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# Improved QoS via Ranking in Ad hoc Cloud over MANET

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***Abstract*****—***Dramatic increase in the capabilities of mobile devices has lead to its wider applications. Mobile ad hoc networks (MANETs) is a continuously self-configuring infrastructure-less network of mobile devices connected wirelessly. Integration of wireless devices over mobile ad hoc network and cloud computing have been addressed in various studies. The goal of this paper is to propose architecture for ad hoc cloud over MANETs with quality of service. In addition to such architecture, C-protocol with ranking operation has been proposed. Proposed system is composed of two types of nodes providers and customers. Such protocol permits dynamic management of providers and customer nodes. Quality of service via Ranking results in better utilization of cloud resources. This scenario has various advantages such as availability, affordability, spontaneity etc.*

***Keywords:*****—***Deployment protocol, Mobile cloud computing, affordability, spontaneity Dynamic management, Mobile ad hoc network.*

## 1. INTRODUCTION

The problem of lack of local resources can be solved using remote cloud. But such type of services and resource providing depends on the connection to remote cloud and system may fail in low connectivity scenario. The solution that is being proposed is to use mobile devices in the local vicinity as local resources providers and to exploit their capabilities. The approach is to consider and use interconnected mobile devices in the local vicinity as resource providers aiming to provide resource sensed data to neighboring nodes in needs. when Wi-Fi terminal do not work properly or get damaged, there can be mobile terminals communicating peer to peer and evolving as a virtual cloud to provide IAAS type of services. The remainder of this paper is organized as follows; section 2 presents the related work, section 3 proposal for communication protocol and architecture, section 4 MCC setup, section 5 dynamic management of MCC nodes.

## 2. RELATED WORK

Mobile cloud computing can be define as "a rich mobile computing technology that leverages unified elastic resources of varied clouds and network technologies towards unrestricted functionality, mobility and storage to serve multitude of mobile devices anywhere, anytime through the Ethernet or internet regardless of heterogeneous environments.

A spontaneous ad hoc network is defined as a special case of MANET that is formed by a set of mobile nodes in a close location and during a certain period. All nodes are free join and leave the group without any permission. There is no centralized control or coordinator and without user intervention.

In[1], author suggested that cloud computing can potentially save energy for mobile users. cloud computing can save energy for mobile users through "computation offloading" Mobile cloud computing services would be significantly different from cloud services for desktops because they must offer energy savings. The services should consider the energy overhead for privacy, security, reliability, and data communication before offloading. In[2], author put forth a vision of mobile computing that breaks free of fundamental constraint. Resource poverty is a fundamental constraint that severely limits the class of applications that can be run on mobile devices. Rather than relying on a distant "cloud," a mobile user instantiates a "cloudlet" on nearby infrastructure and uses it via a wireless LAN.

In[3], author suggested that Hyrax provides a convenient, sufficiently abstract interface for developing applications that use mobile data. Hyrax provides an infrastructure for mobile cloud computing, providing an abstract interface for using data and executing computing jobs on a mobile device cloud. Hyrax easily scales to all of the nodes in his test bed, and would likely scale to many more nodes. It also works reasonably well for local peer-to-peer data sharing and is generally successful in tolerating node-departure.

In[4], the author presented a comparative analysis of Energy consumption in a Smartphone when executing a computation intensive task versus End-to-end energy consumption when the same task is offloaded to a remote server. Also presented an evaluation between two popular communication technologies i.e. Wi-Fi and 3G. In[5], author presented MAUI, a system that enables fine-grained energy-aware offload of mobile code to the infrastructure. Previous approaches to these problems either relied heavily on programmer support to partition an application, or they were coarse-grained requiring full process (or full VM) migration.

In[6], author studied work related to spontaneous wireless ad hoc network along with technologies required to build and secure the network. As it is a social kind of network work as peer to peer network nodes are themselves responsible for all network activities like creating network, joining new node, providing services and so on. They have provided a unique IP address to each node of the network for its identity. In[7], author defined a spontaneous network as a small scale ad hoc network intended to support a collaborative application and explored some of the unique challenges that need to be faced in building such environments.

In[8], author has developed and tested some algorithms that allow managing the nodes that join and leave the spontaneous ad hoc network. In order to guarantee the network security and the reliability of the communications and transmitted data, we have also developed a trusted algorithm. This algorithm is based on the advanced encryption standard (AES) algorithm and it has implemented a symmetric encryption scheme with simple key management features. In[9], the author explored the feasibility of a mobile cloud computing framework to use local resources to solve these problems. The framework aims to determine a priori the usefulness of sharing workload at runtime. The results of experiments conducted in Bluetooth transmission and an initial prototype are also presented.

In[10], author used concept of cloud computing and job sharing over cloud provides a brand new opportunity for the development of mobile applications that can get heavy tasks done over cloud by offloading computation tasks on cloud, since it allows the mobile devices to maintain a very thin layer for user applications and shift the computation and processing.

## 3. PROPOSED WORK

The work undertaken focuses on improvement of quality of service via ranking in ad hoc cloud over MANET. Such type of ad hoc cloud consist of set of nodes acting as service provider and other nodes acting as

cloud customer. Each provider is aware of all other provider by sharing provider list (PL) among them.

### *3.1 Problem Analysis*

Ad hoc cloud consist of set of service providers and any node in the local vicinity can use cloud services just by requesting to any of the service provider. Communication technologies can be Wi-Fi or Bluetooth. In such scenario no fixed infrastructure is there. All nodes are free to join or leave the group. we have set of nodes acting as cloud service provider in the local vicinity and a customer may request a provider for storage service or may need to offload some important data. Resources in such scenario may be underutilized or over utilized. For efficient utilization of resources some additional operation need to be performed. One provider may have more storage than the other. Another provider may have more available bandwidth than the other. Hence we need some mechanism to efficiently use the available resources for better quality of service in ad hoc cloud over MANET.

### *3.2 Model architecture*

We propose a layered architecture for deployment and management of nodes in mobile ad hoc cloud with improved quality of service (QoS). QoS in terms of storage, bandwidth availability, battery charging status etc. we have introduced a layer of QoS in ad hoc cloud architecture. our work also include a communication protocol to set up cloud over MANET with ranking mechanism for efficient utilization of available resources. The role of the providers is to offer services to the customers such as tasks execution and data storage, or collecting information. The communication between nodes is being done using the Wi-Fi as a wireless communication technology. First we define following assumptions:

- Customer node should be connected to at least one service provider.
- A node can be a customer or a provider.
- A service provider must have at least one cloud customer.
- Communication between two nodes is bidirectional.

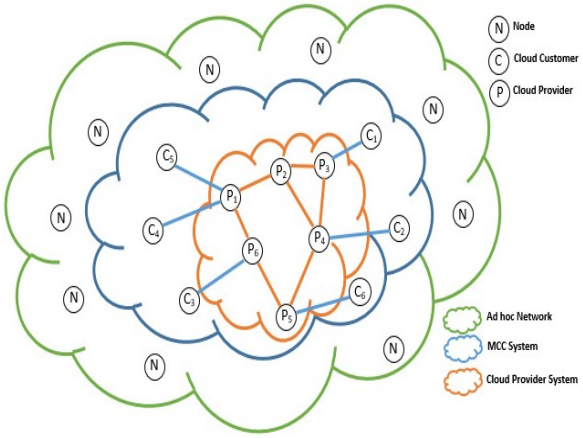


*Figure 1. Ad hoc Mobile Cloud Architecture*

This system is created in the setup phase by the initiator (a customer) and nodes from the ad hoc network can join the cloud provider system (CPS) when they receive a request for the addition of new providers to share their resources.

### *3.3 Identification of needs for cloud provider system*

In order to ensure proper functioning of ad hoc mobile cloud system, we need to identify its requirements in terms of deployment, dynamicity, and management.

***Requirements are***

1. Group communication
2. Cloud deployment on demand
3. Cloud members are dynamically managed.
4. Synchronous communication mode.

### *3.4. Communication protocol with ranking*

This communication protocol uses UDP messages for exchange of information between nodes.

**Table 1 : Protocol Messages and Description**

| | | |
|---|---|---|
| Cloud setup | Cloud advertisement<br>Cloud proposal<br>.<br>Cloud setup | Advertisement of the Cloud creation<br>Participation and registration of a node in the event Creation of Cloud. |
| Add provider(s) | New P _request<br><br>New P _response<br><br>New P _notification<br><br>PL exchange<br><br>PL Backup request<br>PL Backup response | Request of new Providers addition<br>Response to a request of new Providers addition<br>Notification of the addition of a node to the Cloud Provider System<br>Exchange of PLs between the Providers<br>Request for not received PL.<br>Return the requested PL |
| Add customer(s) | Cloud discovery<br><br>Discovery response<br><br>Join C request<br><br>Join C refuse<br><br>Join C accept<br><br>Join C notification | Discovery of an existing Cloud<br>Response to the discovery of the Cloud.<br>Request of adding to Cloud Customers<br>Rejection of the request of adding to Customers.<br>Acceptance of the request of adding to Customers<br>Notification of the adding of a new Customer. |
| Cloud Setup | Node tracing<br><br>Node departure | Indication of the permanence of a cloud member (Provider/ Customer).<br>Notification of the departure of a member. |
| Ranking providers | Request _for_PL<br>Selected_P_request<br><br>Selected_p_response | Request for PL with parameters.<br>Selected provider is requested for service.<br>Response for cloud service to the cloud service customer. |

To improve quality of service in ad hoc cloud over MANET, we have proposed ranking operation where one of customer can obtain cloud parameter of all service providers. After obtaining such parameter for provider from the PL list, one of the customer can rank providers on the basis of available storage, charging status, bandwidth etc. Now this information can be broadcasted to all the provider and the customers. Cloud customer that requested for such ranking can now use this service with suitable cloud provider. Using such technique, one can achieve quality of service in ad hoc cloud over spontaneous network. This also leads to efficient utilization of cloud resources and service can be improved effectively. Ranking operation is performed only when any one of the cloud customers needs it for any critical task. Ranking operation makes use of priority based technique. Each job or request from the customer is assigned a priority and served first. FCFS within each priority level is used. Suppose more than one cloud customer ask for such services, we serve them on first come first serve basis. Providers are ranked on the basis of available resources and customers can be served accordingly.

### *MCC set up*

This phase sets up an ad hoc MCC over a spontaneous MANET. It can be started by any node needing resources (the initiator). This initiator node can announce a request on the network. The process of setup is described as follows. The initiator generates an identifier for the CPS (cloud-ID field) and starts the cloud deployment process by broadcasting a cloud_advertisment message. Payload data of such message (the criteria of selection such as the CPU, bandwidth, and battery charging status). This type of message would be processed by only those nodes which implement cloud framework since the payload data is delivered to the upper layer framework for decision. Nodes that agrees to participate the cloud, send an unicast message to the initiator i.e. cloud_proposal message. The initiator waits for a period of time to collect

cloud_proposal message (t-wait).Such waiting is to give chance to all mobile nodes to send a proposal. Now initiator generates a unique identifier for the selected providers PI(provider identifiers). The initiator creates primary provider and customer lists(CL) and sends a cloud_setup message in multicast to the set of providers. We have defined the PL as a table containing information relative to the provider node, including direct neighbors of each supplier and their type.

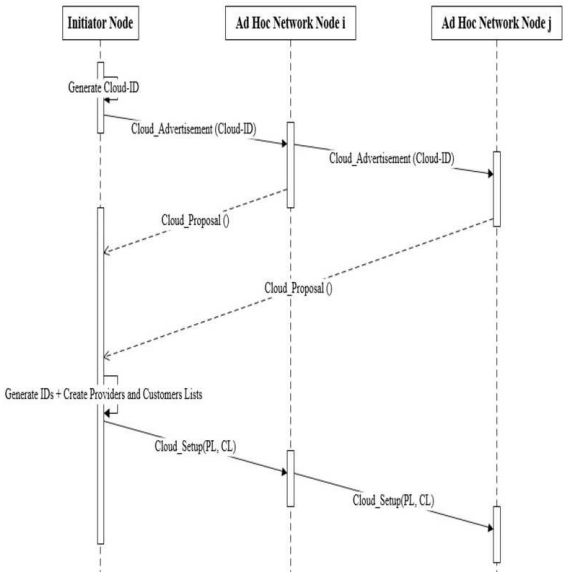


*Figure 2. Sequence Diagram of the Setup Phase*

### *Dynamic Management of Nodes*

To simplify and understand the modeling of this process, we will break it down into following steps. When receiving a request to increase the resources, various provider nodes are launching a process of adding New Provider nodes in their neighborhood (locally). At the end of this, provider nodes perform local update to their PL to add the new members. Members are put into service only when its cloud parameter is obtained. After the exchange of PL list between the provider nodes each one of them must verify that it has received all the PLs by comparing the number of received PLs and the number of providers. If a provider detects the absence of one or more PLs, it starts a process of recovering non received PLs. To guarantee the coherence of the system all the provider nodes must possess the same PL list. Now cloud parameters would be sent to new providers. Each provider which has added the new provider, would be responsible for sending parameters to them. New PL list should be transferred to the cloud customers to realize new suppliers added. Therefore each service provider is supposed to inform its customers located in his neighborhood about the new list PL.

## 4. CONCLUSION

The proposed model presents the deployment of P2P mobile cloud over mobile ad hoc networks. A communication protocol with ranking mechanism have also been proposed. This protocol provides to the upper cloud framework, a set of services like an on demand deployment and dynamic management of cloud members. Ranking operation in ad hoc cloud over MANET leads to efficient utilization of cloud resources. Such model achieves better utilization of available cloud resources in ad hoc cloud over MANET.

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