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Mobile Cloud Computing: An Immediate Transitionfrom Cloud to Mobile Cloud

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Abstract-*Cloud is the kind of distributed computing which disperses and processes data distributed by virtualized manner. Cloud provides resources and computing infrastructure on demand basis to cloud consumers. The combination of cloud computing into the mobile computing environment is developed as a capable technology for mobile services. In this paper we emphasis on scenarios for availability of cloud resources and services on mobile devices. Further need of mobile cloud computing, real time mobile cloud applications, a comparative analysis on mobile cloud enablement technologies and role of middleware system are discussed as counter part of this research.*

Keywords: *cloud computing, mobile cloud, concept of mobile cloud*

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I. Introduction:

Cloud Computing is established as the newest big shift in the computing. For some, the notion of managing and storing data in a centralized, 'Always-On' repository that can be accessed from anywhere is the key. Often these many Service Providers speak of their mobile strategies, and how each of these various services offers a tuned, modified or enhanced experience for mobile.

1.1 Concept of Mobile Cloud Computing:

Mobile Cloud computing is related concepts of cloud computing and it brings the services like on demand access, no on-premise software. Mobile Cloud Computing, use network capabilities alone to deliver the desired service to customers, as well as charging for their use. Mobile Cloud Computing could permit you to reserve network bandwidth,thus confirming timely delivery of information to a user.

1.2 Mobile Cloud Computing: Change is required

Mobile world is dependent on two factors. One is Network Stability and second is Handset availability. Since mobile phones do not have adequate processing power or memory to support huge amounts of data, Cloud Computing seems to be the ideal solution for these mobile phone users. Cloud computing will allow these mobile phone users to have the same amount of data access like "smart" phone users, have their data stored onto the phone. This extra advantage of Cloud Computing allows developers and mobile companies to start targeting a larger market than only "smart" phone users, which in turn will give Cloud Computing more thrustin near future.

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II. The Need of Mobile Cloud Computing:

The case for mobile cloud computing can be claimed by considering the exclusive advantages of empowered mobile computing, and a wide range of potential mobile cloud applications have been recognized in the literature. These applications fall into many areas like natural language processing, image processing, sharing Internet access, sensor data applications, sharing GPS, querying crowd computing and multimedia search. However, as described in, applications that involve distributed computation do have certain common characteristics, like consuming data with easily visible segment boundaries, and the time to recombine partial results into a complete result must also be small. An example is string matching/manipulation like grep and word frequency counters. The different scenarios and applications presented in recent literature are described in detail below:

2.1 Image processing: In this paper [1], the authors have experimented with running GOCR, an optical character recognition (OCR) program on a pool of mobile devices. In an actual life scenario, this would be beneficial in a case of a foreign traveler who takes an image of a street sign, performs OCR to extract the words then translates words into a known language. A similar scenario is given in paper [2] where a foreign tourist Peter is visiting a museum in South Korea. He sees an interesting exhibit, but cannot understand the description since it is in Korean. He takes a picture of the text, and starts an OCR app on his phone. Unfortunately his phone lacks the resources to process the le text. Although he could connect to a remote server via the Internet, that would mean he use roaming data which is too expensive. Instead, his device scans for nearby users/devices who are also interested in reading the description, and requests sharing their mobile resources for the taskcollaboratively.

Those who are concerned in this common processing task create an ad hoc network with Peter and together, their mobile cloud is able to extract the text, and then translate it to English.

2.2 Natural language processing: As mentioned above, language translation is one of the likely applications, and this is mentioned in paper [1] as a useful tool for foreign travelers to communicate with locals. Translation is a feasible candidate since different sentences and paragraphs can be translated independently, and this is experimentally explored in [1] using Pangloss-Lite. Text-to-speech is also mentioned in paper [1], where a mobile user may desire having a file read to them, especially in case of the visually impaired.

2.3 Crowd computing: Video recordings from multiple mobile devices can be spliced to construct a single video that covers the entire event from different angles, and perspectives [4]. In paper [5], two scenarios of this nature are described in detail: ‘Lost child’ and ‘Disaster relief’.

2.4 Sharing GPS/Internet data: It is more effective to share data among a group of mobile devices that are near each other, through local-area or peer-to-peer networks. This is not only cheaper, but faster also [4]. Rodriguez et al. [6] present a case study of a hiking party at Padjelanta National Park, which is a deserted land in the Arctic Circle lacking power access points and network coverage. A data set contains Bluetooth scans for discovering devices and GPS reads of 17 persons.

2.5 Sensor data applications:

Now a day’s most of the mobile phones comes with sensor and reads from sensors such as GPS, light sensor, accelerometer, clock, thermometer, microphone and compass can be time stamped and linked with other phone readings. Execution of queries is done on such data for gather valuable information. These queries could be ‘‘what is the average temperature of nodes within a mile of my location?’’ or ‘‘what is the distribution of velocities of all nodes within half a mile of the next highway on my current route?’’ Sample applications for this are traffic reporting, sensor maps, and network availability monitoring [4].

2.6 Mobile Commerce Applications:

Mobile commerce (m-commerce) is like a business model for commerce by mobile devices.). Mobile commerce applications are used for many mobile transactions and payments, and mobile ticketing and mobile messaging. The most common problem of m-commerce applications are low network bandwidth, high complexity of mobile device configurations, and security. Therefore, m-commerce applications are combined into cloud computing environment to report these issues.

2.7 Mobile Learning

Mobile learning (m-learning) is considered based on electronic learning (e-learning) and mobility. Cloud-based m-learning applications solve the limitations of traditional m-learning applications e.g. high cost of devices and network, low network transmission rate, and limited educational resources [10], [11], [12]..

2.8 Mobile Gaming

Mobile game can completely offload game engine requiring large computing resource to the server in the cloud, and gamers only interact with the screen interface on their devices. It is found that instead of offloading all codes to the cloud for processing, MAUI partitions the application codes at a runtime based on the costs of network communication and CPU on the mobile device to maximize energy savings given network connectivity. The objective is to maximize the user experience given the communications and computing costs.

2.9 Other Practical Applications:

The cloud computing becomes a useful tool to help mobile users share photos and video clips efficiently and tag their friends in popular social networks as Twitter and Facebook. A cloud becomes the most effective tool when mobile users require searching services (e.g., searching information, location, images, voices, or video clips).examples of such applications are

Multimedia search: Mobile devices store several types ofmultimedia content such as videos, photos, and music. Forexample, Shazam is a music identification service formobile phones that searches for similar songs in a centraldatabase. In the context of the mobile cloud, the searchingcould be executed on the contents of nearby phones [4] **Social networking:** Since sharing user content is a popularway we interact with friends on social networks such asFacebook, integrating a mobile cloud into social networking infrastructure could open up automatic sharing and p2pmultimedia access and this will also reduce the need to backup and serve all of this data on huge servers [4].

III. Existing Enabling Technologies of mobile cloud computing:

As we have seen various applications where we need mobile cloud computing solutions, there are some existing enabling technologies and web application which helps mobiles to run cloud services, although they all have some limitations but they are still serving mobile cloud solutions some of them are Clone Cloud that brings the power of cloud computing to your smart phones [6].

Clone Cloud uses nearby computers or data centers to increase the speed of running smart phone applications, one more prominent solutions is Cloudlets which is trusted, resource-rich computer or cluster of computers which is well connected to the Internet and available for use by nearby mobile devices. Thus, when mobile devices do not want to offload to the cloud (maybe due to delay, cost, etc.), they can find a nearby cloudlet. In this way, mobile users may meet the demand for real-time interactive response by low-latency, one-hop, and high-bandwidth wireless access to the cloudlet. If there is unavailability of nearby cloudlet, the mobile device may refer to the default mode that it will request those requirements to other available distant cloud, or in the worst case, it try to use its own resources [7]. There is also a very emerging technology named as Embedded Hypervisor**.** The hypervisor permits additional software to run in a virtual environment. Mobile platforms requisite the hypervisor to be built in. take an example of the Motorola Atrix which consist an embedded hypervisor that allows a vast range of applications, not just those developed exactly for it. Whenever require, the device downloads user data from a centralized location, authorizing local access by the user and so reducing latency.

There are some more enabling technologies like HTML5 ,CSS and Web 4.0 those providing a floor to making mobile devices capable for accessing cloud services like any other computing components. Further, there is a comparative analysis of those available enablement technologies with their advantages and limitations.

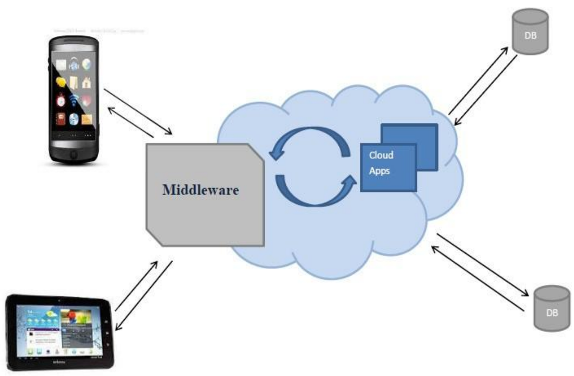
IV. Comparative Analysis of all existing Solutions:

	Advantage	**Limitation**
CloneCloud	CloneCloud the bringscloudyour power of computing tosmart phones	Inability to migrate native state and to export unique native resources remotely and CloneCloud does not virtualize access to native resources that are not virtualized alreadyand are not available on the clone.
Cloudlets	Reliable, resource- rich computer or cluster of computers: When mobile devices do not want to offload to the cloud (maybe due to delay, cost, etc.), they cansearch out any nearby cloudlet.	Unavailability of Cloudlets: If there is no cloudlet available in near location, the mobile device may refer to the default mode that will send requirements to a reserved cloud, or in the worst case, merely its own resources.
HTML5 and CSS3	HTML5 is the development of rich media tags like **audio** and **video** and it isprogrammable withJavaScript, these tagsoffer incredible easeof use. HTML5 also permits specification ofoffline support, which makes localstorage possible, helping withconnectivity interruptions. CSS3 works with HTML5 to specify how elements of a page should be rendered, a CSS specification tells theweb browser how to display it	The key difficulty with HTML5's recognition is that only latest browsers support it and the language itself is measured a work in progress, so precisely, any of the elements could change at any time. Another negative fact about HTML5 is that because of Media licensing issues.
Web4.0	Web 4.0 is also recognized as	Web 4.0 is still an

	symbiotic web. Thevision behind of thesymbiotic web is Communication between humans and machines insymbiosis. Web 4.0 or webOS will be such as a middleware in which will start Functioning like an operating system. The webOS will beparallel to the humanbrain and implies a massiveweb of highlyintelligent interactions	underground idea in progress and there is no exact definition of howit would be.
Embedded Hypervisor	Whenever required ,the device downloadsuser data from acentralized location,allowing local accessby the user and sosinking latency Example : MotorolaAtrix This process occurs invisibly to the user, user observe fasterresponse	It is a still a researcharea and companies are working on mobileembedded virtualization. Althoughthere is challenges like Bandwidth, Latency andlimitation of resources**.**
Elastic Weblets	Elastic applications must not be controlled by the current compute capabilities of mobile devices. If more compute (or storage) is needed then this can be obtained fromthe cloud. From a performance perspective, the capability to allocate resources in the cloudand migrate functionality gives the device excessiveflexibility.	Building authentication between Weblets, Secure migration and Authorization of weblets is puzzling task;more research has to bedone in this direction.

V. Middleware: A need for Mobile Cloud

For dealing these limitations of interoperability across multiple cloud services, to perform data-intensive processing invocation from the mobile devices and to introduce the platform independence solutions for the mobile cloud applications, **Middleware** could be the solution. The middleware provides a unique interface for mobile connection and multiple internal interfaces and adapters, which manage the connection and communication between different clouds. The Middleware capabilities for managing resource intensive tasks can easily be envisioned in several scenarios.



Middleware paradigm for Mobile devices

Middleware provides a platform through which services of cloud computing could be more efficient and powerful. Mobile devices facilitate a range of functionalities even though those are having various constraints, Mobile middleware solution should essentially provide an abstraction over the complexities of working in mobile environments, and provide a mean for a better and convenient device-to-device interaction, mobile**-** computing integration and mobile. Like other kinds of middleware, mobile middleware typically provides messaging services to enable communication between different applications. Middleware implementation scenarios are out of the scope of this paper so architecture and implementation scenario will be discussed in our next research

VI. Conclusion

In this paper we have presented concept of mobile cloud computing, the need of mobile cloud, practical applications of mobile cloud. Although, there are some existing solutions those are providing the necessary means to consume existing cloud services through mobile devices, mobile cloud computing have a broad era of exploration of new mechanism or technologies to exploit power of mobile devices .In our further research we will continue with various implementation scenarios and technologies those make this needed shift possible and try to find out the gapsbetween cloud and mobile cloud.

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