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Estimation, Efficient Resource Allocation and Interference Management Techniques in Femtocell Networks: A Survey Approach

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Abstract--The present era is known as era of intercommunication. Every being is intercommunicating by the means of technology such as cellular and internet networks. From day to day life of a person to big industries, communication has become the necessity nowadays. So the data requirement has increased tremendously but the frequency spectrum is limited. So we have to increase the data transmission rates and accuracy to satisfy the need of growing data requirement. Use of femtocell networks is a new trend in data industries because of its adhoc nature and better data transmission efficiency and speed. Femtocell networks communication is also known as cluster communication. In cluster communication larger network is divided in smaller cluster which increases effective allocation and transmission speed and further reduces the frequency requirement and interference in the network.
Keywords--Femtocell network, cluster communication, effective resource allocation, interference management, estimation techniques, channel propagation

I. INTRODUCTION

Femtocell is small, low power cellular base station. This device is used to provide cellular coverage in the area where cellular network is absent such as basement of a building or upper floors of a skyscraper. With the increasing demand of data and its transmission speed various new techniques and devices have been introduced to satisfy the user's requirement. Femtocell has provided solution to the problem in a way. Femtocell devices create an adhoc network whenever and wherever required. It makes use of cluster communication techniques. Femtocell connects to service providers using broadband cables i.e. DSl lines or cables. It uses same network configuration as of base station to provide the coverage in its own network. The basic principle behind the use of femtocell is to reduce the distance between the transmitter and the receiving device so as to increase the data transmission rates, transmission capacity and coverage. It also increases the frequency reusability thus resource efficiency also increases. Femtocell forms a cluster thus uses cluster communication techniques. In this the large network is divided in small clusters. Frequency band is also divided among the clusters which increases the frequency reusability and thus the spectral efficiency. Each cluster has a cluster head. Cluster head is connected to the base station. Base station allocate the frequency band of the cluster to the cluster head and cluster head further provides frequency to its nodes based on the requirement or according to user settings. Femtocell comes in two versions which are domestic or enterprise. Femtocell has also revolutionized the cellular services. Typically cellular base station consists of hundreds of number of instruments and requires a roof top or tower to mount the instruments on them to create a cell site. Thus cell sites are bulky and complex. This cell site requires continuous maintenance, surveillance and power backups to ensure uninterrupted working of the cell site. Also if we reduce the height of antenna coverage area also get reduced in turns creating the blank spaces in the coverage area. Thus the need of distributed antenna system arises. So the service providers now days provide femtocell to the users so that the coverage area of network get increases and also the capacity of the system. Wireless standard organization has provided specifications for femtocell networks. These standards vary somewhat by air link protocols but can be classified in three main categories such as

Self-organizing base stations
Femtocell gateway
Network management systems

When the femtocell firstly introduced the biggest worry of the service providers is the potential interference it may create in macro cell networks because the configuration used is same in both the base station and femtocell. Also working of the femtocell also depends on the quality of broadband service used by the user. Femtocell networks use various interference management techniques, resource allocation techniques, coding and self-organizing architecture to eliminate the interference between the femtocell and macrocell networks. Thus femtocell provides more reliable indoor services. Due to reduction in distance between the base station and handset the battery life of handset and data transmission rates get increased along with the

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coverage area. Here figure 1 shows the femtocell network architecture.

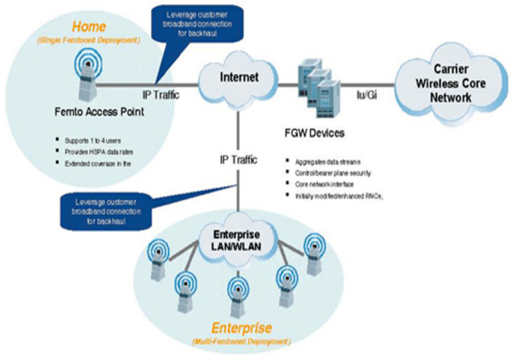

Fig.1. Femtocell network architecture

II. LITERATURE SURVEY

Johanna Ketonen[1] defined a work on various channel estimators for MIMO OFDM networks. Author defined the direction directed analysis on channel estimation based on the downlink receiver side communication. Author also defined a generalized expectation maximization algorithm to provide the space alternating to the pilot symbol so that effective channel estimation will be done. Author defined the performance analysis under the least square channel estimator. The channel estimation here defined under high user velocities so that the performance degradation to the minimum filter will be obtained. Author defined the improvement to the channel estimation under symbol density analysis so that the pilot symbol based performance estimation will be obtained from the work. Author defined the pilot based on LS, MMSE and SAGE.

Md. Nazmul Islam Khan[2] defined a work on noise reduction to the OFDM system based on channel estimation defined under least square method. Author analyzes the signal based on the channel tracking under specification of pilot symbol specification and respective to the channel impulse response so that the accurate demodulation of signal will be obtained. Author defined the work based on computational complexity of signal under multiple estimation vectors so that the complexity level information extraction at high state will be obtained. Author defined the work based on carrier interference analysis so that the channel estimation under the proposed improved estimation method is defined. Author obtained the results under SNR vector so that the performance improvement to the signal is obtained from the work. Author provided the experimentation under computational complexity.

Rajesh[3] defined a study based work to identify the strengths of femtocell device. Author presented the deployment of the device based architecture under specification of mobile coverage and throughput analysis applied on the data services specific to the traffic derivation to the macro radio network under cost of public network. Author defined the design and implementation of cell structure under specification of relative functionality in the air interface. Author defined the coverage analysis based signal traffic derivation and monitoring so that the coverage range based estimation will be obtained from the work. Author defined the hardware architecture based design to specify the macro cell in coverage range optimization with air interface. Author defined the derivation to the cell under specification of relative coverage and capacity estimation so that the signal traffic analysis and different groups will be obtained. Author generated the cell structure to optimize the communication capacity and to reduce the error rate.

Kanak Raj Chaudhary[4] defined a comparative analysis on cell structure specification with Femotocell and Macrocell environments. Author defined the deployment architecture with the specification of indoor performance analysis with derivation of cell structure specification. Author defined the spectrum so that the interference over the signal architecture will be reduced. Author defined the femtocell network based interference analysis defined under the signal level derivation so that the probabilistic network estimation based on power consumption is obtained. Author also reduced the interference vector under probabilistic measure to improve the signal performance.

Brett Kaufman[5] defined a work on cell structure based analysis defined for the conventional cell structure so that the radio network based formation to the signal assignment and the power control based structure will be obtained from the work. Author defined the cell structure based derivation so that the assignment mechanism over the signal structure and architecture will be improved. Author generated the common channel architecture with specification of successive interference cancellation. Author defined the channel estimation based successive interference cancellation so that the power control based estimation to the cell structure is obtained. The work also defined as the mechanism to control the power consumption and optimize the system gain

under channel assingnment schemes.

M. Arif[6] defined a work on femotocell deployment for LTE network. Author defined the network deployment model to identify the path loss over the network and obtain the behavior anlaysis for LTE network. Author defined the work for residential network to estimate the path loss so that the femtocell structure will be obtained from the work. Author reduced the path loss under the specification of power reduction under multiple vectors so that the grid structure based estimation to the environment is done. Author defined the capacity derived analysis to identify the signal error.

Mostafa Zaman Chowdhury[7] defined a work to control the handover mechanism for WCDMA network. Author generated the macro cell structure and provided the comparative analysis with femtocell. Author provided the study on the network deployment and handover optimization obtained in an integrated architectural form. Author obtained the derivation under cell structure based analysis so that the essential derivation to the network will be obtained from the work. Author generated the modifications os that the signal level changes to the signal flow and handover process will be obtained. Author reduced the signal minimization so that the improvement to the cell structure and cell mechanism will be obtained. Author defined the frequency communication based analysis to identify the handover criticalities in the network and also provided the mobility management under architectural specification. Author analyzed the robustness in terms of scalability vector. Author also defined the queuing mechanism to control the performance vector for cell environment.

Saied M. Abd El-atty[8] defined an analytical model to control the user connectivity with generation of relative cell structure. Author defined the connectivity analysis for mobile users in dynamic environment. Author obtained the femtocell based access point specification with low communication range defined specific for the base station. Author also increased the use of resources in the permissible and transmission range specific communication in the environment. Author improved the probability vector so that the connectivity vector is high to the system. Author proposed the tractable effective model to improve the connectivity vector so that the probability based estimation and mobility control will be obtained. Author defined the interplay estimation under probability vector so that the spectrum signal analysis will be obtained from the work. Author defined the connectivity improvement analysis while forming the cell structure and parameters.

Khaled Elleithy[9] defined a work on directional analysis applied on various issues and the characteristics of cell structure formation and generation. Author defined a signal value authenticated network for indoor propagation so that the quality signal based communication will be performed over the network. Author defined the estimation based on the connectivity analysis so that the macro cell generation at high quality calling will be obtained. Author provided the architectural integration to the environment at various interference issues so that the relatively effective communication in the environment will be obtained.

Vikram Chandrasekhar[10] defined a study based work to control the cell structure for femtocell network. Author defined the capacity driven network formation so that the communication control over the network will be obtained from the work. Author controlled the network deployment under infrastructure adjustments so that the cell structure under distributed antennas and relays will be obtained from the work. Author defined the hot spot derived network construction with spatial network formation. Author defined the work for indoor communication network with specification of access points along with the specification of coverage range under femtocell specification. Author obtained the channel in terms of technical formation to the network constraints.

Amr Abdelnasser[11] defined a work on clustering improved resource allocation approach for dense cell structure formation to improve the spectrum to the network. Author defined the frequency estimation under macro cell formation and universal frequency based reuse generation to the network. Author defined the cross tier network costlier generation to the universal frequency derivation so that the critical communication driven network will be formed. Author defined the optimal performance analysis applied to the network so that the impractical computational complexity based distributed solution to the network will be obtained. Author defined interference analysis based management scheme so that the joint clustering to the resource allocation for femtocell structure and performance optimization to the network interference will be obtained. Author defined the semi distributed architecture to divide the problem in two sub problems in shared mechanism so that the gateway specific correlation analysis will be obtained. Author defined the responsible group estimators under low complexity analysis approach. Author obtained the semi distributed interference management with joint clustering and group allocation for femtocell generation and formulation with nonlinear program specification. Author divided the main problem in two sub problems so that the task level allocation to the system will be obtained. Author defined the low complexity grouping to reduce the best cluster configuration under femtocell point generation and adaptation to the system. Author defined the sub channel specification to the power allocation so that the heuristic solution will be obtained from the work. Author defined the allocation phase adaptive cluster formation with comparative complexity analysis.

Da Chen[12] defined a work on cross layer specification based interference analysis to generate the frequency patterns under multiple vectors. Author defined the cell formation for cellular system to improve the coverage and data rate for effective communication control under performance analysis obtained at different frequency bands. Author defined the work to consider

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the interference problem with specification of macrocell and femtocell structures. Author analyzed the cells under overlapping part specification so that the specific part based allocation to the network will be obtained. Author defined the work under frequency partitioning and provided the comparison with different method of partitioning.

Abbas Hatoum[13] defined a work on cluster based cell formation for femtocell network so that the network QoS will be improved. Author provided the solution by migrating the interference over the signal as well as provided the effective utilization of resources. Author improved the signal quality so that the effective change over the signal will be obtained. Author also provided the prioritization approach to control the communication over the network users. Author provided the admission control method for resource allocation to the system so that the femtocell based clustering will be obtained from the work. Author defined the work based on the admission control mechanism so that the information transition and based on the frequency planning. Author provided the spectrum reuse under throughput specification and convergence time optimization.

Brett Kaufman[14] defined a work on spectrum sharing for cellular radio network. Author provided the gain analysis for femtocell so that the effective end user optimization will be achieved. Author provided the interference analysis in the cross layer network so that the optimization to the performance limiting factor will be achieved. Author provided the macro cell generation under architectural specification so that the partitions to the networks will be generated and the specification to the network architecture and communication architecture will be obtained. Author provided a scheme to generate the cross network under interference analysis so that the effective cell generation to the network will be obtained in effective time. Author also provided the interference analysis so that the network formation will be effective.

Ravishankar Bhaskarrao Borgaonkar[15] provided a architecture specific network to control the communication traffic in mobile network so that the smart phone and tablet optimization will be achieved. Author provided the analysis on various associated challenges in congested network. Author provided the load sharing to the network deployment so that the communication technologies to the network will be improved. Author presented the deployment key based approach to improve the architectural strength under integrity and authenticity vectors. Author improved the capability of network against various attacks and reduces the security threats from suspicious users.

Elias Chavarria Reyes[16] defined a model based work to provide the coverage optimization in indoor network. Author provided the characteristics analysis for self-organizing network placement so that the interference over the network will be reduced. Author also provided the entities and functionality based network formation that can reflect the backhaul degradation so that the network performance will be optimized under various key concerns. Author optimized the network generation

O. Simeone[17] defined a work on interference management so that the femtocell generation to the network will be obtained. Author defined the work on network formation so that the base station enable sensitive data derivation will be obtained from the work. Author provided the access link derivation and macro cell generation for the network so that the network capabilities will be improved. Author provided the cell formation along with interference management so that the network robustness against various uncertainties will be improved. Author analyzed the work for inner and outer bounds so that the evidence performance to the network will be improved. Mustafa Y. Arslan[18] defined a work on resource management and interference mitigation so that the OFDM network will be formed. Author defined the work under spectral efficiencies improvement so that the smaller cell based network deployment will be achieved. Author provided the deployment over the critical cell so that the challenging data formation will be achieved for the network. Author provided the design level improvement to the network so that effective resource management for the network will be achieved. Author provided the femtocell network formation so that the resource isolation to the frequency domain will be achieved. Author provided the capacity driven resource pooling under network capabilities and user specific measurements. The work is here defined under distinguish client management and link adaptation so that the network strength will be improved. Author provided the measurement driven analysis so that the network capabilities will be improved. Renuka Rajendra B.[19] defined a work to control the interference for femtocell and macro cell generation in LTE network. Author provided the voice and data communication in home environment so that the connected component based mobile network formation will be obtained. Author provided the analysis on frequency bands so that the effective data set recognition will be obtained from the work. Author provided the femtocell based structure to represent the cell architecture and specification so that the region cell based optimization will be achieved for the work. Author provided the colorization analysis so that the derivation to the network under network interference migration will be achieved. Author provided the work on the coloring algorithm so that the deployment to the interference graph will be achieved for the network.

Davinder Singh[20] provided a work on performance analysis for improving the resource scheduling in the network. Author provided the bandwidth analysis so that the indoor network environment will be formed and the network optimization will be achieved. Author provided the base station based femtocell deployment approach for access point specification. Author improved the network coverage for indoor scenario so that the network resource allocation capability will be improved.

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III. CONCLUSION

A survey of various femtocell networks has been done. Every femtocell network has unique characteristics such as efficient resource allocation, interference mitigation, error rate reduction. We can use different techniques to design a hybrid network to improve the overall performance of the network. The limelight of this survey is focused on the femtocell networks using channel estimation techniques, efficient resource allocation and interference management techniques.

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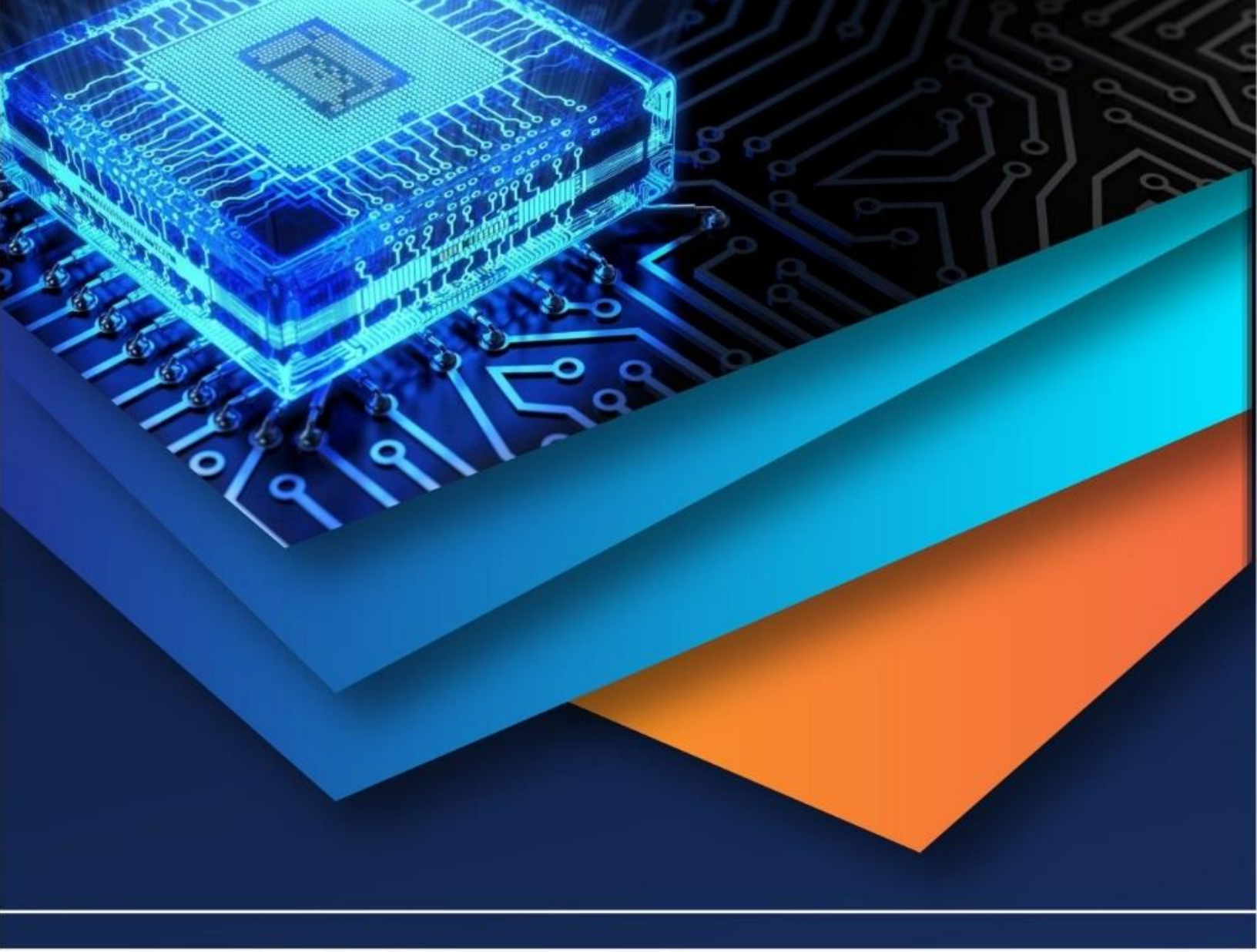

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