AN APPLICATION IDEA BASED ON MOBILE CLOUD COMPUTING

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Abstract : With the advancement of technology, high end applications have come into existence which requires high end hardware to perform their best. In the era of smart mobile devices, many users have experienced performance issues regarding these mobile devices which could not compete with the latest applications. These mobile devices require an upgrade of processor, memory, and a better performance Operation System (OS) to be able to handle resource intensive applications. In short, they need to scale up their mobile devices. Does this mean that we need a smarter phone every time an application out smarts your phone? It is absurd to buy a new phone each time in order to accommodate advancement in application. Revolution should not lead to replacement. What if we could upgrade the specifications on an existing phone ruling out the necessity for replacement? With the proliferation of mobile computing and cloud computing technologies, mobile cloud computing (MCC) has emerged as a new computing paradigm which could facilitate the above-discussed criteria. Upon this emerging concept of mobile cloud computing, we propose an application model to expand the functionality of mobile devices by outsourcing the computing task on to the cloud.

***IndexTerms* – Mobile Cloud Computing, Android Virtual Machine, resource intensive applications, Mobile Devices.**

I. INTRODUCTION

Lately, innovative electronic gadgets by multinational technology companies like Apple, Google, Blackberry, Microsoft, etc. are manufacturing smart phones, tablets, notebooks, home assistants, and versatile Internet based gadgets. These gadgets have occupied a prime part in everyone’s day to day life. These gadgets bolster energizing new applications that give an associated Internet experience to users. Users can check their notifications from social media applications (Facebook, Instagram, Twitter, etc.), call logs, messages; manage their payments and recheck their transactions (Paytm, PhonePe, Tez, etc.), navigate using GPS (Google Maps), capture – edit – upload photos and videos, and play games. Users additionally have developing interest for running resource intensive applications, the sorts of applications they keep running on desktops, laptops or work areas. Examples of resource-intensive applications incorporate recreation and representation in scientific computing, animation, image recognition, 3D modeling, augmented reality, graphic intensive games, etc.

A series of innovations and advances in the hardware and software resources of the smart phones has enabled the users to perform tasks that were once just conceivable on PCs or laptops. However, smart phones are not equipped with running all sorts of applications all alone with no imperative. With the development of Mobile Cloud Computing (MCC) it becomes possible to tackle these resource intensive applications. The mobile cloud computing is a development of mobile computing and an extension to cloud computing [1], to convey improved quality computational resources to network operators, smart phone users, and cloud providers. MCC implies to a framework where both the storage of data and its processing occur outside of the mobile device i.e. in cloud. In this architecture, cloud performs heavy lifting of computing-intensive tasks and store large amounts of data [2]. Mobile Cloud computing has turned into a huge research theme of the scientific and modern groups.

As an improvement of cloud computing, mobile cloud computing aims to increase the processing power over the Internet, increasing storage, lessening cost, automating systems and providing flexibility and mobility. As the computing and resource intensive processing of data has been offloaded to the cloud, the requirement of high end hardware and advanced software for mobile devices is limited, some low cost smart phones can also achieve the concept of mobile cloud computing using a mid-ware platform. Aepona describes mobile cloud computing as a new exemplar for mobile applications where processing of data and its storage are migrated from mobile device to well-built and centralized computing platforms residing in clouds over the internet Gaining access to these centralized applications is achieved by a wireless connection using a thin native client or web browser on the mobile devices [3].

1.1 ARCHITECTURE OF MOBILE CLOUD COMPUTING

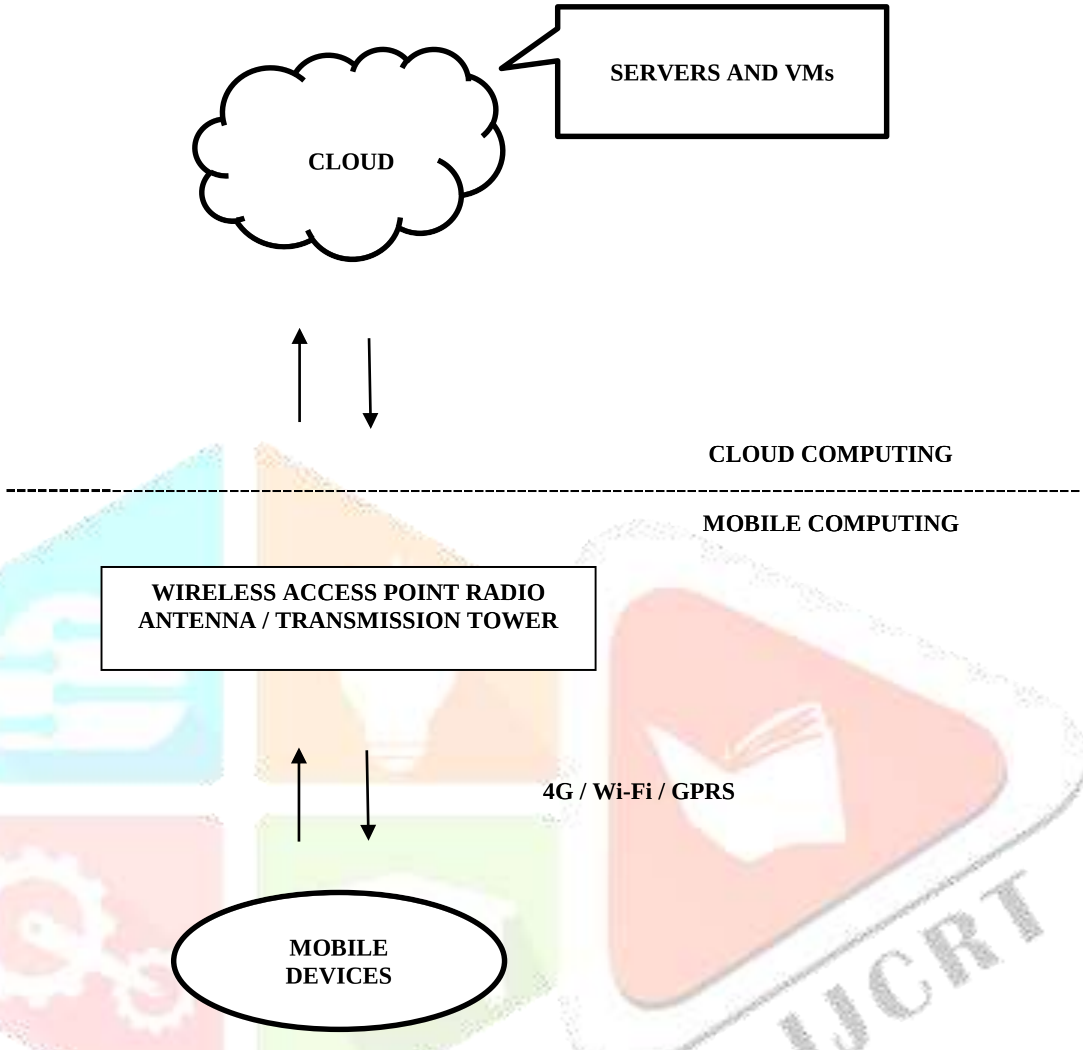


Figure 1. Architecture of mobile cloud computing

The above figure provides a general notion of the architecture of mobile cloud computing, which as seen is a combination of mobile computing and cloud computing. Mobile computing basically incorporates mobile communication, mobile hardware and mobile software. Mobile communication deals with mobile networks (wireless access point radio antenna/ transmission tower) which can be interfaced through mobile devices using 4G/Wi-Fi/GPRS. Mobile hardware is nothing but mobile devices like, laptops, smart phones, tablets, personal digital assistants (PDA), whereas mobile software encompasses the wide variety of programs that can run on mobile hardware. Cloud computing includes servers, virtual machines, central processing units (CPUs) and databases on cloud. When an application or program in run on the mobile devices, the information is migrated from the mobile devices to the cloud for processing via mobile networks. After processing of the information, the output is displayed on the mobile device for the user to make use of [4].

1.2 ISSUES

- **Low Bandwidth -** There may exist fluctuation and intermittence of bit transfer rate commonly occurring in mobile cloud computing environment. In wireless network, the network latency delay may be 200 ms but only 50 ms in traditional wired network [5]. To enhance the bandwidth the rising innovations, for example, 4G organize are utilized to beat the restriction and get a transformation enhancing data transfer capacity.

- **Dependency on Cloud Service Provider –** Reliance on a particular cloud service provider is a major backdrop in mobile cloud computing. It is extremely agonizing and unwieldy on the off chance that one client might need to exchange expansive number of information, if the client requires to transition from the past provider to the new one.
- **Virtual Machine migration issues –** The users always anticipate to experience the performance of an application to be at its best even on their low specification mobile device. Executing such resource intensive applications without the user experiencing lags is performed by encapsulating application's information into a Virtual Machine (VM) instance and then migrated to cloud for processing. The challenging task at hand is to deploy and manage the VM instance which is an additional overhead to deal with [6].

II. RELATED WORK

Every mobile device has its own requirements to manage the computing the user operates. All the requirements cannot be met at all times,the mobile device may depend on various other resources.One such source of computing that the mobile device can depend upon is cloud. Getting the computing resources from the cloud is not always easy but might be expensive too. To spare the resources like energy,battery consumption and processing power in a way to increase the efficiency of performing tasks,the mobile devices can rely on the processing power of the Cloud.

The results obtained through the collaberation of the mobile devices and the cloud can then be sent across the devices through a specific architechture.The various proposals on the Mobile cloud computing involves models on architechture for the smooth transition of work among the cloud and mobile devices.There are various approaches for handling the computing between cloud and mobile devices.We shall discuss these models which are dealing with handling high intensive applications.

- **Clone Cloud [7]:** Clone cloud proposes a flexible architecture for the consistent utilization of the computation to enlarge mobile devices applications making them more energyefficient and fast.Clones in the cloud receive the suitable part of execution from the applications in the mobile device based on algorithm by clonecloud.This framework naturally transforms the single-machine computation into a distributed computation model by sharing the load among the cloud and the smartphones,thereby expanding the processing capabilities of the mobile phone.

  This was derived from the idea that the cloud performs better than the mobile device ,also it has more security and processing power.The additional computing for the migration of execution to the cloud can be compensated by the high processing power in the cloud.Depending on the execution conditions, expected workload and depending on various conditions like CPU speeds and network strength, the right portion of work load is shared with the cloud.

  Virtual machines like the Java VM, DalvikVM from the Android Platform, and Microsoft's .NET are used in application layer of clonecloud. Since application-layer VMs are extensively used in mobile platforms, the application-layer VM model has the advantage of manipulating application executable at ease and migrating pieces to computing devices of diverging architectures, even different instruction set architectures (e.g., ARM-based smartphones and x86-based servers).

  The CloneCloud prototype meets all design goals discussed above, by modifying an unmodified application executable. When the modified executable is running, the chosen individual threads migrate from the mobile device to a device clone in a cloud; remaining application portion on the mobile device keeps processing, but stops if it attempts to access the migrated state, thereby exhibiting concurrency between the states. The migrated thread will be processed on the clone, accessing the better features of the hosting platform such as the storage, network, fast CPU, hardware accelerators, etc. Consequently, the thread returns back to the mobile device bringing back the remotely created state and merge it back into the original process. The choice of migration is made by a partitioning component, which uses static analysis to discover constraints on possible migration points, and dynamic profiling to build a cost model for execution and migration. A mathematical optimizer is used to choose migration points that optimize the total process and provide better performance, for the application and the cost model. Finally, the run-time system decides which partition to use.

- **AlfredO[8]**: For providing a better and efficient mobile cloud application, researchers are using and extending the CloneCloud-based algorithms based on dynamic partitioning of applications to the remote server in cloud. AlfredO is a middleware stage to naturally spread distinctive layers of programs in mobile devices and cloud, individually, by demonstrating applications as a consumption graph, and finding the ideal parts of applications. The study outcome shows that these similar stages enhance the execution of applications in mobile devices and cloud efficiently. This system consists of three packages: AlfredOCore on the server, AlfredOClient and Renderer on the client.

  AlfredOCore first models the requested application by the client and computes the ideal distribution, and afterward send application descriptor and the rundown of services to AlfredO Client. The descriptor is utilized by the renderer to produce the required AWT or SWT interface, while AlfredO Client gets the predefined services by means of R-OSGi.

  Similar to CloneCloud, AlfredO also executes specific modules of application programs remotely on the cloud to retain battery consumption and broaden resources of the smartphones efficiently. A future research on these should include supporting platform independent interaction that co-operates in an open network.

- **Cloudlet [9]**: As the mobility feature in smartphones, give a consistent migration condition to information transmission or service guarantee has been becoming a major issue in mobile cloud computing research. An ideal migration mechanism can mitigate the interaction delay, enhance the execution performance, and improve user experience effectively. Cloudlet gives quickly immediate service to mobile phones utilizing virtual machine (VM) technology for unfolding the problem of data transmission related delay amongst mobile devices and cloud.

  The author proposed that these cloudlets should be provided more like a WIFI or WLAN points and share the workload on these cloudlets in order to mitigate the delay and increase the performance. A key challenge is to simplify cloudlet management. Widespread deployment of cloudlet infrastructure won't happen unless software management is made unrestricted to provide further developments. The solution is transient customization of cloudlet infrastructure using hardware VM technology. The interface between the host and guest environments is made narrow and stable, and available everywhere which ensures the survival of cloudlet investments and encourages the chances of a mobile user finding compatible cloudlets everywhere.

  There are two types of approach to deliver the VM to infrastructure. One is VM migration, in which an already processing VM is stopped from its execution, its processor, disk, and memory state are transferred, and finally VM execution is resumed at the destination from the exact point of suspension. The other approach, which is focused, is called dynamic VM synthesis. A mobile device conveys a little VM overlay to the cloudlet framework that as of now has the base VM from which this overlay was brought. The framework applies the overlay to the base to bring the launching VM, which begins executing in the exact state in which it was suspended.

  The author raised a point that despite the fact that cloud computing is a better solution for resource constraint mobile phones, long WAN latent delay is a snag for its execution. Tragically, some sort of delay, for example, data checking or firewall filtering for security is unavoidable. In this way, the author conveyed Cloudlet as a Micro Cloud to be available by smartphones with high data transfer capacity and low delay.
- **Hyrax[10]:** There are many resource limitations for mobile devices, which are required to meet various computing requirements of users. The methodology that hyrax employs is to allocate Android mobile phones as nodes thereby creating an open system network on mobile cloud computing platform. The efficiency in performance of the system is increased by employing the smartphone as a slave in Hadoop network and master is deployed in PCs.

  Hadoop Distributed File System is used to save data. NameNode and JobTracker are implemented as background services. This system is implemented on various mobile phones to find the performance of the system and the results imply that the performance of mobile phones is not as good as previous system. Hyrax is one of the first few mobile phone based cloud computing systems that contended that the component of resource limitations in mobile phones is the principle reason influencing execution in this cloud based system. Future research might be involving the problem of resource limitations and further development in this direction.

III. PROBLEM STATEMENT

What if there was no need to replace your low specifications smart phone with a high end one? What if we could upgrade the specifications of the phone without actually upgrading the hardware or software? With the proliferation of mobile computing and cloud computing technologies, mobile cloud computing (MCC) has emerged as a new computing paradigm which could facilitate the above discussed criteria.

Upon this emerging concept of mobile cloud computing, we propose to expand the functionality of mobile devices by outsourcing the computing task on to the cloud.

IV. PROBLEM SOLUTION

Researches in accordance with mobile cloud computing by scientific communities have come into light and one such prominent research is CloneCloud. Virtual Machine migration technology is the fundamental concept around which the CloneCloud revolves, i.e. is to migrate execution blocks of applications from mobile devices to virtual machines on the cloud for processing. An analysis of the CloneCloud research provided us with an insight to proceed with our project.

Over the years, cloud services have drastically increased especially when the big companies like Google, Amazon, and Microsoft started providing cloud computing services on a paid subscription basis. Google Cloud by Google, Amazon Web Services by Amazon and Azure by Microsoft are the prominent cloud service providers. They cater the subscribers with a cluster of virtual computers, which are at the subscriber's disposal all the time. These virtual computers comprise of the characteristics similar to that of a real world computer such as central processing units (CPUs), RAM, storage, operating system, pre-loaded applications, networking, virtualized console I/O (keyboard and mouse), etc. Connecting to the virtual computer can be fulfilled by a modern browser that acts as a window, allowing subscribers to sign-in, configure and use their virtual systems just like a real physical computer. Internet based services can be provisioned by deploying the virtual systems [11].

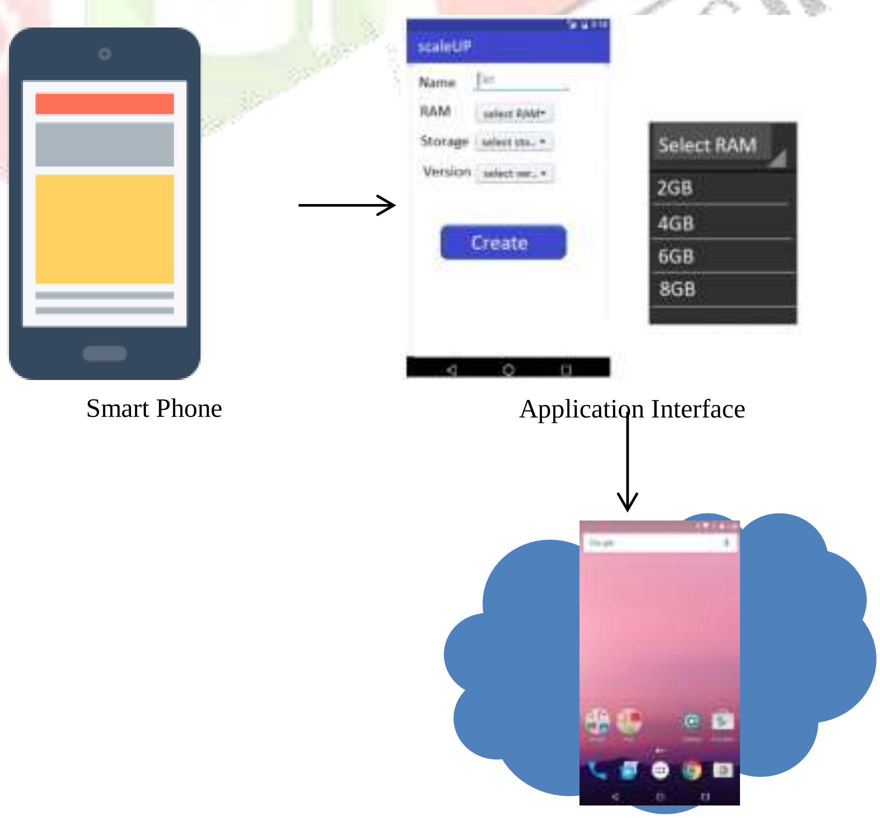
Amazon Web Services (AWS) has provisions to fulfill the requirements in developing the proposed application. The most popular services of are:

1.) **Amazon Elastic Compute Cloud (EC2)** which allows subscribers to rent virtual computers by booting an Amazon Machine Image (AMI) to configure a virtual machine which is called as instance. The user can create, start, terminate and resume these instances as needed, paying by second for the active instances. In the description panel of these instances, we can find the Public DNS and the instance ID, using these credentials it is possible to access the instance through a modern browser.
2.) **Amazon Simple Storage Service (S3)** is used for storing the data and also retrieving it irrespective of the location and time. The interface of S3 is easy to use and it ensures that access to data is swift, reliable and scalable, causing no hassles to the subscriber.
Android is a popular operating system developed by Google primarily for mobile devices such as smartphones and tablets. We plan to create an instance with operating system as Android using the EC2 service. Genymotion on-Demand offers an Android environment featuring the power of Genymotion on Amazon EC2 instances of the cloud platform Amazon Web Services [12]. Genymotion on-Demand provides different flavors of Android (Nougat, Marshmallow, and Lollipop) which can be rented on the basis of “pay-as-you-use”. Once the Android instance is created, access to it is achieved by pasting the instance’s public DNS in a browser. The user is then prompted for the username and password. The default username is genymotion and the default password is the respective instance’s ID; on entering these credentials the user is granted access to the Android Virtual Device. The created virtual device is provisioned to the user via an android application interface, whose architecture is proposed is the following section.

4.1. PROPOSED ARCHITECTURE

We propose to model an application through which users can experience performance beyond the reach of their smart phone. The interface of the Android virtual device is catered through an Android application for the users where the actual brain resides on the cloud. The task at hand for the smart phone would be rendering the interactive User Interface (UI). Thereby, enabling a normal smart phone user to experience cutting edge technology in their “so-called” outdated smart phone.

The application interface requires the details of user to be entered to create a user account so that they could be used in other devices and places as well. Soon after the account is created, the user is rendered with a dashboard to configure the Android virtual machine that the user wants to use for better performance. The specifications provided here are the features such as RAM, cloud storage, flavor of operating system (Nougat, Marshmallow and Lollipop) that is to be used i.e., the user can choose between the different variants of RAM like 2GB,4GB or 8GB, storage size, and the number of CPU cores according to their usage. Utilizing this information provided by the user a virtual instance of android is created in the cloud. The created virtual instance have a username, Public DNS and instance ID, these details are forwarded to the user so that they can access the virtual device. The user can login to the virtual device using the details provided to them. The interface of the virtual device would be same as the one of a normal smart phone with the only difference is *that the virtual device is scaled up. The application only requires an active internet connection to establish the link between the user interface and the android virtual device working in the cloud.



Android Virtual Device
on Cloud

Figure 2. Proposed Architecture

V. OBJECTIVES OF PROPOSED WORK

- Improvement in processing power and data storing capacity.
- Improved synchronization of data due to "Store in one place, Access from anywhere" policy.
- Improved reliability and scalability.
- Extended battery life.

VI. CONCLUSION

With the high expansion of data computation in Business and science, the ability of data processing is considered to be an important resource all over the world. Mobile cloud computing(MCC) ,which is developed as an extension to the existing Mobile computing and Cloud Computing has high versatility and scalability ,has become an research worthy topic now. The principle objective of Mobile cloud computing is provisioning of a seamless and rich mobile experience for high intensive applications on a resource limited mobile device. Although it is still in the superficial stages of development, the future of mobile computing could be based on the applications of mobile cloud computing. Keeping this great significance in purview, we have proposed a model by which this objective of mobile cloud computing can be achieved through an android application, where the users would be able to use high intensive applications on their normal mobile device with the help of cloud. This model of delivery of mobile cloud computing via an application can be a better solution utilizing the resources in a more optimal manner and can be helpful in the further development in this emerging field.

REFERENCES

[1] Authors: Han Qi and Abdullah Gani. Title: Research on Mobile Cloud Computing: Review, Trend and Perspectives. Published in: *Digital Information and Communication Technology and it's Applications (DICTAP)*, May 2012.

[2] Authors: S M Shamim, Agona Sarker, Ali Nawaz Bahar and Md. Atiqur Rahman. Title: A Review on Mobile Cloud Computing. Published In: *International Journal of Computer Applications*, March 2015.

[3] Authors: Surabhi S.Golechha. Title: Mobile Cloud Computing: World's Leading Technology for Mobile Devices. Published in: *International Journal of Computer Science and Information Technologies (IJCSIT)*, 2014.

[4] Authors: Nitesh Kaushik, Gaurav and Jitender Kumar. Title: A Literature Survey on Mobile Cloud Computing: Open Issues and Further Directions. Published in: *International Journal Of Engineering And Computer Science*, May 2014.

[5] Authors: Han Qi and Abdullah Gani. Title: Research on Mobile Cloud Computing: Review, Trend and Perspectives. Published in: *Digital Information and Communication Technology and it's Applications (DICTAP)*, May 2012.

[6] Authors: Nitesh Kaushik, Gaurav and Jitender Kumar. Title: A Literature Survey on Mobile Cloud Computing: Open Issues and Further Directions. Published in: *International Journal Of Engineering And Computer Science*, May, 2014.

[7] Authors: Byung-Gon Chun, Sunghwan Ihm, Petros Maniatis, Mayur Naik, and Ashwin Patti. Title: CloneCloud: Elastic Execution between Mobile Device and Cloud. Published in: *Eurosys'11,* in *Proceedings of the sixth conference on Computer systems*, 2011.

[8] Authors: Han Qi and Abdullah Gani. Title: Research on Mobile Cloud Computing: Review, Trend and Perspectives. Published in: *Digital Information and Communication Technology and it's Applications (DICTAP)*, May 2012.

[9] Authors: Mahadev Satyanarayanan, Paravir Bahl, Ramón Cáceres, and Nigel Davies. Title: The Case for VM-Based Cloudlets in Mobile Computing. Published in: *Pervasive Computing*, *IEEE*, Oct.-Dec. 2009).

[10] Authors: E. Marinelli. Title: Hyrax: cloud computing on mobile devices. Published in: *DTIC Document*, Tech. Rep., 2009.

[11] https://en.wikipedia.org/wiki/Amazon_Web_Services

[12] https://www.genymotion.com/help/on-demand/user-guide/