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GUEST EDITORIAL

Special Issue on Radio Resource Management for Provisioning IP-Based QoS in Wireless Cellular Networks

Quality of service (QoS) has been a commonly overused term with various meanings and perspectives in the past few years. IP networks such as the Internet and Wireless Cellular Networks (WCN) have been looking at QoS provisioning from rather different perspectives. Currently, two operational QoS models are proposed for the Internet: Integrated Services (IntServ) aided with Resource Reservation Protocol (RSVP), and Differentiated Services (DiffServ). Both models mainly concentrated on migrating traditional best effort Internet service with no guarantee on delay or throughput or even reliable delivery of packets into a more predictable architecture. The IntServ model aims to guarantee the QoS in a manner of end-to-end fine granularity, but its scalability is impaired by the need to maintain per-flow state at each core router. The DiffServ model attempts to resolve the scalability problem by replacing the per-flow service with an aggregate-class, per hop service, while pushing the per-flow state management to edge routers.

Extending such QoS paradigms to WCNs is an important step towards achieving all-IP networking. Enhanced Radio Resource Management (RRM) techniques are needed to improve system performance by maximizing the overall system capacity and maintaining the QoS of mobile user traffic. RRM is a set of algorithms that control the usage of the scarce radio resources. RRM functionality is aimed to maximize the overall system capacity in the cellular network. A common definition for capacity is the maximum traffic load that the system can accommodate under some pre-defined service quality requirements. In order to study effective resource management techniques, it is necessary to understand and define the conditions that limit the cellular capacity. These conditions are related to the services characteristics (voice, video or data), the propagation channel variations, the power control operation and the user mobility patterns. The basic RRM components can be classified as follows: Handoff and mobility management, Call Admission Control (CAC), load control, channel allocation and reservation, packet scheduling and power control.

RRM in present cellular systems has essentially been optimized for voice services. However, this is not valid when IP-based QoS is to be supported. QoS requirements can be parameterized in terms of service guarantees and/or service differentiation of throughput, delay, delay variation (jitter), loss and error rates, security guarantees, etc. Therefore, the need for enhanced RRM strategies to enable IP-based QoS provisioning becomes more important.

We are honoured and pleased to report that we have received a total of 25 high-quality paper submissions out of which we were able to accept six. The following briefly introduces the six papers that have been selected to appear in this issue.

The first paper, 'Combined Fair Packet Scheduling Policy and Multi-Class Adaptive CAC Scheme for QoS Provisioning in Multimedia Cellular Networks' by T. Begaoui *et al.*, proposes

an adaptive QoS-based CAC algorithm and a novel fair packet scheduling policy for supporting multimedia services in UMTS cellular network. The CAC scheme, based on service class differentiation, aims at maximizing the use of available radio resource and meeting the QoS requirement of mobile users when the system is overloaded. The scheduling policy, based on an Enhanced Weighted Fair Queuing algorithm and it takes into account a realistic behaviour of traffic while considering the spatial variation of the system characterizing both the user mobility and the signal propagation impairments due to the surrounding effects.

H. Bai *et al*. in the second paper, 'Layered View of QoS Issues in IP-Based Mobile Wireless Networks', presents a comprehensive survey of the rapidly growing research area of enhancing IP services over mobile wireless networks from a layered view. They discussed research issues and solutions to design a multi-layer IP protocol stack for wireless networks that includes middleware layer, transport layer, network layer, MAC and physical layer. They showed that QoS provisioning is required at various layers of the IP protocol stack to guarantee different types of service requests. Many open issues in this emerging research area have also been highlighted.

The third paper, 'Selective Advance Reservations Based on Host Movement Detection and Resource-aware Handoff', by K. Lee *et al*. addresses the excessive advance reservation requirements of QoS guarantee methods for mobile Internet. A novel scheme is proposed in this paper to guarantee seamless QoS for mobile Internet with RSVP. The scheme considers host mobility and provides a number of architectural advantages: avoid multiple useless advance reservation, resource-aware handoff direction scheme to manage the network resources more efficiently, reduced handoff latency and it requires no changes to the existing RSVP and Mobile IP protocol.

The fourth paper, 'QoS-Aware Call Admission Control in Wideband CDMA Wireless Networks', by H. Hassanein *et al*. deals with uplink admission control in UMTS-based wireless networks. A framework features an efficient CAC algorithm coupled with a QoS class-separation mechanism based on the transmitted power of each individual mobile terminal is developed to increase system throughput and to decrease blocking and dropping ratios. The framework consists of three inter-related components: (i) a measurement-based module, (ii) a power-prediction module and (iii) a call admission control algorithm with a power sharing structure.

A channel borrowing problem in wireless cellular networks that provides multimedia services is addressed by Y-T. Wang *et al*. in the fifth paper, 'Adaptive Channel Borrowing for Quality of Service in Wireless Cellular Networks'. Fuzzy logic control and neural networks techniques are utilized here to formulate a new efficient dynamic channel-borrowing scheme for load balancing and satisfying the diverse QoS requirements of multimedia traffic. The scheme has unique features: better learning abilities, optimization abilities, robustness and fault-tolerant capability. They show by simulation that the proposed scheme has a faster and smoother response than conventional systems.

Q. Wang *et al*. in the sixth paper, 'Signalling Analysis of Cost-Efficient Mobility Support by Integrating Mobile IP and SIP in All IP Wireless Networks', designs cost-effective mobility architecture for wireless networks which supports advanced IP-based terminal and personal mobility. The architecture integrates Mobile IP (MIP) and Session Initiation Protocol (SIP). It is featured by the capability to locate a roaming user globally regardless of his or her current location or the terminal being used, the efficient support for both TCP and UDP applications, the choice to register with multiple terminals, and the adaptation to macro-handoffs by session

renegotiation or update. They evaluate the architecture by simulation and discuss implementation issues.

We would like to thank all the authors who responded to the call for papers. We would also like to express our sincere thanks to all the reviewers who did an excellent job. Special thanks to the Editor-in-Chief, Professor Mohammad S. Obaidat and the Editorial Staff at John Wiley and Sons, for their continuous support and professionalism.

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