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Title of the Thesis: **Capacity Improvement of Multi-Bearer Services and Multi-Access Wireless Networks by Using Radio Resource Management Principles**

ABSTRACT

The capacity of a wireless communication network is the maximum number of the subscribers that can be accommodated for a given quality of service parameters. The use of wireless communications has experienced a tremendous growth in the past few years. This number is expected to rise more and more in the coming years.

This remarkable growth has been possible due to a technological factor, which is a rise in the count of the bearer services that the wireless systems provide and this technological factor has consecutively raised the number of end-user services too. The necessity of an enhanced ability of the wireless systems to deal with plenty of users has connection with this growth as well. Developing and setting up of more innovative radio access technologies that go hand in hand with their predecessors can moderately allow growth to be achieved. Hence, the two characteristics that the future wireless networks are expected to exhibit could help in imparting both the multiple bearer services as well as the parallel utilization of multiple radio access technologies.

This work has three parts. The first part of the work is relating to capacity and QoS improvement of Ad-hoc networks. The second part is relating to capacity improvement of GSM networks and the third part is relating to the capacity improvement of CDMA networks. These are being achieved using different techniques of radio resource management principles for different multi-access wireless networks.

The first part of the work examines the quality and capacity improvement of Ad-hoc networks using AODV protocol. Several wireless nodes, which accomplish communication devoid of the presence of a centralized administration and possibly contribute to the routing process in union, constitutes the wireless Ad-hoc network. This work entails the examination of packet scheduling algorithm, which helps in locating those factors that massively enhances the performance in case of a congested network. The network's performance can be improvised, if a scheduling algorithm that schedules the packets in accordance with their priorities exists. Normally, the packet schedulers of wireless ad hoc networks employ FIFO fashion to render the data packets. This work introduces a fuzzy-based priority scheduler, which makes use of Ad hoc on demand distance vector (AODV) to be the routing protocol for computing the packets' priority in case of mobile ad-hoc networks. The OPNET simulator has been exploited to investigate about the scheduler's performance in terms of throughput, end-to-end delay and packet delivery ratio. The scheduler, when assessed with various load and mobility conditions, was found to enhance the entire system's performance. The simulation results reveal that the priority scheduling effectively route the packets at the minimum delay and data loss. Substantially, about 38% of the enhancement has been attained on the entire packet transmission and the end - to - end delay experiences a reduction of about 0.4 seconds. Hence, it is concluded that the network with proposed fuzzy scheduler outperforms the network with no scheduling algorithm.

The second part of the work examines the capacity improvement of GSM networks using soft computing techniques. The beginning of the era of 2.5G services may cause the tele-traffic demand in GSM networks

to increase in an exponential fashion. This work introduces a novel approach, which can augment the network capacity of a typical GSM network. Neural networks, which serve as one of the major components of the adaptive radio resource management system, allow forecasting the future resource demands of all the cells in the network. In the subsequent step, the genetic algorithm does the process of frequency assignment. A total of two approaches have been dealt to perform frequency assignment. In the former approach, the optimal solutions that are associated with the resource requirements were produced and in addition, every single assignment cycle is bestowed with individual frequency assignment plans. On the contrary, the latter approach is capable of maintaining most part of the frequency assignment plans that corresponds to every assignment cycle and may not result in optimal solutions very often.

The third part of the work examines the capacity improvement the Code Division Multiple Access system of wireless communication network by two methods: first by cell splitting method and second by cell sectoring method. In cell splitting method, a location area that is composed of larger cells, which can be divided again into cells of smaller size, has been considered to bring about the enhancement in the system's capacity. This process is only performed in the cell splitting method. The cell splitting approach allows all the areas with abundant congestion (termed as, macro cells) to be split into cells of smaller size (termed as, micro cells, pico cells and femto cells) in such a way that every single smaller cell will have a base station as well as a set of frequency channels individually. Further, the area that a single large power transmitter covers will be now controlled using more number of low power transmitters in the cell splitting phenomenon. Additional traffic can be managed, when the cell radius is decreased. If a certain site is seen to generate a traffic load, then the service to the customers can be rendered only with the presence of large number of base stations. Usually, all the cells possess a individual base station. Due to the reduced radius of the newer cells, when compared to the radius of the larger cells, there would be an increase in capacity with the rise in the number of channels per unit area. The computation of the processing gain, the user-transmitted in-band signal power that helps in attaining the required SNR, the numbers of subscribers demanding service inside every kind of cell, the probability that specify the degree of failure of a call attempt are made later. The MATLAB simulation software has been employed to produce the results and then, a comparison between the results is performed. The second method of the third part of the work examines the performance of the Code Division Multiple Access system of wireless communication networks with the help of the cell sectoring method. The Global System for Mobile communication has limitations on bandwidth, whereas the Universal Mobile Telecommunication Services (UMTS) that make use of the CDMA system has limitations on interference. In the past few years, there is a massive growth in the number of users. But, most of these users lack access to these networks. The inadequacy of channels as well as the worst quality of radio channels may be stated as the cause of such denied access. The continuous increase in the number of cellular mobile users, in addition to the associated impairments in the system is viewed as the major concern of the present network operators. In this work, the CDMA system has been examined to find out a more appropriate scheme that employs cell sectoring for enhancing the cellular capacity. With the improvement in cell capacity, the available static resource spectrum (channel) can be exploited in an optimal way for enabling lager number of mobile users to make access to the network. The directional antenna system plays a crucial part in reducing the number of interfering users in the cell sectoring approach. Therefore, the co-channel interference that badly affects the CDMA system can now be considerably decreased, letting to optimal channel utilization. In Greater Noida, a drive test measurement has been conducted on one of the available mobile cellular network systems that own the CDMA access technology. Using MATLAB software, the simulation of the derived models that utilize cell sectoring to bring about an enhancement in the cellular capacity has been performed. From the results, it is evident that a fall in the interference can cause a rise in the number of users accessing the network.