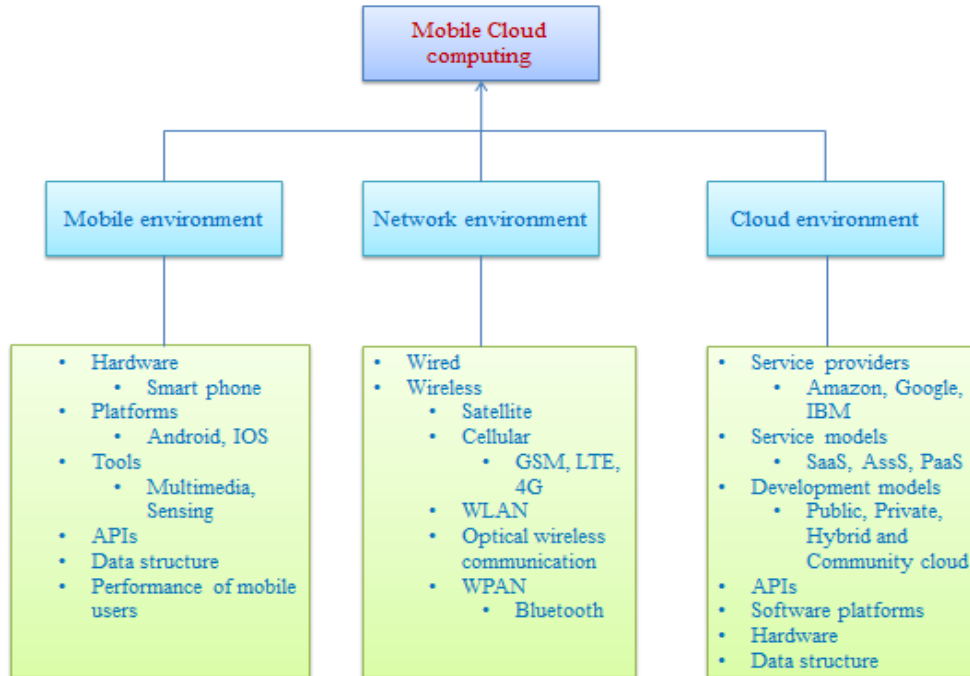


Figure 7: Mobile Cloud Environment Diversity Tree.

3.1 Performance Criteria

Many mobile users want to use real services in MCC that don't cost a lot of money. Also, people who use mobile devices want their apps to be ready on time and without any problems with the network.

3.2 Recommendation using Cloud Service

Researchers have discovered new ways to connect cloud services and resources with mobile cloud users because of the satisfaction of mobile cloud clients [20]. The suggested solutions acknowledge the main objective of the MCC environment, which confront the limitations of mobile gadgets rather than replace them.

3.3 Mobility

The figure 8 shows how a variety of cloud platforms can be employed to enhance and expand the capabilities of mobile devices. As a result, mobile tasks can be delegated to the cloud data center, cloudlet, mobile cloudlet, or mobile device platform [21]. Then, one of them sorted out the transferred info and handed it off to the final mobile apps. Application response times, energy consumption, network resource usage, and access times can be reduced by employing mobile cloudlets.



Figure 8: Cloud Access Platform in Mobile Environment

4. Conclusion and future research

We studied how to use mobile cloud offloading using Energy Efficient Methods. The idea of cloud offloading has been explained. We know that the process of offloading heavily relies on mobile environments, telecom providers, and cloud services. To see how EEM can be applied to mobile cloud offloading patterns, we've examined three typical environments of MCC. Based on our research, we suggested some ideas for future research that could save energy when using mobile cloud offloading. The EEM approach will accelerate the advancement of mobile cloud standards in terms of structure and transmission. The EEM will be used in the computation offloading process in the mobile cloud environment. We would like to know what factors affect the endurance and suitability of EEM solutions.

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