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A Survey on Migration of Task between Cloud and Mobile Device

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***Abstract*— Cloud Computing has been established as an important area of research for industry as well as for educational institutions. Cloud Computing is a template which emphasis on allotment of data and computational resources over a scalable network of nodes, a striding across end users, web services and data distribution centre. A scalable network of nodes form a cloud and application based on these clouds is a cloud application. The enormous use of cloud resources by mobile devices gives rise to a concept as Mobile Cloud Computing. In mobile cloud computing, the mobile devices utilize the resources to migrate computation among the mobile nodes and cloud nodes .These make the use of mobile agents and migrations are invoked by programs. In this paper, we have combined the working of mobile device in combination with the cloud computing so that task migration can take place with less effort and applications can be utilized easily. This topic helped the purpose of application usage at the same time demonstrate the technique of integration between mobile device and cloud computing which are platform independent, means any mobile device can use this application in any heterogeneous environment.**

***Index Terms*—. Cloud Node, Computation Migration, Mobile agent, Mobile Node, Overhead, SOD.**

I. INTRODUCTION

In the world of technology where every hour something new is released and announced, the end users have to push themselves hard to achieve the success. They have to pay very hard if they missed something very important task or meeting. There are lots of products in Market like Google Task, Outlook, and Desk.com which are built for kind of same purpose. However they are very heavy to use and mobile support are not available and few of them are paid also. There was an era where the J2ME, Symbian and BREW were used to create the mobile application. However it's time for Smart phones, Tablets, Touch Screens etc and lots of other technologies are introduced. Cloud computing is a consummate for making it possible to access on demand network assets like networks ,servers, applications, storage which can be easily approached and without much efforts. The computing infrastructure is shifted totally to internet in form of services offered by cloud where users can access the assets through Infrastructure as a service, Platform as a service and Software as a service, by which the users can utilize the resources needed as and when required using pay-as-you-go utility. The cloud computing combines both the computing power and data storage into the web [1].

Today's world deals with use of Mobile devices as an efficient and handy communication tools which are not delimited neither by time nor by place. Mobile cloud computing is the use of cloud computing in coordination with the mobile devices. This makes the use of cloud computing for processing and then storing the data on mobile devices. The Mobile devices are very limited on resources, Battery life, Bandwidth, Memory and so on. It is not always possible to save all the data on Mobile device because of lots of reasons. Few of them are like low memory, accidental damage, device lost etc. So we needed the solution where all the above specified problems can be overcome. Now days, we observe that the number of mobile users is increasing rapidly than desktop or any other electrical gadget. The emanation of mobile agent [3] which is a model of distributed computing plays an important role in remote control, active networks, distribution information retrieval, mobile computing and other applications [2]. So that the mobile agents can utilize the resources from the cloud, it requires the migrations of some resources between the cloud and mobile devices. The migration may result in either light weight or a substantial migration between cloud and mobile devices required that the migration should be portable and should impose minimum overhead.

II. RESEARCH METHODOLOGY

With the increasing demand for mobility of resources, the requirement for mobile cloud computing also increased. The cloud computing has five essential characteristics which includes on demand self service, broad network access, rapid elasticity [11], resource pooling and measured service and there are four deployment models such as private cloud, hybrid cloud, community cloud and public cloud .The private cloud are used by single organization with multiple consumers, while the community cloud are used by community of consumers in an organization. The public cloud is meant for open use for the public. A hybrid cloud is a combination of two or more infrastructure which can include all three i.e. private, community and public cloud. As the mobile cloud computing is combination of mobile device to be used in parallel with cloud computing ,number of users rely on mobile devices ,as they can be easily connected to the cloud, and then mobile application can easily access the resources from the cloud. In mobile cloud computing the mobile applications can upload or download the computation intensive operation as and when required. The tasks can be performed using a Mobile agent. Mobile agents can capture the state either programmatically by weak mobility or transparently using strong mobility [6]. Mobile agents are the programs that can migrate from one host to another host in search of resources and completion of task in a heterogeneous environment. Mobile agents are the process that can be used to transport its state from one environment to another, with its

data intact and capable of performing it in a new environment. Mobile agent is itself a combined unit of code and data, which when required can be migrated from one environment to another depending upon the availability. There is several migration techniques that were developed .Some of the migration techniques depending upon the work done are explained below.

A. *Migration using Clone Cloud:*

The earlier system preferred duplicating the runtime environment and then executes the application either on the cloud or the device. It makes the clone of the device in order to achieve a better performance. Making a clone runtime environment had some advantages as well as disadvantages [9]. The advantages include enhanced CPU and memory resources to be utilized efficiently. Another advantage included that it did not required any modification as the mobile device and clone can run identical barrier. The application on the cloud need to access physical hardware on the mobile devices. When one processor is replaced with another, it can access all the resources from the cloud which is another disadvantage. Another disadvantage is duplicating a device and then executing it on cloud increases the complexity.

B. *Migration using Concept of Weblets:*

It uses an elastic application model that supports partitioning a single application into multiple components called Weblets [7]. Weblets are nothing but a type of internet web design and it usually handled by a single individual and organization and located at a single site. Weblet is independent of location and also it can be run on mobile devices or migrated to cloud. The launching of a weblet depends upon some factors which includes battery level, CPU load. This approach empowers flexibility and optimized elasticity considering some factors such as device status, application performance measures, cloud status and preferences.. In this elastic application is partitioned or spitted into smaller components so that the execution occurs partially on device and partially on the clouds. The partitioning is done in order so that weblet have minimum dependency on others and to reduce the communication overhead. In execution configuration, the applications are partitioned and then assigned to the execution units for processing on the device or on the cloud.

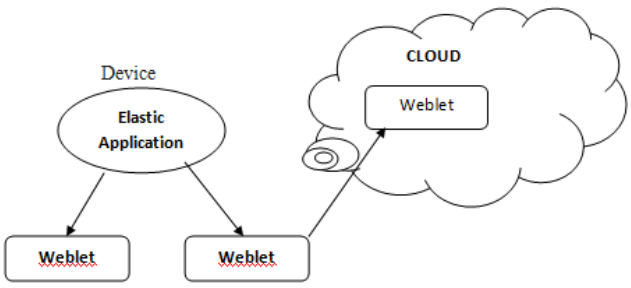

Fig 1: Weblets accessing resources from cloud [7]

C. *VM Migration:*

One of the features of mobile cloud computing is mobility. Task mobility refers to capability to allow users to continue the operation of their tasks on different nodes. This can be achieved using the VM migration. VM migration uses the concepts of virtual machines in which the VM migration transfers the whole VM to another computer, resulting into a coarse grained load balancing [4] among VM's. This process of VM migration can be performed using 3 steps. It stores the entire state of virtual machine encapsulated by set of files stored on shared storage. Secondly, the precision state and active memory of VM is migrated over a high speed network, enabling the virtual machine to move between the source and the target machine. The record for these transactions is maintained in a bitmap. When all the system state is copied, VMotion suspend the source and starts operating on target host. By using a Gigabit Ethernet network, the whole process takes less time [10] .The sources and destination hosts simulates the network used by virtual machine. It checks whether the new physical location of the virtual MAC address is known or not. Even after migration, the virtual network identity and network connections are preserved.

D .*Stack on Demand Migration Concept:*

This algorithm makes the use of Stack on demand (SOD) which allow the partial execution state of the stack machine mainly composed of code, stack and heap area. Each stack is made up of number of stack frames, each containing state of the method invocation. In this migration mechanism, the stack frames are chopped into segments and only the topmost stack frame is pushed. When the top most segments finishes and pops, the values that are returned are sent to the next site to continue the execution. SOD migrates only the required portion to the destination site required to continue the execution [5]. By partial stack migration, the migration cost can be reduced .It allows different parts of the stack migrate to different sites, forming a distributed workflow. So in the case of SOD only the top most frame is required to carry out the execution while the required data and code can be brought up in an on demand fashion. It also makes the use of exception handlers so that execution flow is normal.SOD can dynamically move input processing to the position where there is greatest demand.SOD allow the migration of light weight and portable task for better resource utilization and saves maximum of network bandwidth

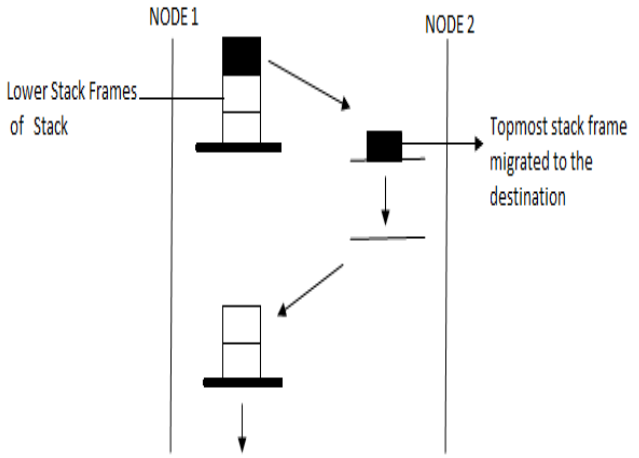

Fig 2: SOD Migration [5]

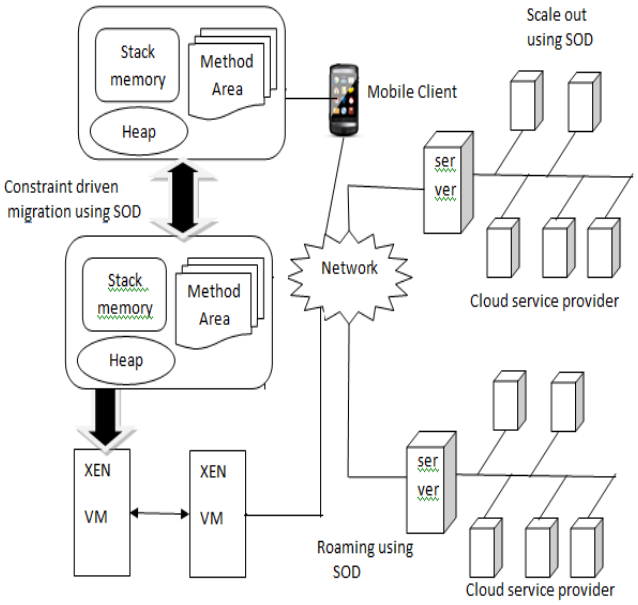

Fig 3: Task Migration between cloud node and mobile node using eXCloud [8]

E. Migration using eXCloud and VM :

This method has extended the concept of SOD and introduced a middleware system named Extensible Cloud (eXCloud) along with SOD and VM system to achieve multi-level mobility. In this SOD is integrated atop VM. eXCloud is a multilevel mobile cloud infrastructure which provides transparent runtime support for scaling the mobile application. eXCloud [8] allows different levels and different granularity of mobility in devices as well as the cloud. The eXCloud combines both cloud node as well as mobile node. The objects present in cloud node are different from those present in mobile node. The high level views are very similar in both nodes but the implementation is different. The communication components are present in cloud node so it makes the use of VM while resource manager is present in mobile node and not in cloud node. So SOD migration is required for mobile node. Thus eXCloud makes the use of both SOD integrated with VM.

F. Twin Method Hierarchy Migration:

Another task migration policy which also extended the concept of SOD migration is a Twin Method Hierarchy (TMH). In this paper, the overhead is reduced using Twin Method Hierarchy is introduced. In this method state capturing and state restoration is done. In case if there are extra conditional branching, the overhead will be increased in the execution of the applications. This overhead is dependent upon the frequency of execution of the functions. During pre-processing some extra codes are added to obtain and send Meta data required for migration. When these application run, added codes will also be executed getting the process to get migrated. In the TMH, the original methods are duplicated to allow instrumented and original methods are used at different stages. During the normal execution the original methods are executed while the instrumented methods with restoration statements are executed during restoration. Methods will be instrumented as, firstly method are duplicated into another set M' while original methods are in set M. In duplicated methods, checking statements are added at the beginning [2] .For normal execution the original methods of set M are used. While during restoration methods from M' will be used. After restoration is completed, these newly executed functions will be a part of set M. Thus TMH reduces the overhead for performing the migration.

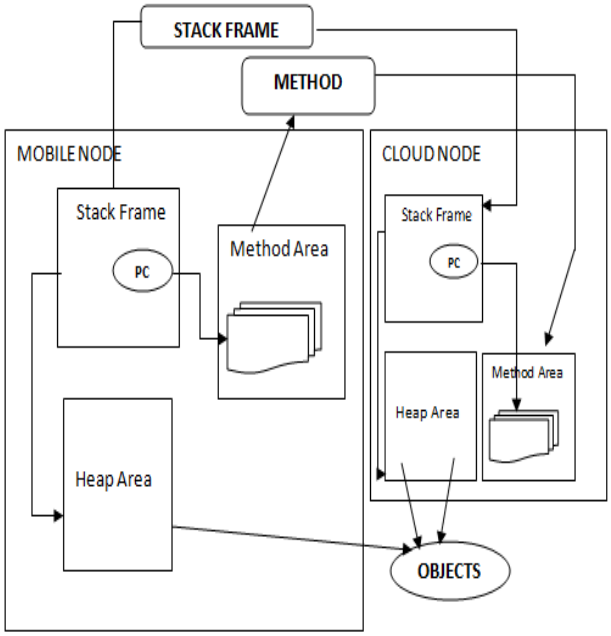

Fig 4: Task Migration between a mobile node and a cloud node [2]

III. CONCLUSION

The efficient utilization of resources from the cloud through a mobile device is required. So task migration becomes an important factor for resource utilization. New mechanism should be developed in order to reduce the access latency and the overhead during migration . Few of the techniques are already developed ,but it requires more attention to achieve scalability, granularity in the available task migration techniques to be used with minimum overhead for future purposes. With the above developed techniques, migration between mobile and cloud can be extended to migration of bigger tasks.

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