Survey on Mobile Cloud Computing [MCC], its Security & Future Research Challenges

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Abstract - Cloud Computing is a fast-growing area in the recent past times and Mixture of Mobile Computing and Cloud Computing termed as Mobile Cloud Computing (MCC). MCC is the incorporation of cloud computing into the mobile environment. This paper enlightens the current trend in Mobile Cloud Computing, its security issues/challenges and associated research challenges in which our research would be focusing on.

Key Words: Cloud Computing, Mobile Cloud Computing, MCC, Algorithms, Research issues, challenges, Cryptography, ECC, HECC.

1. INTRODUCTION

1.1. Cloud Computing

Cloud computing is denoted as “cloud” which means the supply of on-demand computing resources to store, manage, and process data over the internet on pay-for-use basis. It is an Internet-based computing type, which is offered on demand to computer/other devices that needs data and shared processing resources.

Cloud consists of the below given essential characteristics:

- On-Demand self-service
- Ubiquitous network access
- Location-independent resource pooling
- Rapid elasticity
- Measured service

Below given are the Cloud delivery models:

- Application/Software as a Service (SaaS)
- Platform as a Service (PaaS)
- Infrastructure as a Service (IaaS)

Below given are the Cloud deployment models:

- Private
- Public
- Community
- Hybrid
- Virtual Private Cloud

1.2. Mobile Cloud Computing

Mobile Cloud Computing is a new model in which the Cloud Computing resources and services made available for mobile devices. Mobile computing is not meant just for smart-phone users but also for wide-ranging mobile subscribers as well. This MCC technology is defined based on three major concepts: software [mobile applications available in the device], hardware [mobile devices] and communication [network, data delivery and various protocols].

The below given diagrams describes the MCC architecture:
2. NEED OF SECURITY IN MCC

Security is very much essential as mobile devices can encounter various security threats as they are exposed to the outer world, which can cause virus attacks. While using mobile in cloud environments, the users and/or application developers must be very cautious on authentication and integrity of data/application. The mobile security can be easily achieved by any security software installation like mobile anti-virus programs. GPS causes privacy issues and LBS as well as they provide the current location details, which is a private information.

The Mobile Cloud Computing security issues can be categorized as given below:

- Mobile threats
- Cloud threats.

The security related issues are further divided into the below given broad level categories:

- Mobile Cloud Infrastructure Issues
- Mobile Cloud Communication Channel Issues

3. RESEARCH PAPERS PUBLISHED

Following are some of the papers published in the area of MCC & its Security:

1. A Survey on User Authentication Mechanism in Mobile Cloud Computing by A. Cecil Donald, M. Regin, Dr. A. Aloysius, Dr. L. Arockiam in International Journal of Emerging Trends in Computing and Communication Technology Volume 1, No 3, August 2015 ISSN: 2348 4454
talks about a Survey on various User Authentication Mechanisms in Mobile Cloud Computing and also the problems persist in the existing mechanisms.

2. Mobile Cloud Computing (MCC): Open Research Issues by Amit K. Sharma, Priyanka Soni in International Journal of Innovations in Engineering and Technology (IJJET) - Vol. 2 Issue 1 February 2013 ISSN: 2319 – 1058 talks about main open research issues connected with the mobile usage in cloud computing. This is useful person who reads can get an overview of MCC & their issues, current solutions and methodologies with some additional aspects for the further work.

3. MOBILE CLOUD COMPUTING AS FUTURE FOR MOBILE APPLICATIONS by C Shravanthi, H S Guruprasad in IJRET: International Journal of Research in Engineering and Technology eISSN: 2319-1163 | pISSN: 2321-7308 talks about the survey on mobile cloud computing applications, challenges, existing solutions and approaches to overcome these challenges.

4. Mobile cloud computing: A survey by Niroshinie Fernando, Seng W. Loke, Wenny Rahayu in Future Generation Computer Systems 29 (2013) 84–106 talks about an extensive survey of mobile cloud computing research, while highlighting the specific concerns in mobile cloud computing. We present a taxonomy based on the key issues in this area, and discuss the different approaches taken to tackle these issues. We conclude the paper with a critical analysis of challenges that have not yet been fully met, and highlight directions for future work.


6. Securing Mobile Cloud Using Finger Print Authentication by IehabALRassan and HananALShaher from Department of Computer Science, King Saud University, Riyadh, Saudi Arabia proposes and implements a new user authentication mechanism of mobile cloud computing using fingerprint recognition system.

7. Towards secure mobile cloud computing: A survey by Abdul Nasir Khana, M.L. Mat Kiah, Samee U. Khan, Sajjad A. Madani in Future Generation Computer Systems 29 (2013) 1278–1299 talks about highlights the current state of the art work proposed to secure mobile cloud computing infrastructures, identifies the potential problems and provides a taxonomy of the state of the art.


10. Security Issues in Mobile Cloud Computing by JASLEEN in International Journal of Computer Science & Engineering Technology (IJCSET) presents the concept of mobile cloud computing, new terminology Mccloud and other various MCC applications, major concerns and security concern with the preventive measures.

12. A Lightweight Secure Data Sharing Scheme for Mobile Cloud Computing by Ruixuan Li, Member, IEEE, Chenglin Shen, Heng He, Zhiyong Xu, and Cheng-Zhong Xu, Member, IEEE proposes a lightweight data sharing scheme (LDSS) for mobile cloud computing which adopts CP-ABE, an access control technology used in normal cloud environment.


14. A Mobile Cloud Computing Architecture with Easy Resource Sharing by Debabrata Sarddar and Rajesh Bose in International Journal of Current Engineering and Technology Vol.4, No.3 (June 2014) talks about the proposed model and aims to illustrate the manner in which mobile device users would be able to use the cloud application and also take advantage of energy savings not only in terms of power consumed, but also most importantly – time.


19. A Survey of Mobile Cloud Computing Applications: Perspectives and Challenges by Yating Wang and Ing-Ray Chen talks about insights for the enabling technologies and challenges that lie ahead to move forward from mobile computing to mobile cloud computing for building the next generation mobile cloud applications. For each of the challenges, they have provided a survey of existing solutions, identify research gaps, and suggested future research areas.


21. A Survey of Mobile Cloud Computing: Architecture, Applications, and Approaches by Hoang T. Dinh, Chonho Lee, Dusit Niyato, and Ping Wang in Wireless Communications and Mobile Computing – Wiley talks about survey of MCC, which helps general readers have an overview of the MCC including the definition, architecture, and applications. The issues, existing solutions and approaches are presented. In addition, the future research directions of MCC are discussed.


26. ARCHITECTURE OF MOBILE APPLICATION, SECURITY ISSUES AND SERVICES INVOLVED IN MOBILE CLOUD COMPUTING ENVIRONMENT by Swarnpreet Singh, Ritu Bagga, Devinder Singh, Tarun Jangwal in International Journal of Computer and Electronics Research [Volume 1, Issue 2, August 2012] talks about architecture of MCC (Mobile cloud computing) with the different services needed by the client and the server in MCC.


31. Cloud Computing in Mobile Applications by Deepti Sahu, Shipra Sharma, Vandana Dubey, Alpika Tripathi in International Journal of Scientific and Research Publications, Volume 2, Issue 8, August 2012 ISSN 2250-3153 talks about how to implement cloud computing for mobile devices providing data storage and processing outside the device along with the challenges in it and solutions as well.

32. Efficient Energy Reduction and Enhancing Security Privacy in Mobile Cloud Computing by B. Sudhanantham, M. Shankar in International Journal of Innovative Research in Computer and Communication Engineering Vol. 2, Issue 2, February 2014 talks about an encryption based scheme for the situation of single accessible CS and then a coding based scheme for the situation that multiple CSs are available without relying on encryption. They also have provided an analysis of the critical factors affecting the energy consumption of mobile clients in cloud computing.

33. Enabling Secure Location-based Services in Mobile Cloud Computing by Yan Zhu, Di Ma, Dijiang Huang, Changjun Hu in ACM MCC’13, August 12, 2013 talks about propose an innovative location-based fine-grained access control mechanism for LBSs, enabling effective fine grained access control, location-based authentication and privacy protection.

34. Enhancing Mobile Cloud Computing Security Using Steganography by Hassan Reza, Madhuri Sonawane in Journal of Information Security, 2016, 7, 245-259 talks about how steganography can be used to enhance the security and privacy of data images maintained in Cloud mobile applications.


36. Fast Dynamic Execution Offloading for Efficient Mobile Cloud Computing by Seungjun Yang, Yongin Kwon, Yeongpil Cho, Hayoon Yi, Donghyun Kwon, Jonghee Yoon, and Yunheung Paek in International Conference on Pervasive Computing and Communications (PerCom), San Diego, March 2013 talks about novel techniques based on compiler code analysis that effectively reduce the transferred data size by transferring only the essential heap objects.
37. The Future of Mobile Cloud Computing: Integrating Cloudlets and Mobile Edge Computing by Yaser Jararweh, Ahmad Doulat, Omar AlQudah, Ejjaz Ahmed, Mahmoud Al-Ayyoub, and Elhadj Benkhelifa in 23rd International Conference on Telecommunications (ICT) proposed a hierarchical model that is composed of MEC servers and Cloudlets infrastructures to increase the coverage area for the mobile users by which the users can accomplish the requested services with minimal cost like power and delay.

38. Increasing The Performance Of Mobile Smartphones Using Partition And Migration Of Mobile Applications To Cloud Computing by Hatem M. Abdul Kader, Mohie M. Hadhoud, Salah M El-Sayed, Diaa Salama AbdElmeeam in INTERNATIONAL JOURNAL OF TECHNOLOGY ENHANCEMENTS AND EMERGING ENGINEERING RESEARCH, VOL. 2, ISSUE 5 ISSN 2347-4289 developed an architecture that uses cloud to do computations that consume resources badly on mobiles. It targets at finding the right spots in an application automatically where the execution can be partitioned and migrated to the cloud.

39. Smart Phone and Mobile Computing: An Introduction by Rambabu V, Dr. R. Shanthugavadi in International Research Journal of Engineering and Technology (IRJET) Volume: 03 Issue: 03 | Mar-2016 talks about the similarities, differences and the cutting edge technologies and emerging applications of next generation of mobile computing with some challenges, issues in the mobile domain.


41. Secure Mobile Cloud Computing Based-On Fingerprint by Alaa Hussein Al-Hamami, Jalal Yousef Al-Juniedi in World of Computer Science and Information Technology Journal (WCSIT) ISSN: 2221-0741 Vol.5, No. 2, 23-27, 2015 talks about the fingerprints to prove the users identity to determine if this user is authorized or not in which The results showed that this scheme is very strong and difficult to break it.

42. SDSM: A Secure Data Service Mechanism in Mobile Cloud Computing by Weimei Jia yz, Haoqin Zhuy, Zhenfu Caoyx, Lifei Weiy, Xiaodong Lin in The First International Workshop on Security in Computers, Networking and Communications talks about a secure mobile user-based data service mechanism (SDSM) to provide confidentiality and fine-grained access control for data stored in the cloud.

43. Review On Digital Library Application Services Of Mobile Cloud Computing by Dr Abdulrahman M. Alsenaidy, Tauseef Ahmad in INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH VOLUME 2, ISSUE 2, FEBRUARY 2013 ISSN 2277-8616 talks about the basic concept of mobile cloud computing and its growth also as well as its mobile cloud architecture, and also deal with digital library services and synchronization with mobile cloud application.

44. Mobile Cloud Computing: Security Challenges for Threats Reduction by Farhad Soleimanieh Gharehchopog, Rafeleh Rezaei, Isa Maleki in International Journal of Scientific & Engineering Research, Volume 4, Issue 3, March-2013 ISSN 2229-5518 talks about study mobile technology and MCC security challenges facing this technology have discussed. And with respect to services provided in cloud environment, they have proposed a new MCC to provide security.

45. Research on Mobile Cloud Computing: Review, Trend and Perspectives by Han Qi, Abdullah Gani in University of Malaya, Kuala Lumpur, Malaysia talks about a review on the background and principle of MCC, characteristics, recent research work, and future research trends.

46. Reduce Resources for Privacy in Mobile Cloud Computing Using Blowfish and DSA Algorithms by Tawfìq S. Barhoom, Mahmoud M. Abu Ghosh in International Journal of Research in Engineering and Science (IJRES) Volume 4 Issue 1 talks about a proposed solution to the problem of privacy with saving and reducing resources power energy, processor and Memory through data encryption in the mobile cloud computing by symmetric algorithm and sent to the private cloud and then the data is encrypted again and sent to the public cloud through Asymmetric algorithm.

47. PROTECTION ISSUES IN MOBILE CLOUD COMPUTINGBY V.Gayathri, G.Nithya, K.S.Saravanan, M.Jothilakshmi in INTERNATIONAL JOURNAL OF RESEARCH IN COMPUTER APPLICATIONS AND ROBOTICS Vol.2 Issue.1 talks about the concept of mobile cloud computing with M-Cloud. It also describes about MCC applications, major concerns and security concern with the preventive measures.


50. Mobile Cloud Computing Perspectives and Challenges by SUGANYA V, SHANTHI A L in International Journal of Innovative Research in Advanced Engineering (IJIRAE) ISSN: 2349-2163 Issue 7, Volume 2 talks about the background and principle of MCC, characteristics, challenges and recent research work.


52. Mobile phones and cloud computing by Oskar Hamrén in Department of informatics, Human Computer Interaction Master’s programme talks about A quantitative research paper on mobile phone application offloading by cloud computing utilization.


4. Abbreviations and Acronyms

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<thead>
<tr>
<th>Abbreviation</th>
<th>Meaning</th>
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<tbody>
<tr>
<td>CSA</td>
<td>Cloud Security Alliance</td>
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<tr>
<td>ECC</td>
<td>Elliptic curve cryptography</td>
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<tr>
<td>HECC</td>
<td>Hyper elliptic curve cryptography</td>
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<tr>
<td>SLA</td>
<td>Service Level Agreement</td>
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<tr>
<td>MCC</td>
<td>Mobile Cloud Computing</td>
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<tr>
<td>IBE</td>
<td>Identity Based Encryption</td>
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<td>PKI</td>
<td>Public Key Infrastructure</td>
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<tr>
<td>MCC</td>
<td>Mobile Cloud Computing</td>
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<tr>
<td>LDSS</td>
<td>lightweight data sharing scheme</td>
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<td>SMD</td>
<td>Smart Mobile Devices</td>
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<tr>
<td>DAPF</td>
<td>Distributed Application Processing Frameworks</td>
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<td>LBS</td>
<td>Location Based Services</td>
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<tr>
<td>MEC</td>
<td>Mobile Edge Computing</td>
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<tr>
<td>GPS</td>
<td>Global Positioning System</td>
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5. CONCLUSIONS

The prevalence of Mobile cloud computing is blocked by its security widely. The need of security is very much essential on various concerned areas. Our future research would be focusing on enhancement of existing security frameworks & multi-factor authentication technologies for highly secured data using cryptography. Our research goal is to offer a more reliable security in Mobile cloud computing.

REFERENCES


[34] Seungjun Yang, Yongin Kwon, Yeonggil Cho, Hayoon Yi, Donghyun Kwon, Jonghee Youn, and Yunheung Paek, “Fast Dynamic Execution Offloading for Efficient Mobile Cloud Computing”, International Conference on Pervasive Computing and Communications (PerCom), San Diego, March 2013


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BIOGRAPHIES

G. Kishore Kumar is a research scholar in Department of Computer Science, Chikkanna Government Arts College, Tirupur, India. He has completed Master of Computer Applications [MCA] in Alagappa University, Karaikudi, India. His major field of study in Network Security and Cryptography.
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