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A Survey on Mobile Devices and types of Ofloading Algorithms

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Abstract — Mobile phones are essential part of our society. They are becoming smarter day by day. They are used for several purposes like watching videos online, gaming, documentation, of course for communication and many more. More usage leads to more computation; it results in more usage of power and finally results in lower battery backup. A Cloud computing for mobile devices rose like a saviour. This paper includes a survey on various Mobile Cloud Computing Methods used for offloading.

Keywords – mobile devices; computation; offloading; communication; performance; power; survey.

I. INTRODUCTION

Computation Technologies are having advancements in mobile devices and because of that more and more computational power is given to them. But then also they run on battery power which is after all a limited source of supply. A big range of mobile phone applications, including gaming, sensors, GPS, video calls, etc. run on limited battery supply [1]. Applications are being more complex and require more data computation. That resolves increment in battery backup by having very little effect.

What we require is a cloud computing or offloading. By using one we can offload data to a cloud and get the results computed by computational units on cloud. But it is not at all "free of cost" in terms of battery power. We need to upload, wait and download data using communication and it costs. There are several offloading methods used to offload data and are beneficial depending on various parameters.

II. ANALYSIS OF REVOLUTION

Several parameters have impact on mobile computing and communication, according to them any one technique may be cheaper to execute. Offloading may save energy and improve performance on mobile systems. However, this usually depends on many parameters such as the network bandwidths and the amounts of data exchanged through the networks [1]. On the other hand computation may also get cheaper if it is having limited length and we are having a powerful device. There are some factors which affect a decision of usage of Mobile cloud computing.

2.1. World Wide Smartphone Users

Smart mobile phone users are increasing day-by-day worldwide. The statistic derives the total number of Smartphone users worldwide from 2014 to 2019, for 2016, the number of Smart mobile phone users is forecast to reach 2.08 billion as shown in figure 1 [4].

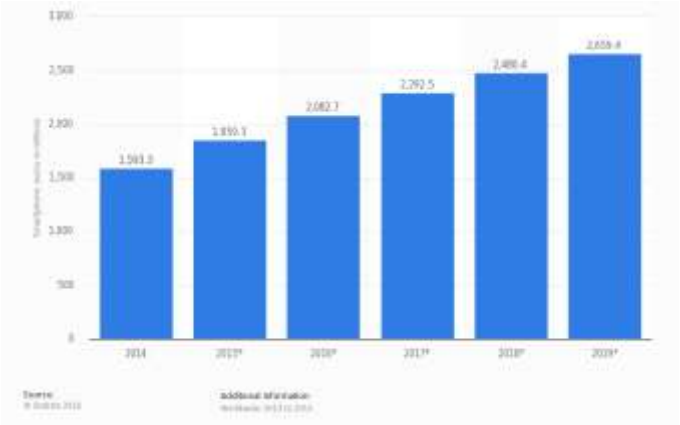

Figure 1. Number of Smartphone users worldwide from 2014 to 2019 (in millions)

There is almost 70% of raise shown in forecasting. It means many more number of communication devices will be in requirement by 2019 to fulfill our requirement of communication for offloading efficiently.

2.2. Global Mobile Data Traffic

As the number of Smart mobile phone users will be increased, the Mobile Data used by them will also be increased. Overall mobile data traffic is expected to grow to 30.6 Exabytes per month by year 2020, an eightfold increase over year 2015. Mobile data traffic will grow at a CAGR of 53 percent from year 2015 to year 2020 as shown in figure 2 [3].

Figure 2. Cisco Forecasts 30.6 Exabytes per Month of Mobile Data Traffic by 2020

That is almost ten-times of growth as compare to year 2015. To fulfill our requirement of offloading, speed of communication must be increased otherwise it will be costlier.

2.3. Average maximum Battery Power

As the usage and applications of Smartphone users will be increased, more battery power will also be required. An average predicted Maximum power capacity of a mobile device by year 2020 is shown in figure 3.

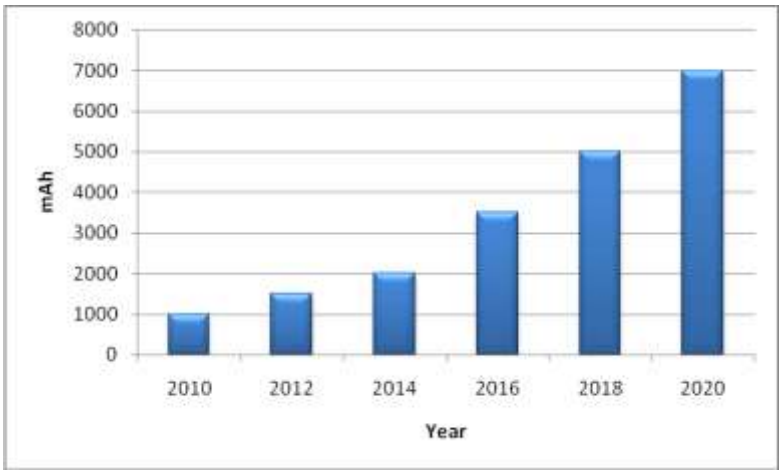

Figure 3. Forecasting of average Max. Battery Power of Mobile device by 2020

As the battery power increases, more complex and lengthy computation can also be done by mobile devices locally which restricts the requirement of offloading and so communication.

2.4. Average maximum Processor Power

As the usage and applications of Smartphone users will be increased, more processing power will also be required. An average predicted Maximum processing power of a mobile device by year 2020 is shown in figure 4.

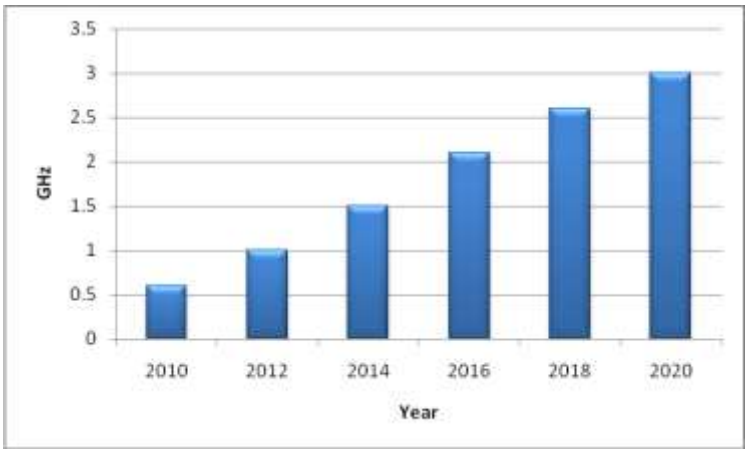

Figure 4. Forecasting of average Max. Processing Power of Mobile device by 2020

As the processing power increases, more complex and lengthy computation can also be done by mobile devices locally which restricts the requirement of offloading and so communication.

2.5. Global Mobile Devices and Connections

Mobile devices and connections are not only getting smarter in their computing capabilities but are also evolving from lower-generation network connectivity (2G) to higher-generation network connectivity (3G, 3.5G, and 4G or LTE) as shown in Figure 5 [3].

Figure 5. Global Mobile Devices and Connections by 2G, 3G, and 4G

Globally, the relative share of 3G- and 3.5G-capable devices and connections will take over 2G-capable devices and connections by 2017. The other change will occur in year 2020, when 4G will take over all other types of connection share [3].

III. ANALYSIS OF TYPES OF OFFLOADING ALGORITHMS

Several Offloading algorithms are available to offload data to cloud and get it computed over cloud resources. They offload data and sometimes instructions also to compute data over cloud systems. And after computation is done by cloud system, the result is getting by mobile device back. Only need of a mobile device is a connectivity to cloud Server and high data transfer rate. We can use any offloading algorithm according to our needs.

3.1 Single-site Computation [1]

First and basic approach of offloading is to send data to a server which computes data for you and you can get results directly without computing anything. One thing required is an active data connection, which means communication. It is

feasible when a site is in near field and data connection is having significant speed. This method may be static or dynamic.

3.2. Multisite Computation [2]

Another option is to compute data on more than one site for data computation. We need to provide appropriate data to appropriate sites and can get results back. We can merge data afterwards. It is obviously better than local communication and single site offloading in some cases because we distribute the work among various sites and we can get a benefit of parallel computing.
More to that we are having dedicated servers for dedicated type of processing like image processing or data computation etc. Because of that also we can get faster result then single site offloading. It can be feasible when cost regarding merging of data sent by different server is minimal. It is a dynamic method.

3.3. HELVM [4]

It is a Heavy Edge and Light Vertices algorithm. It calculates the nodes and their connecting edges for selection of offloading node. Heavy Edge shows a strong and speedy communication while light node shows traffic to that particular node. It is a dynamic algorithm, it means an algorithm checks for available nodes and connections each time you offload data. It consumes battery power at the time of searching particular type of nodes and connections it requires to execute.

3.4. Labeling Technique [5]

This algorithm provides a technique called labeling nodes. Node here is abbreviated as server computation device. Here providing label to node tells the computation requirement of that node in terms of power which is related to computational capacity of that node. Providing label to edges shows the communication cost for reaching to the other end of the edge means to the cloud computation unit. This algorithm selects nodes having lowered computational as well as communication cost for offloading. This is a dynamic multi site offloading algorithm.

IV. CONCLUSION

It is clear that now day's mobile devices are having more and more computational power and a large amount of battery backup for complex and lengthier type of computation of data. On the other hand Offloading techniques are also getting better by having techniques like multisite and selection of nodes. It is advisable that one must compare total power consumption in both offloading and on-device computation and make decision about what to do. By reviewing and forecasting mobile revolution, we can say that if the calculations are not so lengthy and complex, computation on device only can be chosen because of assured cheaper option. Otherwise offloading option can be chosen in which only communication power is the total cost.

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