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The research work focuses on the problem of channel allocation in present day wireless networks. The aim was to develop novel approaches for high performance hybrid channel allocation algorithms for wireless networks. In general, the term "channel" could be referred to frequency or time slot or code. The main emphasis of this work has been on the frequency aspect. The research methodology is experimental and divided into five phases. The first phase consists of minimizing the network cost while allocating channels (fixed and dynamic) and ensuring high reliability (in terms of link failure). A technique to design a cost optimal wireless network layout which incorporates some real life constraints of cost and reliability is proposed. This has been achieved by efficiently numbering the nodes of a wireless network to obtain a minimal cost K- fault tolerant network preserving the actual topology. The second phase of our work consists of maximizing the utilization of available frequency spectrum with minimum or no interference. The work in this phase concentrates on utilizing the available frequency in an effective way while allocating channel dynamically in a distributed wireless network. The issue is addressed in a distributed environment with minimum message complexity and channel acquiring time and better channel utilization. This is achieved by partitioning the cells of the network into clusters where one cell may belong to more than one cluster. The proposed channel assignment technique assigns channels in a distributed way as intra-cluster assignment. The performance of the technique is verified with

simulation. The next phase emphasizes on minimum channel acquisition delay. We proposed a token based mutual exclusion technique to solve the problem of distributed dynamic channel allocation. We showed through simulation, how message exchange between cells is reduced in token based relaxed mutual exclusion as opposed to other relaxed mutual exclusion techniques. The fourth phase focuses on adaptive channel allocation technique with or without prior traffic load prediction. Channel allocation in wireless communication network plays a crucial role in the performance of the network. The fuzzy clustering technique introduced in second phase of our research work is further extended to impart the ability to change according to incoming traffic. The work addresses the issue of efficient time bound channel allocation in cellular network with non-uniform traffic load distribution. The proposed technique identifies "heavy load_cells" and partitions the cells of the network into groups where the "heavy load_ cells" will act as a group head. The number of such groups is not known a priori. We presented a hybrid traffic aware channel allocation technique which adapts itself on the basis of altering load patterns for every region. The technique is based on backpropagation algorithm for identifying the traffic trends of different regions or cells and utilizes the information for clustering cells and spectrum allocation in an intra-cluster manner. The final phase concentrates on energy efficient channel allocation in WiMAX (IEEE802.16e) and Wireless Mesh Networks with maximum channel utilization. A hybrid multi-channel allocation in wireless IEEE802.16 network is formulated through game theory approach. Hence, a Fuzzy game theoretic approach is proposed.