A Decision-making hybrid offloading algorithm for mobile cloud computing

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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APPROVAL

This Project titled **"A Decision-making hybrid offloading algorithm for mobile cloud computing"**, submitted by S.M. Roudro Mehedi ,ID No: 161-15-928 and Md Mahabub Hasan, ID No: 161-15-922 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of Bachelor of Science in Computer Science and Engineering and approved as to its style and contents.

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DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Fatema-Tuj-Johra, Lecturer, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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ABSTRACT

Due to the use of heavy weight applications battery life is draining faster and performance is decreasing day by day. Smartphone isn't capable to run heavy applications smoothly. Here we are proposing a Decision-making hybrid offloading algorithm to save energy for mobile devices. Decision making hybrid offloading algorithm can be an effective way to get rid of this problem. The method is effective to address the limited battery life of smart mobile devices. This algorithm takes decision based on available bandwidth and computational time. This algorithm also offloads computational tasks to the cloud as much as possible when the bandwidth of network transmission is suitable to offload. This algorithm can improve execution time and improve battery consumption of smart mobile devices.

Key words: Cloud computing. Mobile Cloud Computing. Offloading, Energy-Efficiency. Cloud computational algorithm.

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CHAPTER 1

Introduction

1.1 Introduction

Smart Mobile devices have become an inseparable part of our daily life to make our life easier and comfortable. Smart mobile devices provide us smart services anytime and anywhere. Now a day the number of Smartphone's and tablets are increasing dramatically. The number of Smartphone and tabs are much higher than other smart devices. Newly arrived Smartphone and tabs are full of hardware and software resources such as different types of sensors and AI integrations. Mobile devices are giving the largest contribution to the social network. The wireless connection allows users to get connected with each other. It also allows us to play online games and applications. Despite these advance features the most common issue we are facing that is its limited battery life. Cloud computing can be a promising solution to tackle this problem smartly and easily. Cloud computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the data centers that provide those services. The services themselves have long been referred to as Software as a Service (SaaS). Some vendors use terms such as IaaS (Infrastructure as a Service) and PaaS (Platform as a Service) to describe their products.[16]. Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.[17]. It is a technique to connect mobile devices to a cloud, with vast resources in terms of hardware as well as software, for the purpose of computations related to various mobile applications, processing, storage of data etc.[18,19]. The mobile cloud that has unlimited resources virtually run the applications for the Smartphone's to save the battery, to improve the performance and to improve the overall computation efficiency. In recent years, the researchers have greatly focused on the field of Mobile cloud computing. For the vast amount of the applications of Mobile cloud computing attracted the researchers to devote their time in it and make their contribution; due to this the field of Mobile cloud computing has been growing so rapidly. The area of Mobile

cloud computing is so vast so it has a number of applications in the field of mobile healthcare, mobile gaming, online business transactions, e-learning, multimedia services etc.[20,21]. There are also some obstacles of mobile cloud computing such as limited bandwidth, heterogeneity of the networks, service unavailability due to network congestion or may be due to link failure etc.[23]. f any kind of network failure happens during execution then the entire process will stop working. So, to getting rid of this problem we are proposing a decision making an offloading algorithm that is a concept of cloud computing to minimize the execution time of tasks and save battery life of a Smartphone. In this algorithm, some of the computational tasks will be offload to a remote cloud server. The task which needs to offload it must transmit through a wireless network. In this case, the algorithm will take a decision where it will compute its tasks based on available bandwidth and execution time. If the available bandwidth is less than the bandwidth it's needed, then the application loads the computational process over Smartphone but if the application gets a higher bandwidth than required bandwidth then it will offload the task to a remote cloud server. Decision-making hybrid offloading algorithm for mobile cloud computing can be a promising solution to tackle this problem smartly and easily.

1.2 Cloud Computing

Mobile cloud Computing is a process, Where Device connect with the cloud server. User can use their device from the cloud by using network. Which network is connecting with the cloud, we know that, cloud consist database server. Then user can easily use their data from this database with more smoothness.

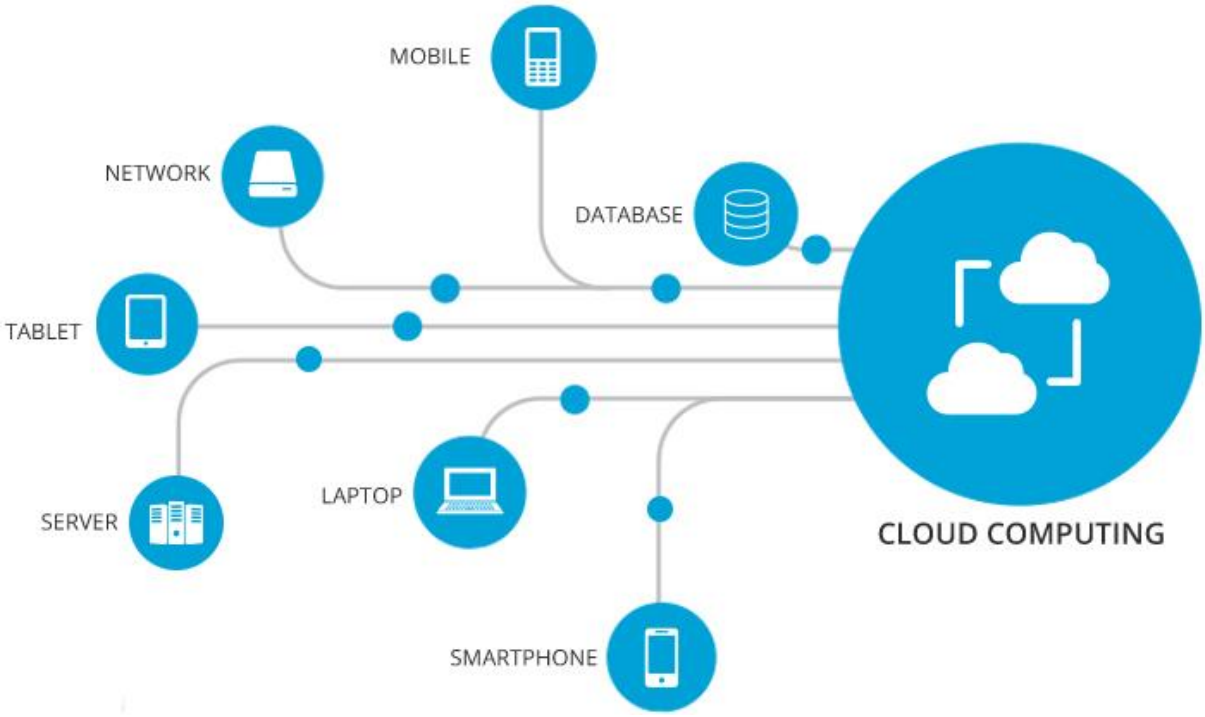

Figure 1.1: Cloud Computing

1.3 Motivation

Because of the utilization of overwhelming weight applications battery life is depleting quicker and execution is diminishing step by step. Cell phone isn't competent to run overwhelming applications easily. To address this problem we have selected this area as a research. We have developed a algorithm to spare vitality for cell phones. Decision making hybrid algorithm can be a viable method to dispose of this issue. The technique is viable to address the restricted battery life of savvy cell phones. This method takes choice dependent on accessible transmission capacity and computational time. This calculation likewise offloads computational assignments to the cloud however much as could reasonably be expected when the data transfer capacity of system transmission is appropriate to offload. This calculation can improve execution time and improve battery utilization of keen cell phones.

1.4 Objectives

Every research work done by based on finding the problem and solve it more efficient away. In our research we also try to find some limitation and try to solve it.

- Offloading computation.
- Security.
- Mobile Gamming.
- Increasing battery life.
- Improving Reliability.

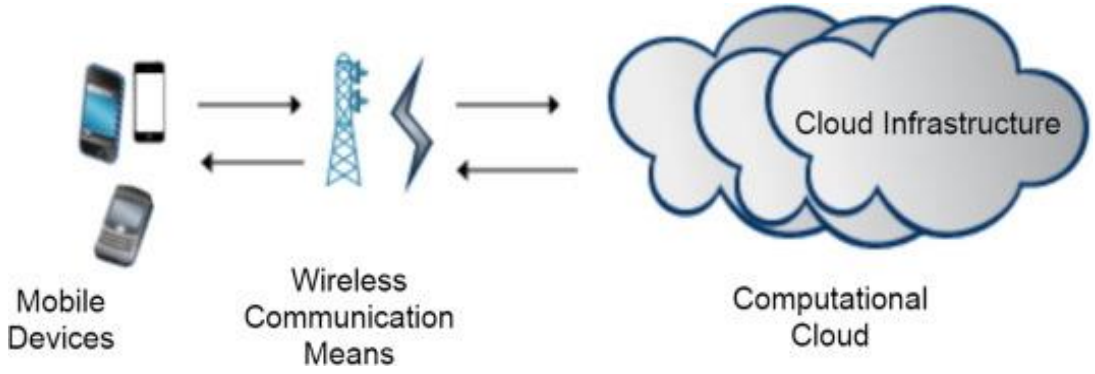

Figure 1.2: working process.

CHAPTER 2
Background

2.1 Literature Review

A system where mobile devices were connected to the mobile networks via base stations (e.g., base transceiver station (BTS), access point, or satellite) that established and controlled the connections (air links) and functional interfaces between the networks and mobile devices. Mobile users' requests and information (e.g., ID and location) were transmitted to the central processors that were connected to servers providing mobile network services.[1]. Another research group examined the efficiency of data security of scheduling in cloud computing. Where they proposed an authenticated key exchange scheme, namely Session Key Negotiation for Fast and Secure Scheduling of Scientific Applications in Cloud Computing, for encryption. Another group developed a system where, by using mobile cloud computing, the processing and the storage of intensive mobile device jobs will take place in the cloud system and the results will be returned to the mobile device. This will reduce the required power and time for completing such intensive jobs.[3,4].According to Wang, the middleware is responsible for consuming the Cloud Services whether they are SOAP or RESTful WS and delivers the service result to the mobile client. On the mobile client, users can define WS or mashup services and later execute the pre-defined WS on the fly. The middleware provides RESTful WS interface for mobile clients.[5]. Single or multi-layered Multistage Interconnection Networks (MINs) has been proposed by Fernando where Backpressure operation of MINs providing service differentiation and QoS guarantee.[5]. Asrani they proposed three layers of Mobile Cloud Computing.[7]. They proposed that Security and privacy are the key issues for mobile cloud computing applications, and still face some enormous challenges. [8][9][10]. Three-tier architecture ENDA that leverages user track prediction, Real-time network performance and server loads to optimize offloading decisions. In this paper, they proposed an Energy-Efficient Computational Offloading Framework (EECOF) for computational offloading in mobile cloud

computing. The framework focused on leveraging application processing services of cloud data centers with minimal instances of application migration at runtime. [13][14].

2.2 Summery of Research

Decision making hybrid offloading algorithm is to save battery power of smart devices. Hybrid offloading computation can be a feasible strategy to discard this issue. The system is feasible to address the confined battery life of shrewd mobile phones. This figuring takes decision reliant on open transmission limit and computational time. This count similarly offloads computational assignments to the cloud anyway much as could sensibly be normal when the information move limit of framework transmission is suitable to offload. This can improve execution time and improve battery usage of smartphones.

2.3 Challenges

There are several challenges to do this work. Most common challenge is to ensure processes syncing. Because when the algorithm will transform its processes to clout to local or local to cloud then managing data syncing is a challenge to perform tasks efficiently. Another challenge is to ensure internet connection all the time, because there will be only one database to store data and it have to accessable from both local and cloud computation.

2.4 Background Graphical view

Cloud computing is a complex process but very useful and efficient process. Where web server works like a middle friend of cloud and devise. This is the basic background process of cloud computing.

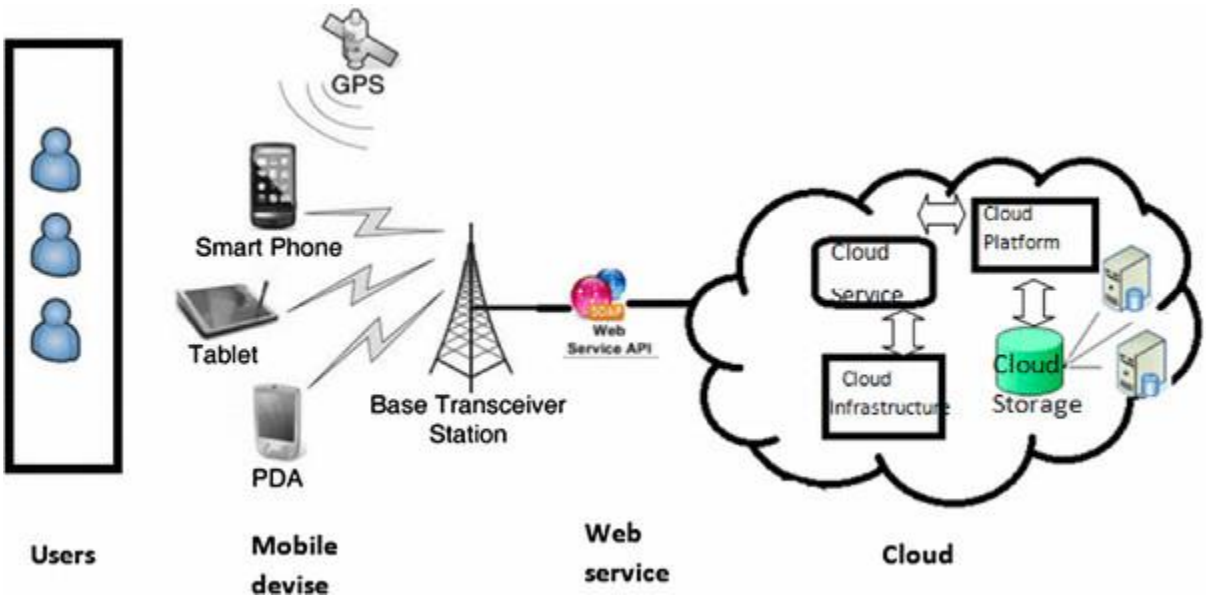

Figure 2.1: Background graphical view.

CHAPTER 3

Research Methodology

3.1 Methodology

Average Bandwidth Prediction: In this stage, the system will predict how much available bandwidth requires to run the application on the cloud. The system will set average bandwidth speed in terms of best execution time. Example: 2.5 Mbps bandwidth need for best execution. Denoted by “Bavg”.

Get current bandwidth status:

In this portion of the work system will try to communicate with the related server. The system will recognize how much bandwidth is available currently. Denoted by "Bp resent

3.2 Flow-chart

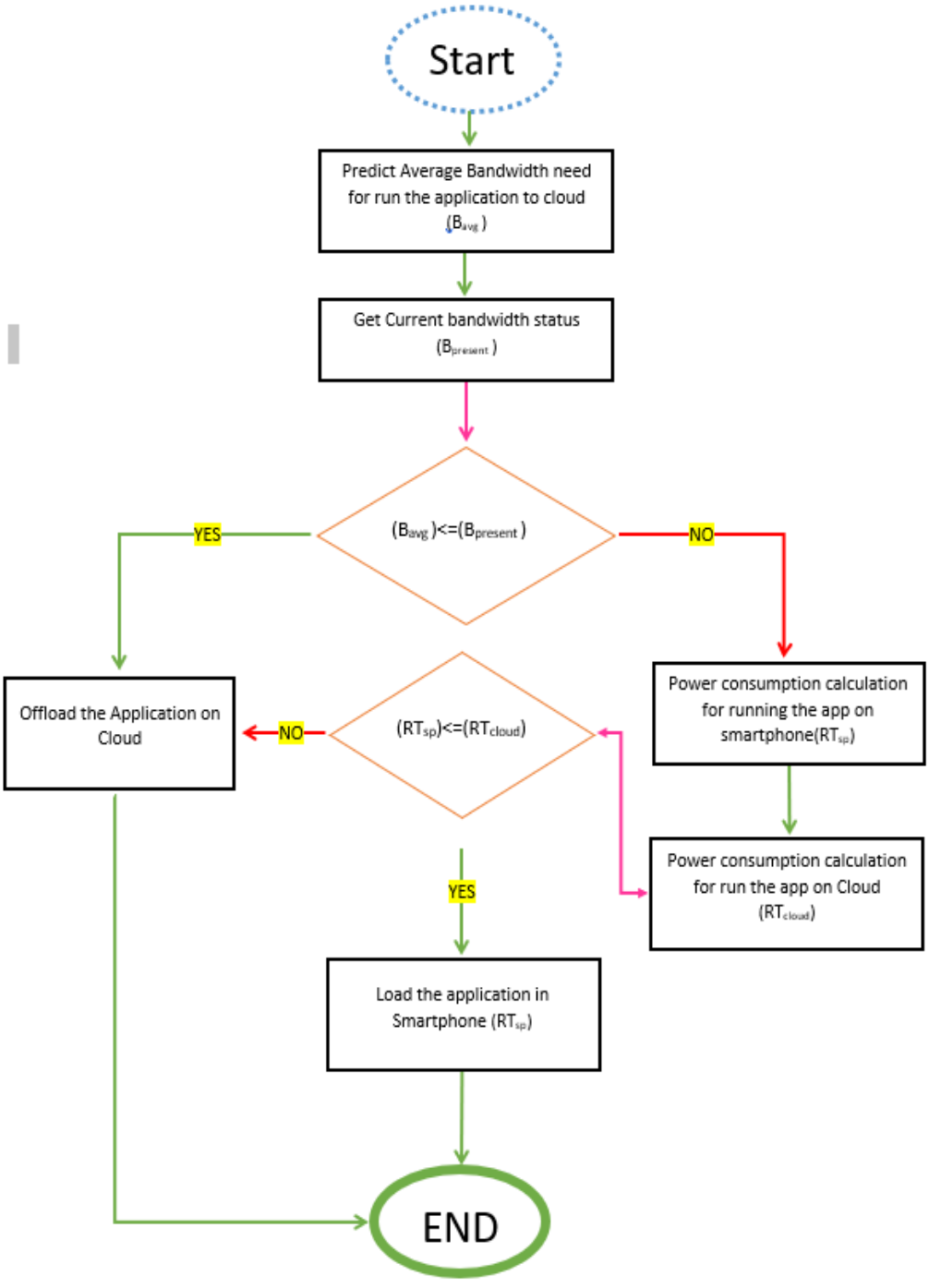

Figure 3.1: Flow-Chart.

3.3 Decision Making

It is the most important part of determining Suitableness.

It's consisting of 2 parts:

- Identifying Suitable platform Based on Bandwidth.
- Identifying Suitable platform Based on power consumption.

Identifying Suitable platform Based on Bandwidth:

In this step, the system will identify which medium is suitable for executing the application. It will check is it suitable to execute the application on the cloud or not.

If,

$$(Bavg) <= (Bpresent)$$

Then the system will decide to execute the application on the cloud.

Else If,

$$(Bavg) >= (Bpresent)$$

Then the system will go for calculating power consumption (Based on execution time) to execute the application on the smartphone. Denoted by (RTsp) and then the system will calculate power consumption to execute the application on cloud. Denoted by (RTcloud).

Identifying Suitable medium Based on power consumption:

In this step, the system will identify which medium is suitable for executing the application for the sake of low power consumption. It will check is it suitable to execute the application on the cloud or not.

If,

$(RTsp) <= (RTcloud)$

Then the system will start execution of the application on the smartphone itself.

Else if (RTsp)>=(RTcloud)

Then the system will take the decision to execute the application in the cloud.

3.4 Working Procedure of Cloud Computing

This is the basic working process of cloud computing. But we added that, its depends on bandwidth. If devise gate required bandwidth, applications run into the cloud. Else, it's run in the device system.

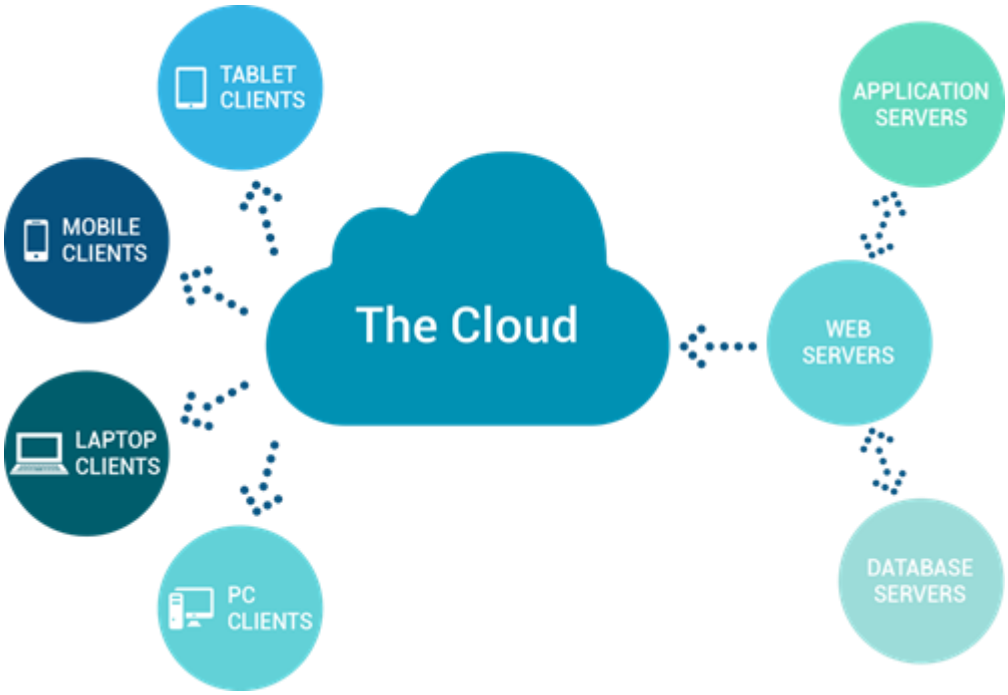

Figure 3.2: Working process.

3.5 Algorithm

Step 1. Predict Average Bandwidth (Bavg)

Step 2. Getcurrent bandwidth status (Bpresent)

Step 3. **IF** Average Bandwidth <=current Bandwidth

Step 4. **then**

Step 5. go to step 13

Step 6. **Else**

Step 7. predict Execution time on local device (RTSP)

Step 8. Predict Execution time on the cloud (RTcloud)

Step 9. **IF** Execution time on local device <= Execution time on cloud Then

Step 10. go to Step 13

Step 11. **Else**

Step 12. Load application on the smartphone

Step 13. Offload to cloud

3.6 Operating process:

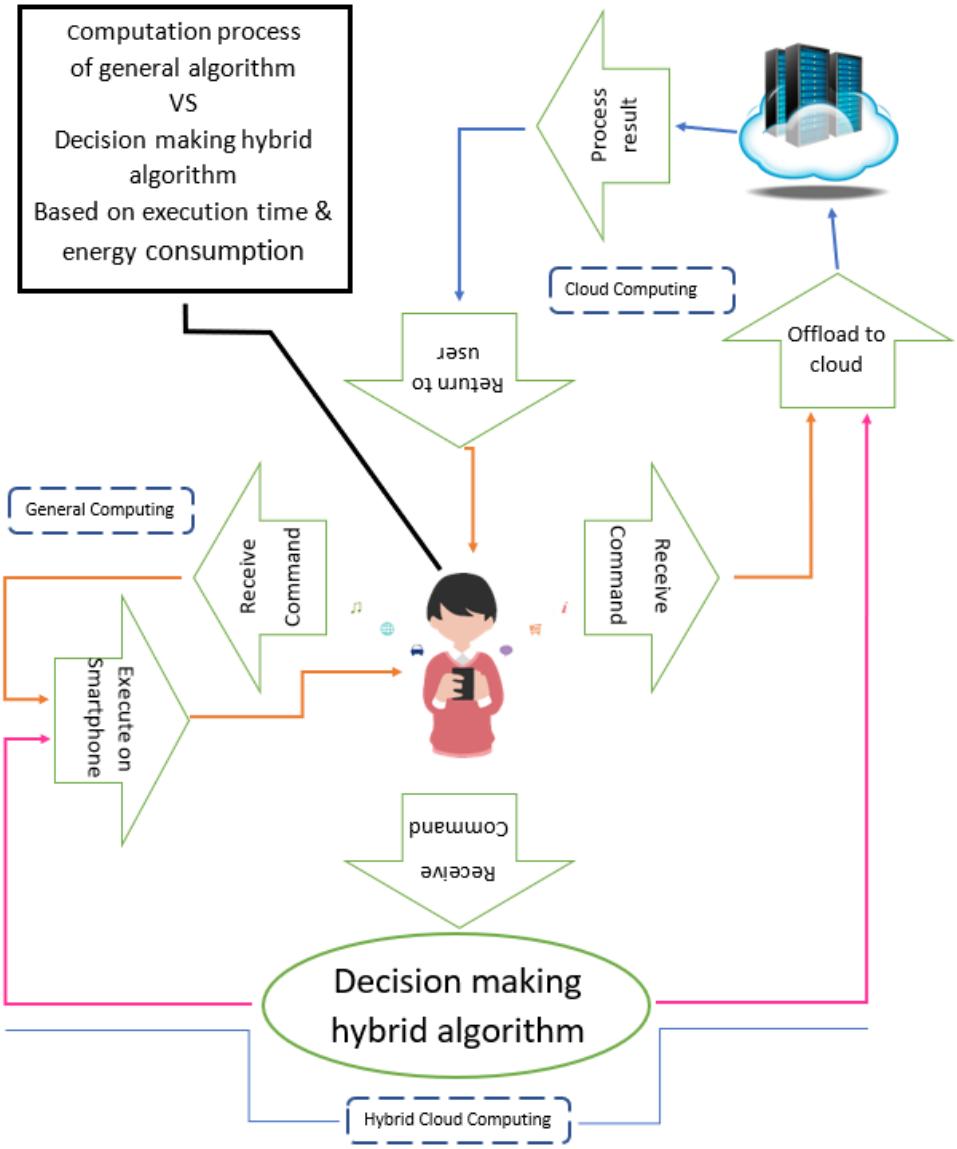

Figure 3.3: Operation process diagram.

3.7 Used Model

Cloud models come in three types:

- SaaS (Software as a Service)
- IaaS (Infrastructure as a Service)
- PaaS (Platform as a Service).

Each of the **cloud models** has their own set of benefits that could serve the needs of various businesses

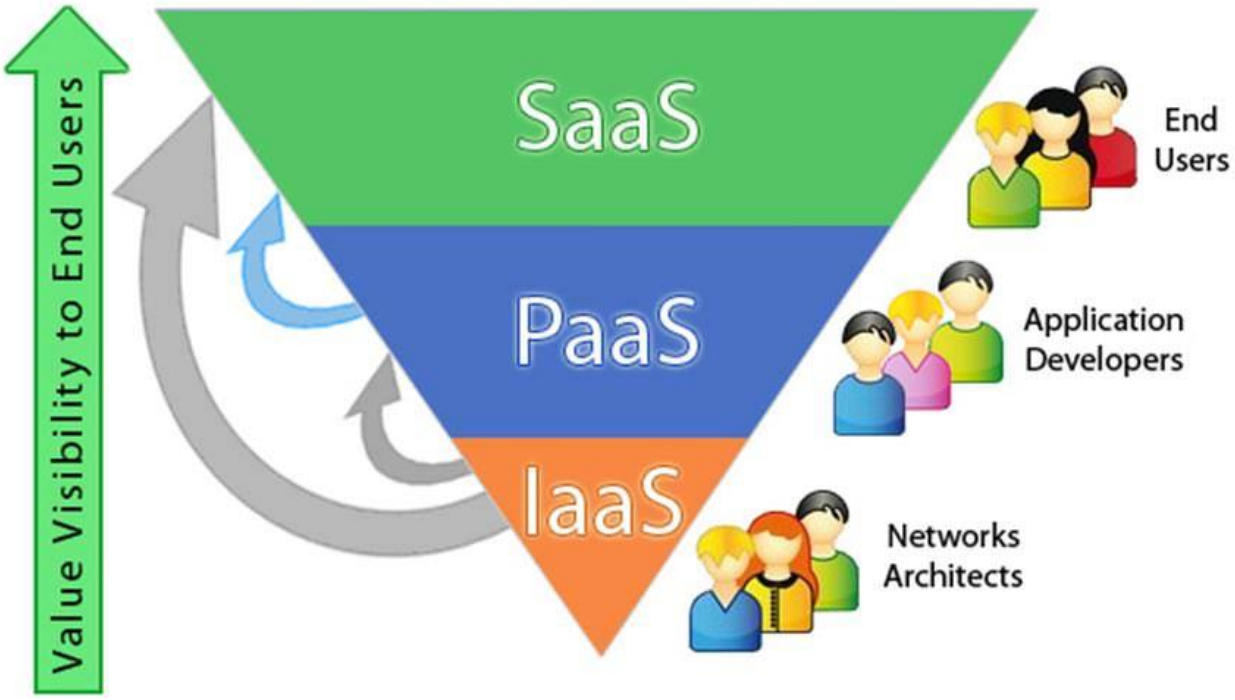

Figure 3.4: User model.

CHAPTER 4

Experimental Result and Discussion

4.1 Simulation & Result:

Execution time (millisecond)			
Transmission Rate	Hybrid Algorithm	Local Execution	Offloading all
10	100	550	120
8	200	550	230
6	270	550	300
4	310	550	340
2	360	550	400
1	500	550	600

Table 4.1: Execution time of (1) Hybrid Algorithm, (2) Local executing and (3) Offloading all.

In this section, we have provided simulation results. In Table.1 we have provided the outcome of execution time between i) Hybrid Algorithm, (ii) Local execution and (iii) offloading all. In local execution, there is no effect of the network transmission rate. Local execution remains constant whatever the transmission speed is. (i) Hybrid Algorithm and (iii) offloading all Affected for network transmission. When the transmission speed is higher than offloading all

algorithm executes tasks at a very short time but when the transmission speed is low then it consumes much time to execute tasks. In Hybrid algorithm when the transmission speed is high then it is consuming the lowest amount of time.

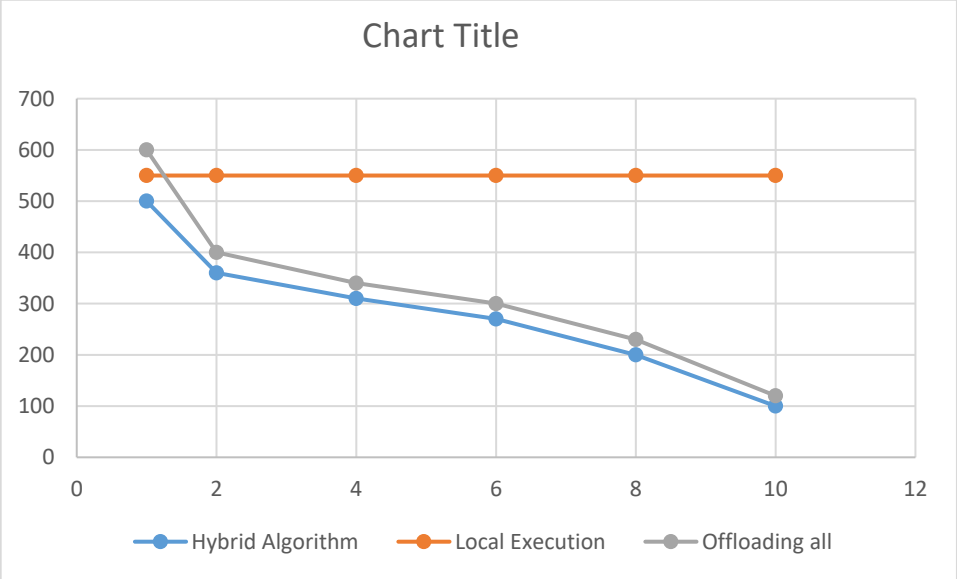

Figure 4.1: Comparison of the total execution time of (1) Hybrid Algorithm, (2) Local executing and (3) Offloading all.

and when the transmission speed is low then it is also consuming lowest time between (ii) Local execution and (iii) offloading all

In Table.2 we have provided the result of the execution time of i) Hybrid Algorithm, (ii) Local execution and (iii) offloading all based-on number of tasks. Local execution is free from the effect of the network transmission rate. Local execution remains constant whatever the transmission speed is. (i) Hybrid Algorithm and (iii) offloading all tasks.

No of Tasks	Hybrid Algorithm	Offloading all	Local execution
10	100	120	180
15	140	160	280
20	220	300	395
25	310	400	540
30	500	595	740
35	700	800	960

Table 4.2: Execution time of hybrid algorithm for different number of affected for network transmission.

The hybrid algorithm gives better performance in terms of execution time than offload all and local execution. When a number of tasks continue to grow then local execution and offload all give less performance than Hybrid offload algorithm if the available bandwidth is sufficient.

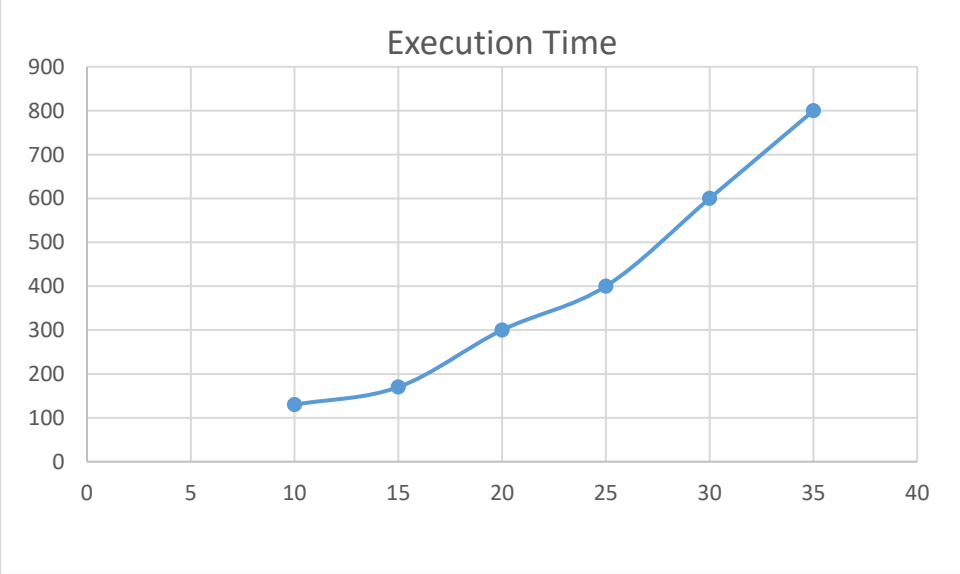

Figure 4.2: Execution time of hybrid algorithm for different number of components.

4.2 Output Result

When, require Bandwidth is given:

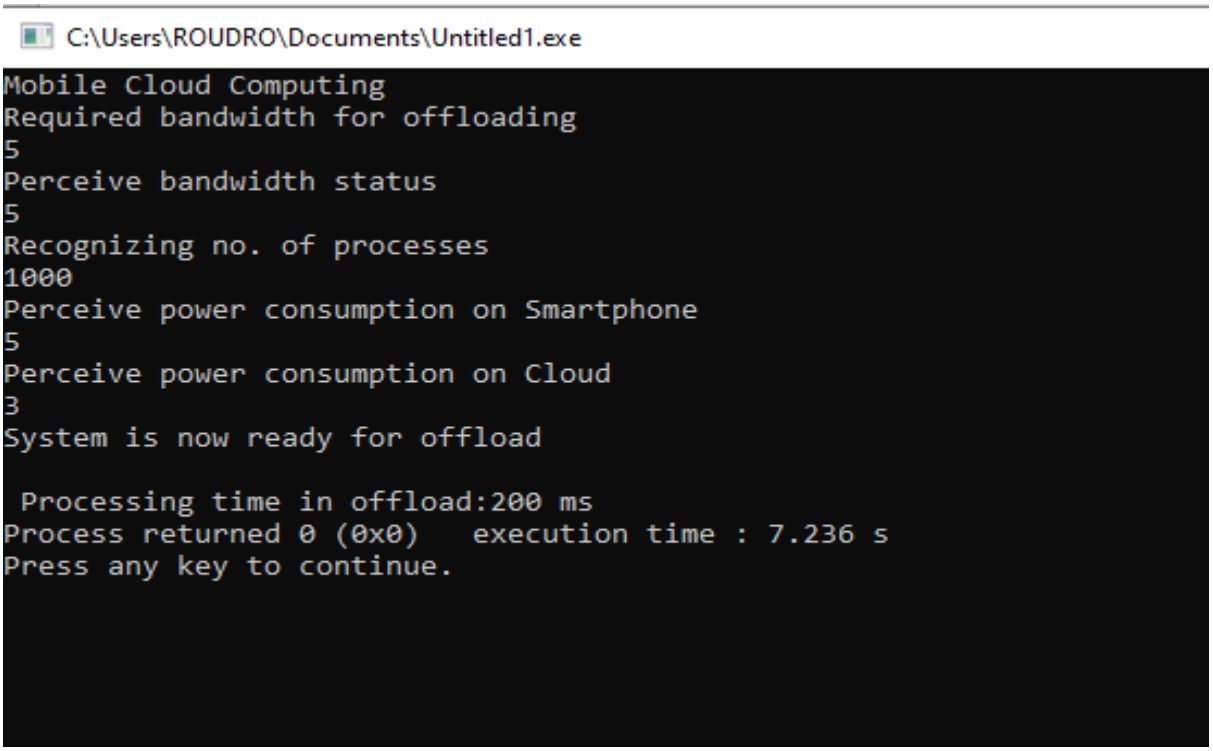

Figure 4.3: System ready for offload.

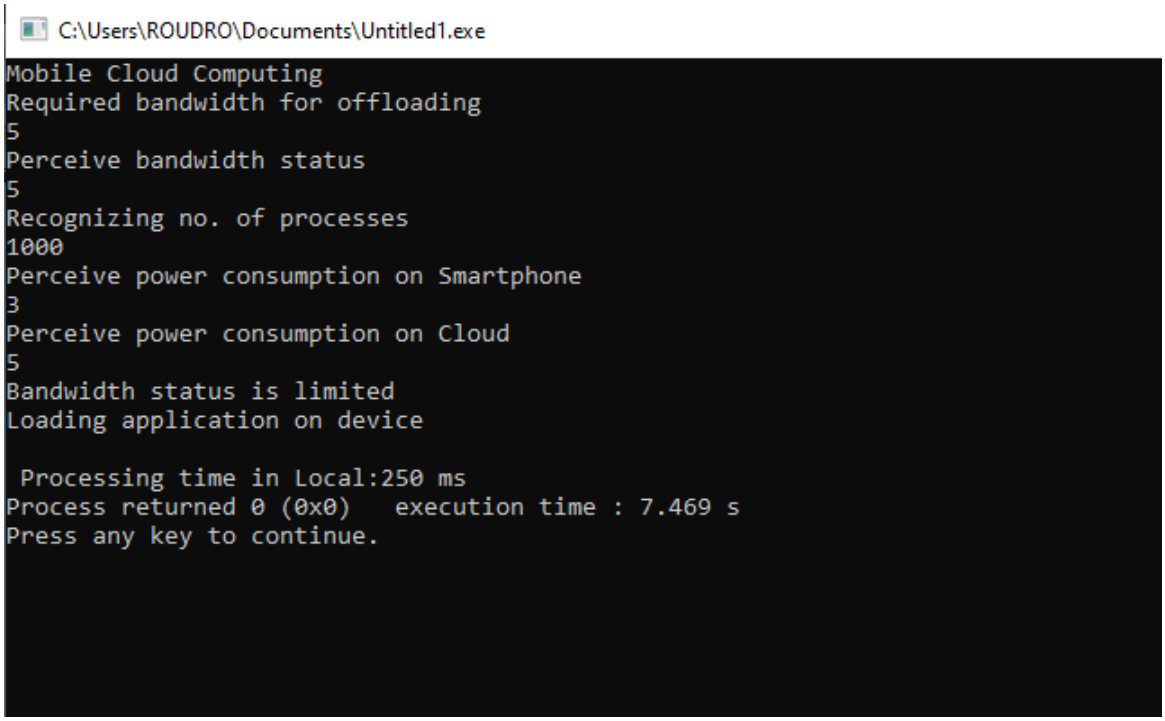

Figure 4.4: Bandwidth Status is limited.

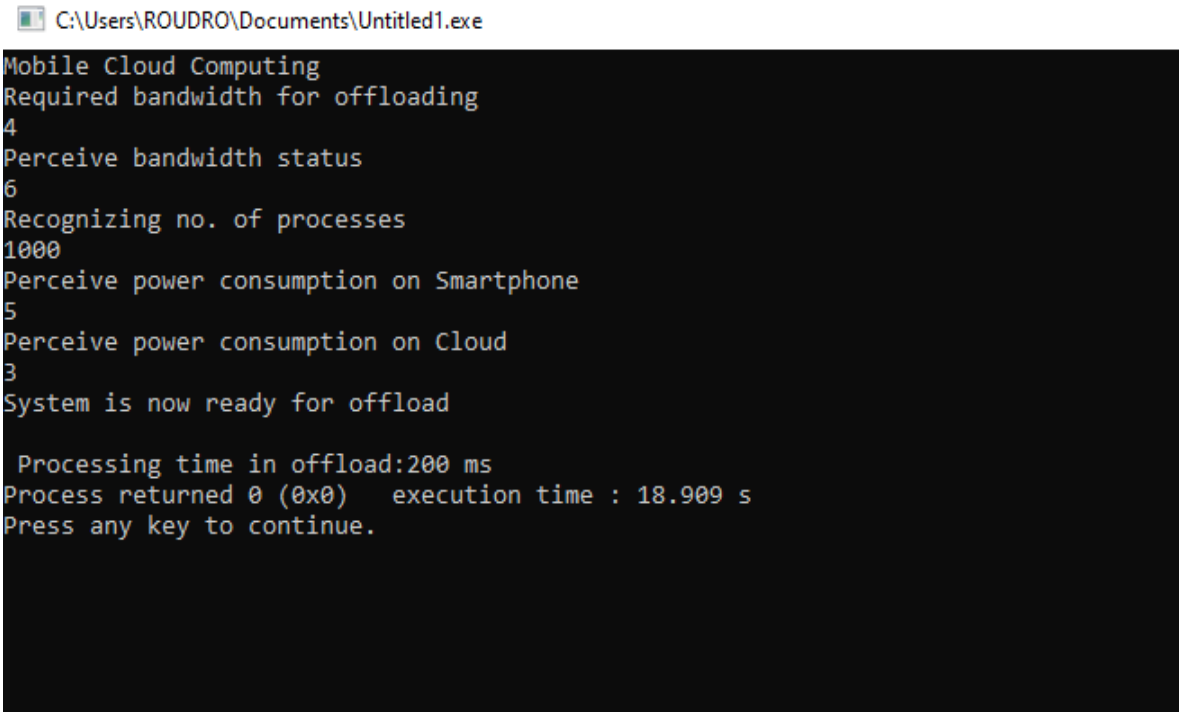

Figure 4.5: Ready to offload.

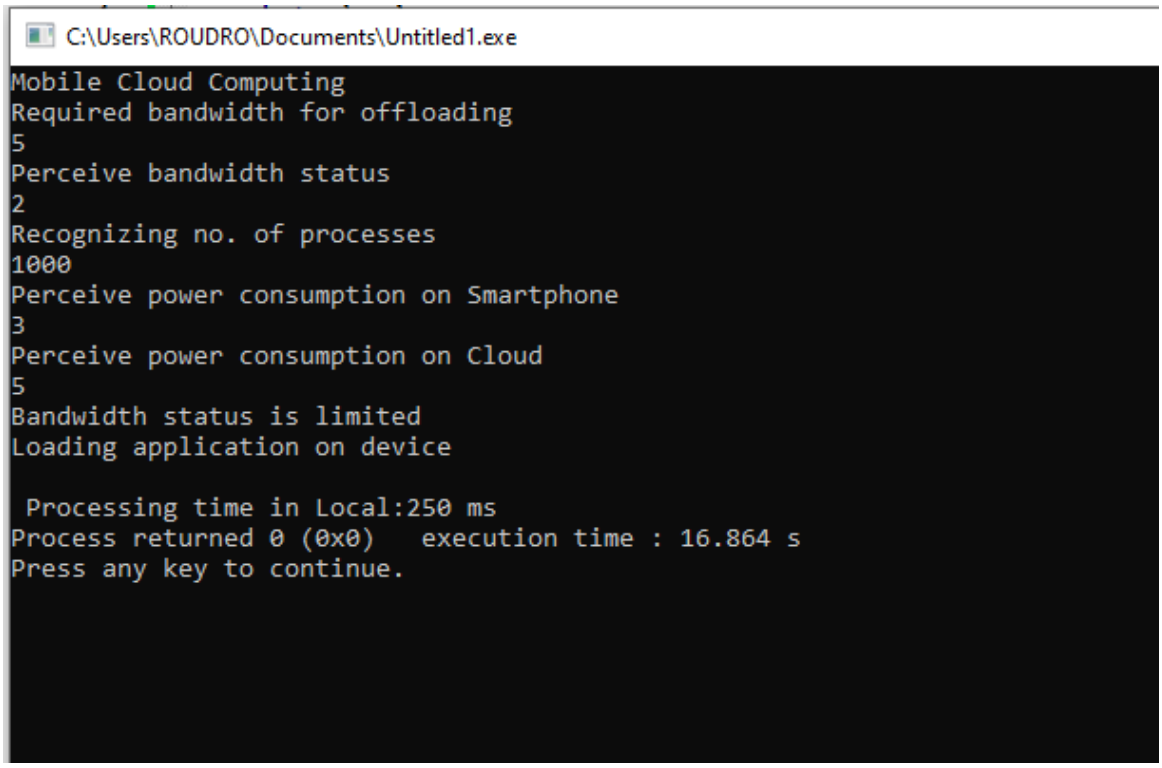

Figure 4.6: Bandwidth Status is limited.

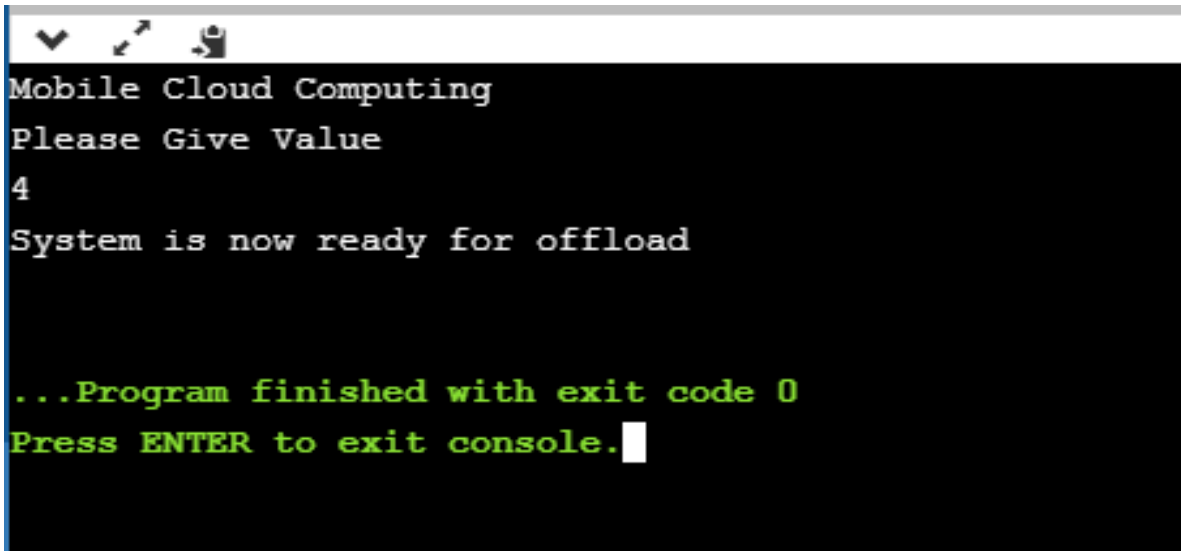

Figure 4.7: System ready for offload.

When, require Bandwidth is not given:

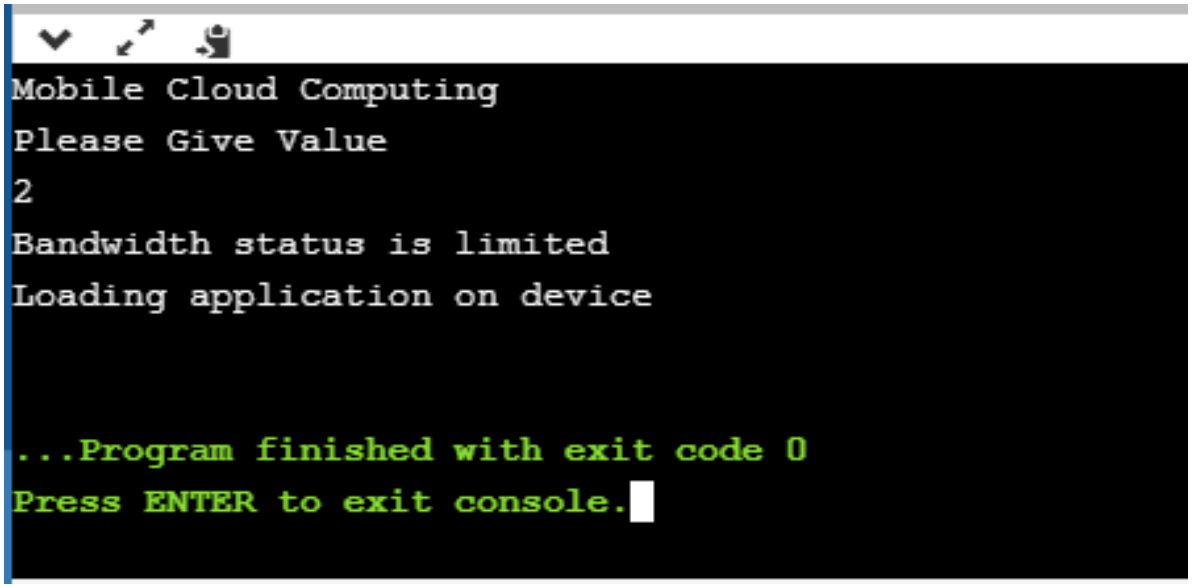

Figure 4.8: Loading application on device.

CHAPTER 5

Summery, Conclusion and Implication for final Research

5.1 Conclusions

It is clear that although the use of cloud computing repidly increased day by day. Cloud computing security is still considered is the mejor issues of cloud computing environment.

Customers do not wants to loss there private information, as a result malicious insiders in cloud computing. In addition, the loss of servise availability has coused many problems for a learge muner of customer recently.

5.2 Limitations

Limitation is the part of a resarch project. Our project has also some lomitation.

- Internet required with good bandwidth.
- Security.
- Cost efficiency.
- Not all application run in cloud.

5.3 Implication of Future Research

Cloud computing have positive impact on the business organizations as it increases their revenue and helps them to achive the business goals. Companies prefer to use the services offerd by the cloud rather than building their own infrastructure.

I think our research helps to go to the next steps of cloud research. It can helps to develop a new feature in the devis

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