Mobile Networks and Cloud Computing Convergence for Progressive Services and Applications

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A volume in the Advances in Wireless Technologies and Telecommunication (AWTT) Book Series
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Mobile Cloud Computing: Technologies, Services, and Applications ........................................... 1
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Mobile devices have gained great importance in the daily lives of people. Smartphones and tablet com-
puters make people's lives easier by being more useful and offering more capabilities and services for a
plethora of activities. Those devices include various sensing modules for collecting location information
related to navigation, gravity, and orientation, which bring a diversity and intelligent ubiquitous mobile
experience to users. In this chapter, cloud computing and mobile cloud computing are addressed in or-
der to give insight about the topic and offer an important overview for this book. The diverse research
definitions of these emerging technologies and contributions to enhance users' lives are considered.
Furthermore, the technologies and identified advantages to improve and justify the strong use of mobile
cloud are discussed. Relevant mobile cloud computing applications are presented, showing good results
and a promising future for mobile cloud computing technologies.

Chapter 2
Mobile Cloud Media: State of the Art and Outlook ....................................................................... 18
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Leveraging Mobile Cloud Computing (MCC), resource-poor mobile devices are now enabled to sup-
port rich media applications. In this chapter, the authors briefly review basic concepts and architecture
of mobile cloud computing, and focus on the technical challenges of MCC for multimedia applications.
Specifically, they discuss how to save energy, ensure Quality of Experience (QoE), deal with stochastic
wireless channels, support security and privacy, and reduce network costs for rich media applications.
Prototypes, ongoing standardization efforts, and commercial aspects are also reviewed. The authors
conclude this chapter with a discussion of several open research problems that call for substantial re-
search and regulation efforts.
Chapter 3
Addressing Fundamental Challenges in Mobile Cloud Computing with 4G LTE-Advanced

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Today, mobile tools, such as smartphones and tablets, have become primary computing devices for many users. One mobile tool to satisfy this is the 4G network technology LTE (Long-Term Evolution)-Advanced. These mobile tools are resource-poor due to limited battery life. Mobile Cloud Computing (MCC) is intended to provide services to mobile users by supplementing the resource-paucity of mobile devices (i.e. off-loading tasks/data on the Internet and providing the resources to a local client on-demand). However, despite LTE-Advanced’s improved network quality, much needs to be done before MCC can reach its true potential. This chapter characterizes key challenges for deployment of MCC with 4G: device battery lifetime, latency, quality of service/experience, and handover. Statistical modeling is a powerful tool to address these issues. Once MCC with 4G network behavior is characterized, it is translated into the future development of innovative mobile technologies for a wide variety of new applications.

Chapter 4
Privacy and Security of Wireless Communication Networks

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Wireless networks are inherently more vulnerable than their wired counterparts. In addition, complications arise in the presence of node mobility and dynamic network topology. Moreover, intermittent connectivity, whether caused by mobility or periodic node sleep, brings about additional challenges. At the same time, node resource constraints make direct adoption of existing security solutions difficult, if not impossible. Wireless Communication Network Security and Privacy analyze important problems in the realms of wireless networks and mobile computing. The Security aspects relate to authentication, access control and authorization, nonrepudiation, privacy and confidentiality, integrity, and auditing. Privacy is an essential feature of any product or service.

Chapter 5
Security in Mobile Cloud Computing

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Rosli Salleh, University of Malaya, Malaysia

Cloud computing is a new and promising technology that is transforming the paradigm of traditional Internet computing and probably the whole IT industry. Cloud computing is predicted to expand in the mobile environment leveraging on the rapid advances in wireless access technologies. These mobile applications are built around mobile cloud computing techniques and models. In the Mobile Cloud environment, users can remotely store their data as well as enjoy high quality on-demand cloud applications without the limitations of having to purchase and maintain their own local hardware and software. However, data security is still a major concern and is the main obstacle preventing cloud computing from being more widely adopted. This concern originates from the fact that sensitive data stored in the public clouds is managed by commercial service providers who might not be totally trustworthy. As such, there are several security and privacy issues that need to be addressed. This chapter gives an overview on the cloud computing concept followed by a description on mobile cloud computing and the different security issues pertinent to the mobile cloud computing environment.
Chapter 6

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Information systems and wireless communications are becoming increasingly present in the everyday life of citizens both from a personal and business point of view. A recent development in this context is Mobile Cloud Computing (MCC), which is the combination of Cloud Computing and pervasive mobile networks. Ensuring the preservation of privacy can be difficult in MCC. Therefore, this chapter provides an overview of the main challenges in ensuring privacy in MCC and surveys the most significant contributions from the research community. The second objective of the chapter is to introduce and describe a new framework for privacy protection based on the concepts of Virtual Object (VO) and Composite Virtual Object (CVO), where data are encapsulated and protected using a sticky policy approach and a role-based access model. The proposed iCore framework is compared to the privacy challenges described in the first objective.

Chapter 7
Agent-Based Resource Management for Mobile Cloud

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Mobile cloud computing is a new computing paradigm to integrate cloud computing technology into the mobile environment. It takes full advantages of cloud computing with great potential to transform a large part of the IT industry. The objectives of mobile cloud computing are to meet user demand, efficiently utilize a pool of resources, including mobile network, storage, and computation resources, and optimize energy on mobile devices. Here, the authors review the current mobile cloud computing technologies, highlight the main issues and challenges for the future development, and focus on resource management. Then, combining the current agent architectures and resource optimization strategies, they present an agent-based resource management to deal with multiple data and computation intensive applications of user demand. The chapter offers a promising solution of selecting the best service provider and efficiently utilizing mobile network resources given the user’s request constraint.

Chapter 8
Transporting the Cloud

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Cloud computing is consistently proving to be the dominant architecture of the future, and mobile technology is the catalyst. By having the processing power and storage remotely accessible, the main focus of the terminal is now related to connectivity and user-interface. The success of cloud-based applications greatly depends on the throughput experienced by the end user, which is why transport protocols play a key role in mobile cloud computing. This chapter discusses the main issues encountered in cloud networks that affect connection-oriented transport protocols. These issues include, but are not limited to, large delay connections, bandwidth variations, power consumption, and high segment loss rates. To reduce these adverse effects, a set of proposed solutions are presented; furthermore, the advantages and disadvantages are discussed. Finally, suggestions are made for future mobile cloud computing transport-layer designs that address different aspects of the network, such as transparency, congestion-intensity estimation, and quality-of-service integration.
Chapter 9
Mobile Video Cloud Networks

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Mobile multimedia computing has become ubiquitous in everyday life. However, mobile device users involved in resource-demanding visual applications such as video streaming often encounter performance degradations due to their mobile devices' intrinsic constraints in processing power, storage, and battery capacity. Cloud computing can be explored to circumvent such problems thanks to the vast resources available in the cloud. Mobile video cloud computing has thus emerged as an important research and development topic to achieve high-performance, innovative networked video applications. This chapter discusses the recent advances in mobile video cloud technologies and applications. The authors investigate mobile video cloud systems starting with the various mobile cloud paradigms and then present challenges and solutions of mobile video cloud management for mobility, context, and security. Furthermore, the authors examine the latest video coding standards and explore methods based on parallelisation and scalability for their optimised application over mobile clouds, followed by three highlighted mobile cloud video applications including streaming, transcoding, and gaming. Finally, future directions in this area are envisioned.

Chapter 10
Cloud-Based Service Delivery Architecture with Service-Populating and Mobility-Aware Mechanisms

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Advances in Mobile and Cloud technologies have redefined the way we perceive and use computers. Mobile devices now rely on Cloud technology for storage and applications. Furthermore, recent advances in network technology ensure that mobile devices in the future will have high-bandwidth connectivity at all times. This drives the incentive of doing all the processing and storage in the Cloud and using mobile devices to access the services. In this chapter, the authors argue that always-on connectivity along with increased demand of Cloud services will contest the Internet backbone and create problems in the management of Cloud resources. Client mobility is also a factor that should be taken into account when providing Cloud services to mobile devices. The authors therefore propose a new service delivery architecture that takes into account client mobility as well as the distance between clients and services in order to manage Cloud and network resources more efficiently and provide a better Quality of Experience for the user.
Chapter 11
QoS in the Mobile Cloud Computing Environment

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Mobile Cloud Computing (MCC) integrates cloud computing into the mobile environment and overcomes obstacles related to performance (e.g., bandwidth, throughput) and environment (e.g., heterogeneity, scalability, and availability). Quality of Service (QoS), such as end-to-end delay, packet loss ratio, etc., is vital for MCC applications. In this chapter, several important approaches for performance evaluation in MCC are introduced. These approaches, such as Markov Processes, Scheduling, and Game Theory, are the most popular methodologies in current research about performance evaluation in MCC. QoS is special in MCC compared to other environments. Important QoS problems with details in MCC and corresponding designs and solutions are explained. This chapter covers the most important research problems and current status related to performance evaluation and QoS in MCC.

Chapter 12
The New Paradigms of the Internet Combined with Energy Management: New Models and Tools to Aid the Integration of Data

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Earlier this century there was a crisis among the major Web companies. Berners-Lee started the concept of semantics for the Web. The large academic centers began to create tools to support the dissemination and research associated with their work; the collaborative networks emerged. Taking advantage of this new concept and seeking to attract new users to the Web, social networks began to emerge with a single purpose: to enable new users to customize data. Startups represent this new concept of the Web of the 21st century. In this sense, cloud computing, as well as energy efficiency should represent the biggest advances of this decade, enabling the growth of new market niches. This, along with the need for integration and mobility, is the object of study in this chapter.

Chapter 13
A2Cloud: The Anytime Anywhere Cloud

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This book chapter presents the integration of widely available technologies to bridge the gap between mobile devices and their computational rich surrounding environments. Taking as common glue Cloud Storage systems, new interaction between devices becomes more natural. The processing of files can be transparently executed on nearby computers, taking advantage of better hardware and saving mobile devices power. In this chapter, the authors present a novel resource evaluation mechanism, which allows a finer evaluation and more precise comparison of remote resources, leading to fewer wasted resources and better use of those resources. The use of remote resources can be performed by means of processing offloading, executing complete application on remote devices or by relocation of mobile classes. Both methods resort to the presented resource evaluation mechanism. Monolithic applications are transformed (with information from a configuration file) into distributed application, where some components execute on remote devices: nearby computers (to take advantage of existing human-computer interaction devices) or on the cloud (to speed processing). Processing offloading is accomplished by executing on nearby computers applications compatible with the one on the mobile device. This speeds that processing task (better CPU, better interaction devices), reducing the mobile device’s power consumption.
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Recently, Vehicular Ad Hoc Networks (VANET) have attracted the attention of research communities, leading car manufacturers, and governments due to their potential applications and specific characteristics. Their research outcome was started with awareness between vehicles for collision avoidance and Internet access and then expanded to vehicular multimedia communications. Moreover, vehicles’ high computation, communication, and storage resources set a ground for vehicular networks to deploy these applications in the near future. Nevertheless, on-board resources in vehicles are mostly underutilized. Vehicular Cloud Computing (VCC) is developed to utilize the VANET resources efficiently and provide subscribers safe infotainment services. In this chapter, the authors perform a survey of state-of-the-art vehicular cloud computing as well as the existing techniques that utilize cloud computing for performance improvements in VANET. The authors then classify the VCC based on the applications, service types, and vehicular cloud organization. They present the detail for each VCC application and formation. Lastly, the authors discuss the open issues and research directions related to VANET cloud computing.

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Previous medical services for humans provided healthcare information using the static-based computing of space-constrained hospitals or healthcare centers. In contrast, current mobile health information management computing and services are being provided so that they utilize both the mobility of mobile computing and the scalability of cloud computing to monitor in real-time the health status of patients who are moving. In addition, data capacity has sharply increased with the expansion of the principal data generation cycle from the traditional static computing environment to the dynamic computing environment. This chapter presents mobile cloud healthcare computing systems that simultaneously leverage the portability and scalability of healthcare services. This chapter also presents the wearable computing system as an application of mobile healthcare.

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This chapter is about the study of treatments for autistic children and interventions of entertainment games with the purpose of developing a technological solution in order to promote a better adaptation between the autistic children and treatment, consequently showing better results in a shorter period of time. The multidisciplinary software for Autism treatment is being developed. It is based on PECs, ABA, and TEACCH methods, and it uses ludic games and activity interventions. Before applying technology to autism treatment, a deep study about autistic children is made. This way, concepts such as customization and the use of Kinect, Mobile (WP7), and Cloud Computer technologies take part as a stimulator system, since they are responsible for intensifying cognitive development and reducing the patient’s excitement, aggressiveness, and irritability.
Cloud Computing is one of the most rapidly evolving technologies available today that offers the possibility of multimedia content exploitation with rich media experience. Cloud computing users have the flexibility to enjoy media content independently of time and space. Multimedia cloud computing encompasses technology, multimedia data, and community contribution, offering augmented multimodal interaction and advanced processing services to the users. Mobile multimedia resources can now be accessed through the cloud practically at anytime and from anywhere, facing contemporary demands for information access and process, thus perfectly matching to the nature of news media. Such features are very favorable in online journalism and specifically in news reporting services. This chapter presents technological and application-oriented trends in cloud-based mobile news reporting both at journalists' (news producers) and users' (news consumers) sides. Future and emerging perspectives, such as ubiquitous and pervasive computing, incorporating context and location-aware services in semantic interaction modes, are also described from the news-reporting point of view.