Preface

Multimedia services include the processing and communication of image, audio and text in real time. The convergence of computer communication and telecommunication has re-defined current multimedia and coming services. Internet has come to be the new backbone for convergent multimedia services. Examples of convergent services over Internet are *Voice over Internet Protocol* (*VoIP*), *Television over IP* (IPTV), IP Telephony, Real time video streaming, *Video on Demand* (*VoD*) … In the last recent years, a lot of services like these have appear in the Market and new kind of services are expected in the next recent future (in fact every day appear new forms of multimedia services over Internet).

It is well known the high evolution of wireless networks in the recent past. But it is also true that this evolution is being increased every day at present. Current and coming mobile devices (sometimes defined as ultra-small-mobile-computers) are being defined every day: From smart mobile telephones to new multimedia tablets. The topology of interconnection of these wireless mobile devices varies from a *Wireless Personal Area Network* (*WPAN*) to a *Wireless Metropolitan Area Network* (*WMAN*). These networks and mobile devices allow their users to use Internet multimedia services at any time and at any place where there is wireless coverage.

Taking into account the joint work of multimedia services and mobile devices, it is easy to realize a scenario of future impact of coming mobile multimedia services to be implemented in coming mobile devices. The research area of mobile multimedia is active nowadays and some commercial interests are also very important. In this research area there are a lot of challenges and innovations. Examples of challenges are the efficient communication of media streaming in different wireless topologies and technologies, the definition of efficient application level mobile streaming protocols, the codec adaptation to efficiently stream multimedia information, the content adaptation for mobile devices and the efficient distribution of streaming services to mobile users defining a good *Quality of Experience* (*QoE*).

The book editors have a long experience in mobile multimedia streaming over mobile devices. They have organized this book for young and experimented researchers in mobile multimedia, graduate and under-graduate students, university professors (exposition of relevant description cases), people interested in mobile multimedia, network engineers and designers, leaders of emerging technical companies, multimedia mobile applications designers...

The editors (guided by the reviewers) selected 49% of the received chapter proposals. The selection was guided in order to show the reader some challenges and innovations in multimedia services for mobile devices. They selected research works and reviews of current state of the art challenges. The contributors are currently working in research centers at the University and in the department of research and innovation of Telco companies. The idea is to provide not only a vision of current challenges and research solution, but also actual works in the Technical companies. These final works will aid researchers

in defining better solutions to the problems they are studying because they will have information about which works companies have interests in (favoring in this way the innovation).

The first challenge is reviewing the identification of Real time constraints for actual mobile telephones and wireless networks. Once these constraints are identified some challenges in streaming video are also identified and specifically those challenges that are influenced by the limited computational resources of mobile devices and bandwidth of mobile networks.

In order to be specific and clear, it is analyzed the specific challenges for different kinds of mobile network topologies. First we analyze the problems of Multimedia in a mobile *Worldwide Interoperability for Microwave Access* (*WiMAX*) network for VoD as well as broadcast TV services. Additional challenges like rate and congestion control are analyzed. And particular solutions: multi-connection streaming and data-partitioning are proposed. The main idea is to show the problems of Streaming in this kind of network. Networks in the short range (*Wireless Personal Area Networks* (*WPAN*) and *Wireless Local Area Networks* (*WLAN*)) are also excellent candidates for implementing future multimedia services based on local streaming servers. It is clear that in the next years wireless technologies for short distances could change the current cable communications for domestic mobile devices. In this area there are several kinds of multimedia streaming based services that could use new standards of *Institute of Electrical and Electronic Engineers* (*IEEE*) and *European Computer Manufacturers Association* (*ECMA*). It is also reviewed those standards to inform the reader of possible new improvements in this kind of communications related to multimedia services. Some challenges and solutions are also presented in order to discover the key features of these new standards favoring innovation in multimedia and mobile devices design.

The Streaming is hard to implement in wireless networks, in part due to time and space varying nature of wireless channels. Thus, to maintain the quality of wireless multimedia streaming throughout the transmission is a challenging task. The adaptation of the codec in real time to the wireless channel conditions using information provided by the *Received Signal Strength Indication* (*RSSI*) and *Medium Access Control* (*MAC*) is a good solution. This topic is also reviewed to show solutions to provide high quality video to mobile users mitigating the adverse effects of wireless channels.

The only way to improve the quality of video reception in mobile devices is not to adapt the codec. There are recent proposals to modify the streaming protocols or propose new ones. Traditional Streaming protocols must be adapted to efficiently issue multimedia information to mobile devices. Recently the old project *hotmedia* have received renewed verve. That is, *HyperText Transfer Protocol* (*HTTP*) is the new candidate to be used for mobile media streaming. Two well known and well commercially established Media platforms mark the forefront in this new tendency. An interesting overview of these two platforms is presented. The utility of this overview is high due to the researchers could analyze the state of the commercial business of media streaming for mobile devices. In this manner they can propose practical and challenging ideas in their streaming research works. Also the graduate students, network engineers, designer … can observe the tendencies in media streaming and mobile devices business. The convergence process between computer communications and traditional telecommunication business is sometimes guided by commercial initiatives. For this reason, an interesting initiative named WIMS 2.0 (born in a Telco company) is presented. Some barriers to converge between Internet multimedia services and traditional Telco services are presented and also some challenges and a new business model.

Nowadays there is an intense diversification among the devices that can display multimedia content to the user. This does not always respond to marketing strategy for selling more devices but in other cases that diversification is necessary in order to attend the different user profiles. In any case, this represents a problem from the point of view of multimedia content visualization in the mobile devices. Media Re-

source Adaptation for Multimedia Services and Streaming Media for Mobile Telephones are important topics in actual mobile devices. Some devices are unable to receive large audio-visual data volumes in the original quality that they were stored in on the VoD server. The original multimedia content must be issued to different mobile devices and this means the content must be adapted to different formats in real time. This adaptation must also take into account current mobile device capabilities, network characteristics, server capacities and user preferences. To illustrate this challenge several works are presented. The first one is a survey on media resource adaptation in which related standards and specifications are presented. The aim of this survey is to introduce this topic to young researchers on and to update the knowledge of experienced researchers. The second one is a work centered on the design and implementation of remote visualization applications that presents solutions for streaming interactive and customizable (adaptation) multimedia contents to mobile devices. This work introduces the design of applications that treats large multimedia data sets in the mobile clients. Most of today's smart-phones are geared towards a single user experience: reading a book, watching a movie, playing a game or listening to music. Smart mobile phones offer the access to Social networks to share information and access to shared documents and videos. Some timid effort has been done in the area of real time video sharing in mobile devices. The need of a general programming platform to develop applications that help users to connect and share information with each other is discovered in another chapter. It is presented to the Misco framework in order to solve this challenge and treat large data sets in mobile devices. Another very interesting kind of application is m-learning, one that automatically adapts to the current situation and intention of the user. It is explained as the technical architecture behind these kind of applications. The aim is to show recent and future trends of mobile applications for mobile devices that could take into account streaming technique to share large data sets.

In the last few years a lot of work has been done to obtain good metrics for *Quality of Experience* (*QoE*). To cope with this topic an interesting survey is presented aimed at young researchers to introduce in this research area. It also overviews the most recent advances and challenges in assessment and traffic conditioner procedures for wireless multimedia streaming systems. It is presented as the use of well-known objective and subjective QoE metrics, namely, Peak Signal-to-Noise Ratio, Video Quality Metric, Structural Similarity Index and Mean Option Score in a case study.

At this point we turned back to the adaptation of the design of mobile multimedia applications for wireless network topologies. To do this, the book presents two examples of how to optimize Quality of Service (*QoS*) and *QoE* in two interesting wireless network topologies: mesh connected wireless networks and Vehicular *Ad-hoc NETwork* (*VANET*). These two topologies share the ad hoc interconnection of mobile devices. In the first case, an additional backbone of fixed network routers is in charge to efficiently manage the routing of multimedia content. In the second case is a pure ad hoc network in which the mobile devices (we can consider the vehicles as the mobile terminals in this case) circulate at a certain velocity and have several movement restrictions. In both kinds of networks is a large challenge to provide QoE and QoS. Two simulated case studies are shown for both types of topologies. In the first one, results show that Multi-description Coding (not an adaptation of multimedia content technique) achieves better quality on video transmissions when nodes have medium or high mobility; especially when using multipoint-to-point transmission or disjoint paths in a hierarchical structure. In the second one, it is proposed the concept of resilient multi-source streaming using a peer-to-peer overlay network over an urban VANET and the examination of the impact of differing traffic densities and road layouts upon a peer-to-peer overlay network's performance when streaming video. These two updated works

are representative of the research that has been done in streaming over new and future kinds of wireless networks and mobile devices. The aim is to show recent and possible future works in this research area.

The editors end the book with a chapter that introduces interesting actual mobile multimedia services. Challenges of mobile video streaming are also presented as well as characteristics of the actual mobile telephones, operating systems, programming environments and commercial video server. The aim is to resume and present new challenges in mobile video streaming. Also the editors present a new manner to solve the analyzed problems using a software agent based proposal to cope with the problem of multiplatform solutions to mobile video streaming. The editors think that in the next years it would be very interesting to cope with efficient multiplatform solutions in mobile multimedia and streaming software.

The different works presented in this book present different faces of the mobile streaming and multimedia services in actual mobile devices. On one hand, an intention of the editors was that the experimenting researcher could find new material in this book (research and commercial proposals). Another intention of the editors was that the interested public could find an interesting introduction to the challenges and innovations in this research area.