ABSTRACT

Wireless data services have captured only a limited market share so far, due to the limitations on transmission rates. The general perception is that the future mobile communications technology will deliver better quality of service as the wired networks do now. However, a number of obstacles need to be tackled before this could be achieved. These problems arise principally from the band limiting nature of the wireless link, which is extremely hostile due to multi-path fading. The future systems are expected to support much higher data rates than what the existing systems can currently offer. It has been universally agreed that a richer set of QoS levels are still needed for the emerging networks to successfully launch the upcoming applications. Therefore, spectrally efficient techniques, which could simultaneously meet the QoS guarantees is highly essential. This prompted for developing QoS solutions that are suitable to meet the multifaceted requirements. Although, CDMA is the preferred access technique, the predominant influence brought out by GSM systems has resulted in TDMA cellular markets to capture about 75% of the wireless population. The investigations have thus been to enhance QoS in both the competing access technologies. The ability of a network in establishing and maintaining wireless connections gives the measure of offered QoS. Therefore, the prime focus has been given to QoS from network perspective, which relies greatly on the radio resource tools like call admission controller, scheduler, power control schemes etc. These QoS components reflect the network's availability and transmission quality. Thus, this study focuses on various adaptive methods by which the radio management techniques can be better tuned to overcome the obstacles.

The call admission controller limits the number of new calls admitted into the network in order to reduce the network congestion. The dropping/blocking probabilities have been analysed to help in finding the load carried by the network. In the first phase, mobility predictive multi-class admission control algorithm has been proposed for cellular mobile networks and their performance is tested in terms of blocking probabilities and resource utilization rates.
The scheduler assigns the required amount of resource at the right time to the admitted user. Due to time varying channel conditions, mobile users accessing the cellular networks will observe a fluctuating performance. Therefore, the wireless schedulers should essentially involve the channel state of the user for making scheduling decisions. This clearly established the need for the association of channel predictors with schedulers. A novel channel predictor has been introduced to enable the scheduler to take optimal decisions. Scheduling decisions purely based on link conditions will tend to improve the performance without satisfying user fairness. Hence, a link adaptive scheduling scheme that achieves a higher performance gain in terms of throughputs together with and without user fairness is executed in the second phase of the work.

Studies demonstrate that it is possible to achieve an improvement in spectral efficiency by varying the transmission parameters such as modulation levels and power control. Therefore, link adaptation technique is employed to further improve the spectral efficiency besides satisfying the quality assurances. The need for incorporating the loop delay has paved the way for developing a predictive power control scheme. The ability to predict the interference using kalman filter is the attractive feature of this work. In the third phase, power control and adaptive modulation schemes have been jointly executed to satisfy the objectives.

To further enhance the performance, in the final phase an integrated QoS model has been suggested. This model can be realized by performing adaptation at two levels: adaptation by scheduling and adaptation by varying the transmission parameters. It has also resulted in the improvement of the short-term user performance, which is mainly affected due to greedy resource assignments.

In short, this research contribution mainly has focused on enhancing quality using adaptive elements for various air interfaces from network perspective. It has been identified that improvement in quality as well as spectral efficiency is possible with the proposed solutions. The research findings are certain to attract the network operators and contribute in a large measure for better quality of service.