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Multihop Cellular Network Using OFDMA – A Survey

S. S. Saravana Kumar

Department Of Electronics And Instrumentation Engineering, Sri Chandrasekharendra Saraswathi Viswa Maha Vidyalaya (SCSVMV University),INDIA.

A B S T R A C T

MCN have made much impact in future generation networks, thanks to its better throughput and network coverage. But, still there are issues just like the signal coverage in dead spot and hot spot which don't seem to be addressed and also to urge the high throughput. The cochannel interference becomes severe in mobile station near cell edges, which affects the network performance. Here we present a comparison on different resource allocation schemes and also a way to reduce the co channel interference between the users using Orthogonal Frequency Division Multiple Access (OFDMA) technique and also Intercell Interference Coordination (ICIC) is investigated.

Keywords:MCN, Relay Stations, SCN, OFDMA/TDD, Relay Zone, ART, CCI, Access Zone.

1. Introduction

Next generation cellular networks exploit orthogonal frequency division multiple access (OFDMA) technology for Multihop cellular networks (MCNs). In OFDMA, larger data has been split into several smaller data packets so transmitted through radio waves. In Multihop new relay transmitters were introduced inside base stations for communicating between user and mobile station to extend the network signal. The relay uses the shared power from the bottom station to scale back the work load within the base station, because of this distribution of power eventually. Due to these new relay strategies introduced within the cell structure, we are able to increase the coverage at cell edges within the other hand, OFDMA uses multiple access technique.

Orthogonal frequency division Multiplexing (OFDM) could be a most well-liked scheme for wide band electronic communication for both wireless and wired applications. Initially OFDM is employed for wired and general stationary wireless communications. However increasing the OFDM usage for highly cellular environment will make the users to research more. OFDM is nothing but a frequency division modulation scheme which uses digital multi-carrier modulation method. The massive data is split into several smaller data packets or channels then transmitted together with sub-carriers which are modulated with conventional modulation schemes like Quadrature AM at very low symbol rate within the same bandwidth. Generally, wireless cellular systems are multi user systems during which the radio resources are limited to bandwidth and also number of channels. These radio resources are used among multiple users so as to manage the transmission of information multiple access controls which are needed for both contentions based and non-contention based transmissions. The OFDMA allows different users to transmit the information over different portions of the broadband spectrum. This helps in reducing the co-channel interference between the users.

An extra radio resource for the booster amplifier plays a serious drawback for the Multihop Cellular Networks. Hence, a well-designed radio resource allocation schemes were needed for MCNs to eventually utilize the benefits of RSs by overcoming its disadvantages. In MCNs, RS also uses the identical spectrum as MSs or BSs, hence there could also be an opportunity of occurring co-channel interference to radio resource allocation schemes in MCNs. Keeping in mind, OFDMA system have to employ the frequency reaching to acquire good performance at cell edge and make ease for interference management. A reuse factor of three or 7 is employed in single-hop networks (SCNs) to scale back CCI, which ends up in low spectral efficiency. As we all known, the most feature of future cellular networks is its high

* S. S. Saravana Kumar. Tel.: +91 99405 17232.
E-mail address: sssk.saravana@gmail.com

rate. Hence a frequency reuse of 1 is also employed in LTE-Advanced and IEEE 802.16m systems which might aim for improving the spectral efficiency. Due to this frequency reuse planning, there could also be an absence in performance at cell boundaries.

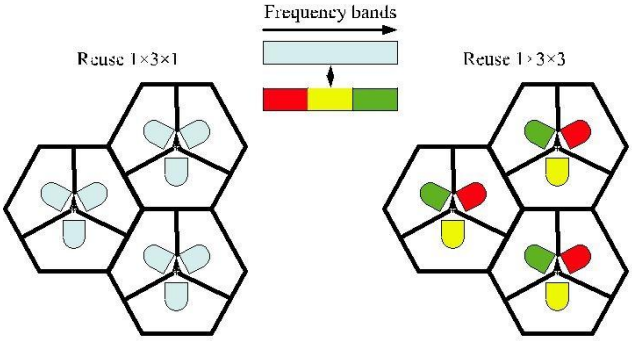

Fig. 1 –Frequency Re-use Pattern for Networks.

According to WiMAX forum, the frequency reuse pattern may be expressed as NxSxK. Means each network is split into group of N cells with S sector and K different frequency bands per cell. That means, all available frequency spectrum is given to the arena Base Stations (BSs) in an exceedingly reuse pattern of 1x3x1 or either within the reuse pattern of 1x3x3, only 1 third of band is reused. The Figure 1 shows both the reuse patterns. From the figure we will say clearly that co-channel interference (CCI) level is higher within the first and spectral efficiency is far lower within the secondary reuse pattern. If 1x3x3 is employed in MCNs, there could also be a discount in spectral efficiency; it's due to extra frequency resources were allocated to the boosters. Keeping in mind about the importance of frequency reuse scheme for multi cell scenario we are able to use 1x3x1 in MCNs. Compared with BSs arranged at cell centre and RSs installed at cell edge causes severe interference, because RSs are very closer to the mobile stations within the adjacent cells than that of base stations.

2. System Model

According to KibeomSeong, Mehdi Mohseni and John M. Cioffi within the work Optimal and near-optimal resource allocation algorithms for OFDMA networks by Wireless Communications, IEEE Transactions in 2006, includes two algorithms, where subcarrier is assigned to a minimum of one user. The primary algorithm considers the initial condition. It also eliminates a channel from nearly have a condition that's one user at the one stage. This idea is understood because the Dynamic Programming (DP). With the assistance of the Dynamic Programming approach, development of branch-and-bound algorithm is guaranteed for the optimal solution. System capacity is increased from the 2 algorithms and encompasses a better gain comparatively.

M Rahaman, H Yanikomeroglu and W. Wong in 2008 Communications Magazine, IEEE – "Interference co-ordination and cancellation for 4G networks" stated within the article which is especially supported the Inter-cell interference Co-ordination (ICIC). It's a good benefit within the 4G OFDM system. Here, the present approaches are sued like Fractional power control, MIMO, SDMA, Static and adaptive fractional frequency reuse, intra and inter-based station interference cancellation, opportunistic spectrum access, dirty paper coding, sphere decoding, adaptive beamforming, network MIMO. Performance is summarized. Combination of these approaches will provide a strong N=1 reuse capability instead of one approach.

In 2008, IEEE Communication Magazine – "Overview of mobile WiMAX technology and evolution". this text is principally on the mobile WiMAX technologies. Mobile WiMAX is one among the access technologies within the fast growing broadband, combining both OFDMA and advanced MIMO. This creates a high air interface robustly, which incorporates a capacity of existing and evolving 3G radio access network. WiMAX network will be plug and play network deployments on all- IP spec. The mobile WiMAX supports the low-cost mobile internet application and specification. WiMAX will be a member within the 4G network also. Advancement within the field of radio and network with fair bandwidth.

In 2005 Wireless Communications, IEEE Transactions – "Adaptive resource allocation in multiuser OFDM systems with proportional rate constraints". This paper assures that every user can do a compulsory rate. The system will have the great Quality of service (QoS). For the separation of sub-channel allocation and power allocation, a low-complexity sub-optimal algorithm for the –user system is taken into account. This algorithm achieves ideal capacity. The Resource Allocation algorithm and equal power distribution is employed within the sub-channel. Within the case of power allocation, capacity is maximized. The radio resource allocation algorithm is employed, rather than the sum capacity maximization method and is distributed more fairly and flexibly among the users.

In 2005 Wireless Communications, IEEE Transactions – "Cross-layer optimizations for OFDM wireless networks-part I: theoretical framework" by G Song work relies on the cross-layer optimization. States that the Cross-layer optimization is taken into account to maximize the typical utility of all active users. This theory relies on the OFDM wireless network. Adaptive Resource Allocation schemes are wont to determine the active users on certain conditions. The utility, links between the physical and therefore the MAC layers, efficiency is balanced within the network, Significant performance gain of cross-layer optimization is understood by numerical results. This work is one in every of the bottom for the cross-layer optimization for the following generation wireless network. The modulation will be changed as per the channel conditions due to infinite number of subcarriers within the OFDM signal.

This work exploits the multi-user diversity by low-complexity approaches for the OEDM networks. Jiho Jang In 2003 IEEE Selected Areas in Communications, IEEE Journal "Transmit power adaptation for multiuser OFDM systems" stated that, the entire rate of multi-user OFDM system in downlink is maximized by a transmit power adaption. The transmit power adaptation (maximization) involves two steps. within the start, assigning a subcarrier to a group of users takes place; in such a condition that assignation should be done to just one users who has the most effective channel gain. The transmission power is distributed over the subcarrier by the water-filling policy. Within the second step, FDMA system with dynamic allocation.

3. Conclusion

During this work, we've disclosed the measurable study for an adaptive resource allocation scheme which is predicated on interference coordination with load balancing for Multihop cellular networks under different constraints. We also produced a survey on innovative frequency reuse scheme to eliminate the interference between the users and also to take care of high spectral efficiency. And presented practical LB-based handover mechanisms which won't to distribute the traffic load eventually and guarantee users' QoS. because the work considered by us, is that the earliest work which offer dynamic resource allocation by jointly considering the load balance and interference coordination for Multihop Cellular Networks.

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