Abstract

Wireless Communication has witnessed tremendous growth in last decade. Variety of newer applications encompassing every walks of life are emerging based on wireless communication platform. However, channel interference, fading, providing high speed reliable and secured communication are still the challenges which prevent the wireless communication systems from fulfilling the demands of novel applications. Cooperative communication has shown the capability of making wireless communication ready for challenging applications of the next generation. In cooperative communication wireless nodes cooperate with each other to create virtual spatial diversity to yield the benefits of diversity combining without using multiple antennas. Duplication of transmission, wastage of resources, increased interference, increased traffic and selfish behaviour of the node are the challenges which are the hurdles in the path of implementation of cooperative protocols in the wireless network. Appropriate mechanism of resource allocation can be employed to resolve many issues in the cooperative network.

Resource allocation mechanisms are evolved in this thesis for Centralized, Semi-distributed and Distributed environment. In order to achieve improved data rate in centralized network, transmission power of source & relay and bandwidth are the resources considered for judicious allocation. Three approaches are developed to yield efficiency-fairness trade-off in the network as (a) Utility function based (b) Resource constraint based, and (c) E-F function based approach. A generic utility function is developed to allocate resources to achieve five types of allocation: (i) efficient, (ii) proportional fair, (iii) min-max fair, (iv) minimum delay fair, and (v) desired degree of trade-off between efficiency and fairness. Performance of all approaches are evaluated by extensive simulations. The results exhibits that the proposed approaches are capable to allocate the resources to increase the data rate of users compared to non-cooperation. Also, the approaches have capability to allocate the resources as per the class of services and applications of users.

To eliminate the need of global channel knowledge at the central controller, nodes are motivated to cooperate using the concept of pricing in distributed network. Multi-unit auctioning based on revelation demand curve parameters is proposed in this thesis. The proposed technique has
lower computational complexity, lower overheads and need less time before starting cooperation phase unlike conventional clock auctioning techniques.

Advanced wireless networks are aimed to be fully autonomous, heterogeneous and self-organizing. The price mechanism is supervised by the central controller as discussed in the previous paragraphs and is not suitable for this kind of networks. The mechanism with exchange of resources such as power and bandwidth is considered in the literature as a suitable mechanism to leverage the benefit of cooperation for such networks. Nodes in the network form pairs having complementary resources and share the resource own by it with the partner. A one-shot algorithm, for negotiation between the source and the relay with fewer overheads, is developed and compared with conventional iterative algorithm. The proposed exchange mechanism not only stimulate nodes to stick to cooperation, but also save energy and increase data rate.