Survey on Mobile Social Cloud Computing (MSCC)

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Abstract: Due to enhancement in technology the use of mobile devices increases with time. Now mobile devices (mobiles, PDA, Laptops etc.) became an essential part of mankind's life. With the ease of Internet the popularity of Social Networking Services (SNS) among people increases. With the sharp drops in the prices, the working of mobile devices including smart phones and laptops is rising steadily. So due to this, mobile devices are now used as a provider of computing resources and services instead of requester. For this concept of Cloud Computing (CC) is merged with the mobile computing and SNS which is known as MSCC. MSCC is technology of future and it enables users/consumers to access the services in a fast and efficient manner. MSCC is the integration of three different technologies 1) Mobile Computing 2) SNS 3) Cloud Computing. Here mobile devices are (those have moments) using SNS (Both as a provider or requester) in Cloud Computing (CC) environment. In such environment, a user through mobile devices canparticipate in a social network through relationships which are based on trust. Units of the identical or alike social network can share services or data of cloud with other users of that social network without any authentication by using their mobile device as they be members of the identical social network.

Various techniques are revised and improved to achieve good performance in a cloud computing network environment. In this work, there is a detailed survey of existing social cloud and mobile cloud techniques and their application areas. The comparative survey tables can be used as a guideline to select a technique suitable for different applications at hand. This survey paper reports the results of a survey of Mobile Social Cloud Computing (MSCC) regarding the importance of security of MSCC. Here we compare the works of different researcher in the field of MSCC on the basis of some essential features like security algorithm used, Qos and Fault tolerant strategy used, ease of proposed algorithm, space complexity etc. Considering all the limitations of the existing social cloud and mobile cloud techniques, an adaptive MSCC framework of Fault tolerance for future research is proposed.

Keywords: *Cloud · Social cloud · Mobile social cloud ·Fault tolerance*

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1. Introduction

Cloud computing is the delivery of on-demand computing resources, everything from application to data centers over the internet on a pay for use basis.It enables convenient and on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

Cloud computing is also spreading to different areas such as mobile and social network computing. Mobile cloud computing is such a computing environment which extends cloud computing to include mobile devices such as laptops, netbooks,etc.

A suitable application is required in mobile cloud computing foreach mobile device to access mobile cloud computing. Each mobile device can act both as a server for providing cloud service or data as well as a client for requesting cloud service or data.

A social network is defined as a social structure composed of individuals or organizations, called "nodes", which are connected by sometype of interdependency, like as friendship. In social computing environments, through a social network user can share data among various individual users based on real world relationships without any authentication.

Mobile Social Cloud Computing is an integrationof mobile devices, cloud computing, and social networking. In Mobile Social Cloud Computing, a mobile device user requests cloud service from a cloud server and the cloud server informs user about the closest mobile device of a user who belongs to the same social network which is able to provide the asked cloud service.

2. Cloud computing

A type of Internet-based computing which provides shared pool of computer processing resources and data or information to computers and other devices on demand. It enables convenient and on-demand network access to a shared pool of configurable computing resourceswhich can be instantly provisioned and released with minimum management. Cloud computing along with

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1332 – 1340

storage solutions is providing users and enterprises with various capabilities for storing and processing their data in either privately owned, or third-party data centersirrelevant of the location from the user.

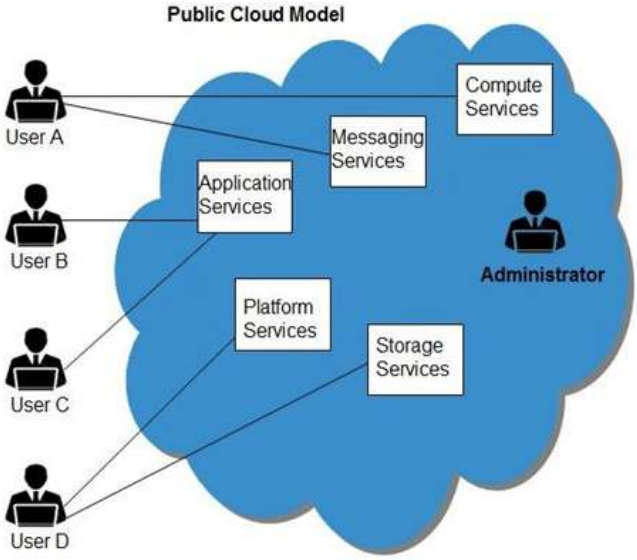

Figure 1. Public cloud model

3. Social networking

In today's scenario people use an online platform like a social networking service (also SNS or social media) to build their own social network or social relations with different other people who possess similar personal or career interests, activities, backgrounds connections. Different variety of stand-alone and built-in social networking services currently are available in the online space, introducing challenges of definition; however, there are always some common features prevailing:

Social networking services are Internet-based applications.User-generated content is the lifeblood of Social Networking Serviceorganizations.SNS organization design and maintain the site and app for social networking service where users create service-specific profiles.Here by connecting a user's profile with those of other individuals, SNS facilitate the development of online social networks.

Since most of the social network services are internet-based hence they provide means of interactionamong the users over the Internet, such as by instant messaging, online forums and e-mails.Social networking sites are of different varieties and they incorporate a range of new information and tools of communication such as availability on mobile devices,desktop and laptops, digital photo/video/sharing, etc.

Figure 2. Social Networking.

4. Mobile Cloud Computing

Mobile Cloud Computing is an integration of mobile computing, cloud computing, andwireless networks to provide resources to mobile users,cloud computing providers, as well as network operators. MCC has a goal to enable execution of mobile applications on a plethora of mobile devices, with a rich user experience. MCC provides different opportunities of business forcloud providers as well asmobile network operators.

MCC uses a different computational approaches where computations are executed remotely instead-of on the device itself because of which resource constraint mobile devices are able to utilize resources of different cloud-based resources. In mobile cloud computing, there are four types of cloud-based resources, they are

- Distant immobile clouds,
- Proximate immobile computing entities,
- Proximate mobile computing entities, and
- Hybrid (combination of the other three model).

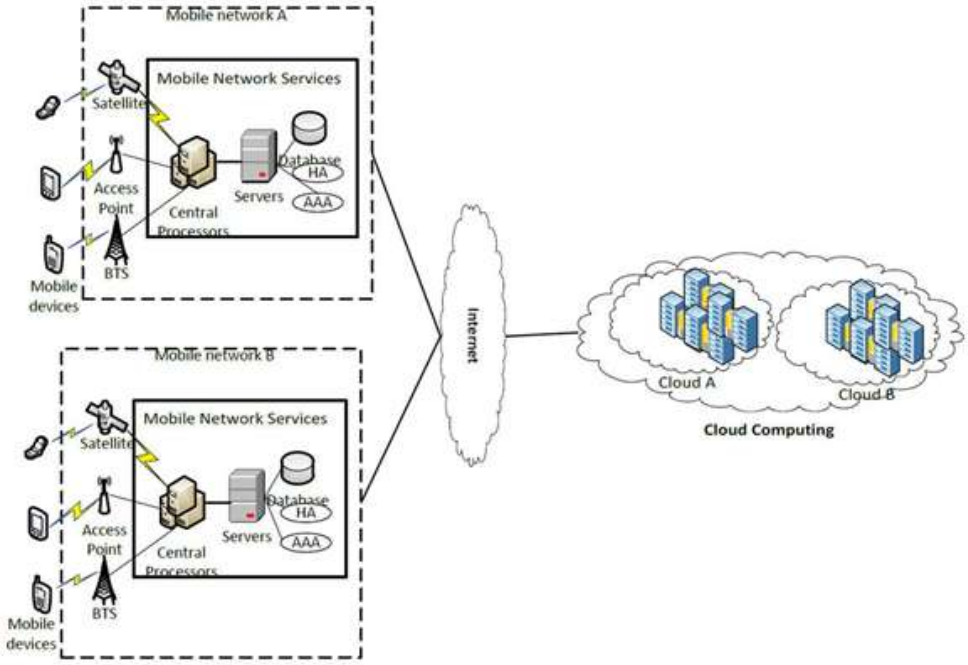

Figure.3 Mobile cloud architecture.

5. Social cloud computing

Social cloud computing can also be calledas peer-to-peer social cloud computing. It is that area of computer science which generalizes cloud computing of including the sharing and renting of resources across the peers whose owners and operators are verified through a social network. Social cloud computing expands cloud computing beyond the confines of formal commercial data centers operated by cloud providers. This in turn leads to broader options, greater economies of scale, while bearing additional advantages for hosting data and computing services closer to the edge where they may be needed most.

Social cloud computing is an intersection of peer-to-peer cloud computing with social computing to verify peer and peer owner reputation thus providing security and QoS assurances. Social cloud computing can be seen as a potential benefit to large-scale computing,media streaming, and video gaming.

Many challenges that arise when moving to a social cloud environment:

- Availability of computational resources

Social Cloud Computing doesn'tguarantee the availability of resources because in a P2P environment, mobile devices are peers which can lead to temporary network disconnection any time.

- Security and Trust

There is a need of proper encryption whenever there is some sort of computation associated with sensitive information but the overhead of that encryption may reduce the usefulness of the offloading in P2P.

- Reliability

Since the speed of the client calculation may depend on the usage of the end device, so it is quite difficult to achieve reliable computation power in P2P social computing.

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Figure.4 Social Cloud Computing.

6. Mobile Social Cloud Computing

MSCC is a computing environment which integratesmobile devices andsocial network-based cloud computing. In this environment, through mobile devices a user can become a member of a social network through real world relationships based on trust. Members of a social network will be able to share data or cloud service with other members of the same network without further authentication.

Mobile Social Cloud is the convergence of cloud computing, mobile applications and social networking providing a powerful new paradigm for achieving disruptive innovation.

Mobile Social Cloud Computing (MSCC) is a computing model which includes mobile devices to support user mobility in a network and connects with social networks to reflect real world user relationships, and providing and sharing cloud services among the members of a social network.

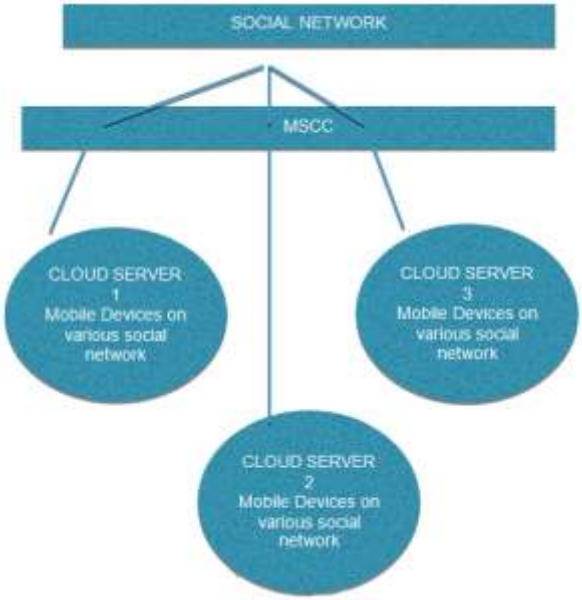

Figure.5 MSCC

There are several important issues in MSCC. In MSCC users generally share sensitive information through social network with each other. The concern of security of confidential data is always there.

Another major problem is of fault tolerance that may occur due to malicious and selfish nodes. Generally Computing resources are available on demand in CC model, on user request. To fulfil it dynamically some organizations are taking advantage of cloud and using mobile devices as resources. While using mobile device as a computing resource, temporary network disconnection caused by user mobility and various HW/SW faults cause service disruption. Mobile devices may have problems such as battery drain, software error and network disconnection. Ensuring Quality of Service (QoS) for reliability, resource ability and network status in MSCC is also a major issue.

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1332 – 1340

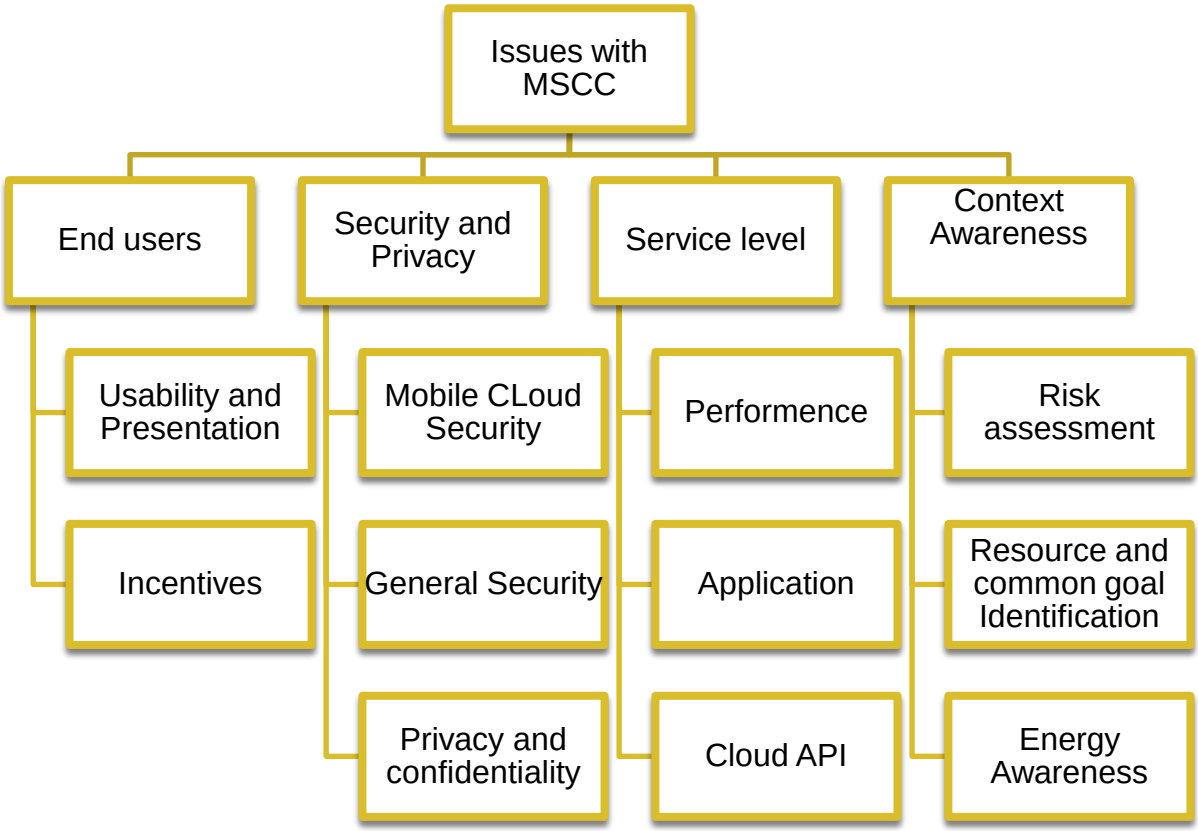

Figure.6 Issues with MSCC

7. Literature Survey

Jing Deng et al. [5] proposed matrix multiplication as a cloud selection strategy and technique to improve fault- tolerance and reliability and prevent faulty and malicious clouds in cloud computing environment having multiple clouds.

Jie Li et al. [6] proposed MODISAzure and used additional redundancy and fault-tolerance capabilities through retrying task execution, which supports debugging of user code encountering unanticipated data issues.

Yilei Zhang et al. [7] presented BFTCloud (Byzantine Fault Tolerant Cloud) for building robust systems in voluntary-resource cloud environments. They used replication techniques because computing resources in voluntary- resource clouds are heterogeneous and less reliable and malicious behaviors of resource providers cannot be prevented. They proposed a BFT group of one primary and 3f replicas for tolerating different types of failures. The primary and replicas form a BFT group for executing requests from the cloud task. If some nodes of the BFT group are identified as faulty, the cloud module will update the BFT group to guarantee system reliability.

Yi Hu et al. [8] proposed a security-aware and fault- tolerant job scheduling strategy for grid computing. The scheduling strategy includes JRT (Job retry), JMG (Job migration without check pointing), and JCP (Job migration with check pointing). They concluded that JRT strategy has the most optimal system performance improvement for small jobs and JCP strategy leads to the lowest performance improvement. Unfortunately, the check pointing method was not described clearly.

Hyunjoo Kim et al. [9] proposed server selection schemes for a service migration-based fault-tolerant streaming on P2P computing.

Yanchao Zhang and Yuguang Fang [14] proposed a reputation system to predict the reliability of candidate servers for clients and support reliable service selection in P2P net- works. They defined the reputation of a server as the probability that the server is expected to demonstrate a certain behaviour, which is assessed by a client based on self- experiences with and other user feedback on the server. User QoS experiences are recorded on a data structure called a QoS experience vector. The reputation system uses reputation scores from QoS self-experience and support functions for fault tolerance and load balancing.

Uan M. Tirado et al. [15] proposed a data grouping and placement strategy on LastFM, an on-line music portal with social networking capabilities using cloud-based elastic server infrastructure. In the network, users have the possibility of mutually connecting through friendship.

Kyle Chard et al. [16] defined a social cloud as a resource and service sharing framework utilizing relationships established between members of a social network. The social cloud allows users to share heterogeneous resources with low privacy concerns and security overheads by utilizing the relationships in the computing environment.

Ryan Wooten et al. [17] proposed healthcare as a promising application of cloud computing and social media. They described the design and prototype of a social healthcare network through cloud computing and designed a trust- aware role-based access control to ensure the privacy and confidentiality of users.

8. Comparison Survey Table

The various research papers have been summarized based on some features in Table.

Authors Name & Performance Comparison of their Research Papers							
Features	**Jing Deng et al.[5]**	**Jie Li et al.[6]**	**Yilei Zhang et al.[7]**	**Yi Hu et al.[8]**	**Hiyunjoo Kim et al.[9]**	**Qian Tao et al.[10]**	**MengXu et al.[11]**
Fault Tolerance	High(30%)	High(30%)	High(30%)	Moderately High(20%)	Moderately High(20%)	-	-
Fault Tolerance Scheduling Strategy	Matrix Multiplication	MODIS-Azure	BFTCloud	JRT, JMG and JCP	Server Selection Schemes	-	-
Space Complexity	High	More Space	More Space	High	Medium	More Space	Medium
QoS	Low(3%)	Medium(10%)	Low(3%)	Medium(10%)	Low(3%)	High(45%)	High(45%)
QoS Scheduling strategy	-	-	-	-	-	TrustworthyQoS Scheduling	Multiple QoS Scheduling
Implementation of Algorithm	Complex	Hard	Hard	More Complex	Hard	Complex	Difficult
Methodology/Environment	Cloud Computing having multiple Cloud	Cloud Computing	Voluntary Resource Cloud Environment	Grid Computing	P2P Computing	Cloud Computing	Cloud Computing
Used Technique	Matrix Multiplication	Additional Redundancy	Replication	Job Migration with/without Check pointing	Server Based Migration	Basic QoS and Extended QoS Sets	Covariance for Time and Cost

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1332 – 1340

Efficiency/Reliability	High	Medium	High	Medium	Medium	Compara-ble High	High
Feasible	Yes	At some point	At some condition	Yes	Yes	Yes	No
Security	High	Moderate-ly High	High	High	Secure Enough	High	Moderately High

Authors Name & Performance Comparison of their Research Papers							
Features	**Sheikh Mahbub Habib et al.[12]**	**Peng Zhang &Zheng Yan[13]**	**Yanchao Zhang &Yuguang Fang[14]**	**Juan M. Tirado et al.[15]**	**Kyle Chard et al.[16]**	**Ryan Wooten et al.[17]**	**Henry et al.[18]**
Fault Tolerance	Medium (10%)	Medium (10%)	High (30%)	Medium (10%)	Medium (10%)	High (30%)	High (30%)
Fault Tolerance Sche-duling Strategy	-	-	Supports functions for FT	Data group-ing	Relationship based shar-ing	Role based access	Transpa-rent data replication
Space Complexity	More Space	Less Space	More Space	More Space	More Space	More Space	More Space
QoS	High(>45 %)	High(>40 %)	High(>45 %)	Moderately High(>20%)	Me-dium(10%)	High(30 %)	Medi-um(10%)
QoS Scheduling strate-gy	Reputation based ap-proaches	QoS aware system for cloud ser-vices	Reputation System	Data Placement strategy	Service sharing based on relations	Trusta-ware role based access control	Support of multiple data que-ries using CAN
Implementation of Al-gorithm	Easy	Difficult	Hard	Difficult	Difficult	Difficult	Difficult

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1332 – 1340

Methodology/Environment	Landscape of trust in selecting service providers of cloud	Aware system for cloud services at run time	To predict reliability of candidate servers in P2P networks	Cloud based elastic sever infrastructure	Share heterogeneous resources with low privacy concerns in cloud.	Cloud Computing and social network	Transparent data distribution using CAN
Used Technique	QoS+ parameters for performance tests and security measures.	Used QoS properties like CPU consumption	Uses reputation scores from Self-experiences	Mutually connecting through friendship in the network	Social Network based utilization of resources and services	Role based access control to ensure privacy	Reducing latency between underlying network structures
Efficiency/Reliability	High	High	High	Medium	Medium	High	High
Feasible	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Security	High	Medium	Medium	Medium	Medium	High	High

Table. Comparison Survey table.

9. Conclusions

On the basis of study of all the mentioned research papers it is found that MSCC has a number of challenges such as Accuracy,FaultTolerance, implementation of algorithm and reliability. Solution to such challenges of MSCC systems can help for faster and secure cloud computing as well as mobile social computation as compared to cloud computing. It is a social network-based cloud computing environment supporting user sharing of cloud services,user mobility, and QoS. Members of a social network can share cloud services based on basic authentication of the social network without any further authentication. MSCC is a new paradigm and is very successful in future because of the growth of social networks for continued rise of cloud computing, business and ascendency of mobile computing. Thus a feasible MSCC can be implemented if proper algorithms are designed for its security,QoS and faulttolerance.

Using comparison tables the selection of algorithm to determine fault tolerance and QoS will be easy.

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