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# Dynamic Clustering For Radio Coordination To Improve Quality of Experience By Using Frequency Reuse, Power Control And Filtering

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***Abstract :*** *For Quality of Experience (QOE) to users in wireless systems the Co-Channel interference (CCI) is most hampering factor. Hence we explored the technique called radio co-ordination (RC) to control CCI. The computing technique of RC is clustering. Clustering explains which subnet of radio node to be jointly coordinated. Current results of RC include one cluster which consists all radio nodes for coordinated power control we present further dynamic clustering. The ruling interference relation between radio nodes is captured by the Radio coordination graph (RCG). For solving the clustering problems we put forward RCG. We assess their impact on RC complexity and session QOE by simulation. We use the in-house power control algorithm and CBR traffic to reduce RC complexity and to improve QOE.*

***Keywords :*** *CCI, RC, RRM, RAN, QOE, SDN, RCG, CBR, RCF, ILF*

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## I. Introduction

The crucial factor in wireless communication is Co-Channel interference (CCI), which reduces system capacity and thus Quality of experience (QOE). By altering the system parameters in time, frequency, power and spatial domains Radio resource management (RRM) offers system level control to CCI. If we carry out seemly it permits use of end point radio resources and radio network infrastructure which results in improved QOE. Exemplary control strategies [1] incorporate amplified inter-cell interference coordination (eCICI) in time domain, power control in power domain, frequency reuse in frequency domain. By merging above techniques we get improved performance, e.g. when we combine frequency reuse and power control we get soft frequency reuse. In [2] We are having recent Radio resource management (RRM) surveys. Radio coordination (RC) means coordination of many radio nodes which controls CCI. To attain the governable optimization complexity formation of clusters should be in on-demand fashion. So computing step of radio coordination (RC). Clustering tells the cluster to which the radio node should collaborate. To diminish the CCI .we have to accompany a sympathize parameter. Central RC controller or radio node distributly does the parameter setting according to channel state in dynamic fashion.

For the coordinated multipoint transmission (COMP) cluster has been studied in the RC context [3-7].The mobile stations to be jointly served by A cluster of base stations are allowed by COMP. Power control is one of the RC technique. At receivers if we transfer the signal at high power it results in increased (SNR). This results in improved data rate and increased spectrum efficiency. The high transmit power results in reduced CCI. Current solutions include either all radio nodes in one cluster or they rely on previously declared clusters [8]. In future the 5G mobile [10] networks will be very dense in terms of wireless devices and radio nodes. Multiple operators with different radio access technologies will provide the 5G services. A cloud based radio access network (RAN) coordination framework we discussed in [11]. The framework illustrates software defined networking (SDN) concepts [12]. .we provide the performance analysis of given system using constant bit rate (CBR) and mean session quality of experience (QOE, .to reduce the RC complexity and results are obtained using extensive numerical calculations on MATLAB. The rest of the paper is organized as follows: In section II, we illustrate the given system model of radio access network (RAN).. In section III, we discussed different detection schemes. In section IV, we present radio coordination graph (RCG) using 57 Omni directional antennas. In section V, MATLAB results are given. Finally section VI concludes the letter.

## II. RAN Coordination In 5G

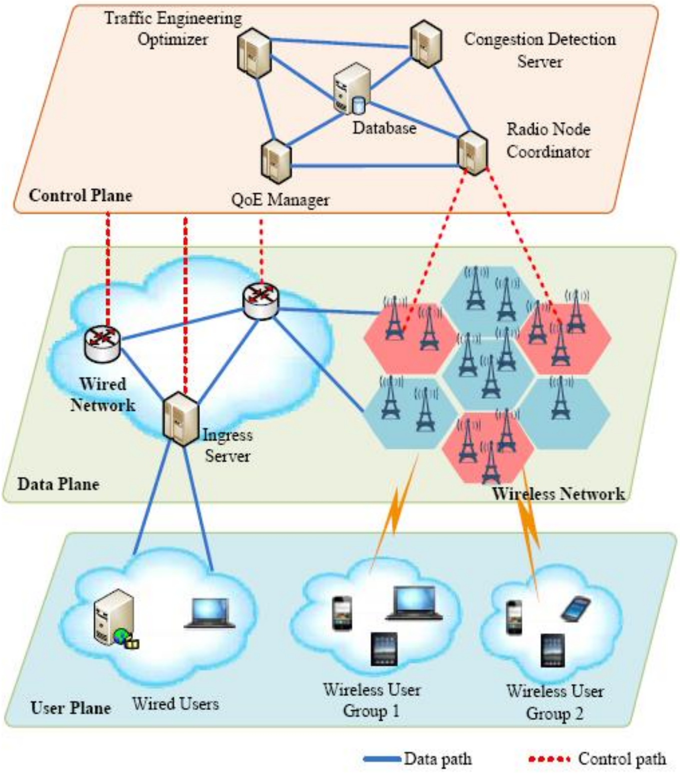


**Fig 1**. RAN coordination framework

The architecture of RAN is as shown in figure 2. There are 3 decoupled planes mainly user plane, data plane and control plane. Use plane contains multiple user sets which are classified by types of connections (wired and wireless) and class of service for example data forwarding among users is done by data plane. Radio nodes (RN's) are present in data plane. Each radio node (RN) forwards data packets to wireless users by local scheduler. The all network control functionalities are done by control data plane. Traffic engineering optimizer determines route from traffic source to destination and portion of traffics on each route and also does the resource allocation. QOE manager gathers and processes QOE reports which were sent by the users. QOE manager uses QOE reports for manipulating operations of other entities of control plane and RN's in data plane.

Database stores network status for e.g. load condition in RN's, QOE status of user applications. Congestion detection server detects the congestion in RN's by analyzing loads. RAN coordinator minimizes the transmit power and solves congestion. Radio coordinator component conducts RC. The congestion detection server and TE optimizer gives the information to radio node coordinator to determine is there any congestion happened. Once congestion is detected from the information of database and QOE manager clustering decisions are made and radio nodes coordination is done in each cluster. The RC technique is within the framework and is proposed dynamically from clusters according to channel conditions and network state.

### RCG Graph

This RCG graph is drawn by considering 57 randomly deployed base stations which are present on the top of the voronoi diagram of base stations. It is undirected graph which allows theoretic clustering solutions for radio coordination (RC) to mitigate the co-channel interference (CCI).

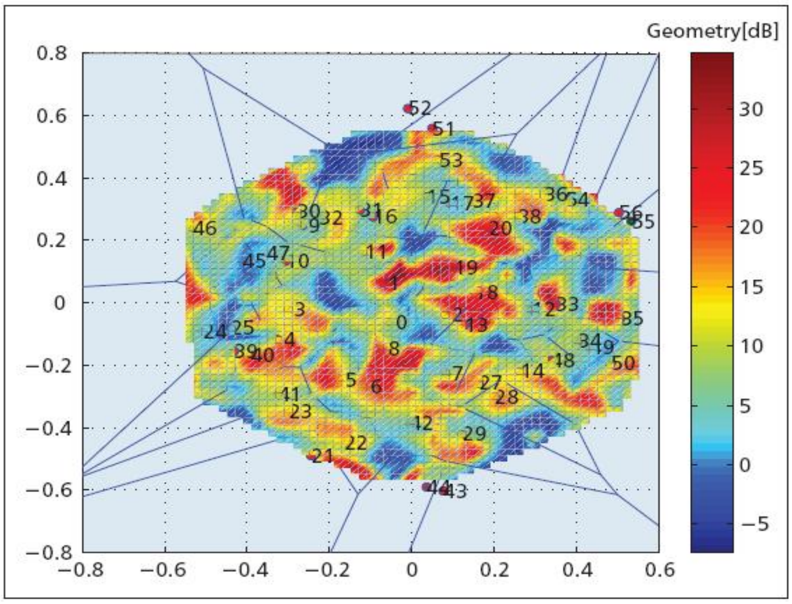


**Fig 2.** An SINR map of 57 base stations and their Voronoi cells.

Radio coordination graph (RCG) indicates which base station should work jointly and performs graph theoretical clustering solutions for radio coordination (RC). When the respective interference contribution is greater than interference domination threshold (IDT) then interference relation on channel is said to be dominating, IDT value is apparently user dependant. Radio coordination graph (RCG) can be drawn by considering base stations as vertices and adding arcs between the vertices which have the dominant interference relation. Base stations work on the power of 46 dBm. Further fig 3 shows the Radio coordination graph (RCG) of 57 base stations which are generated from filtering techniques like incremental local filtering (ILF) and recursive collective filtering (RCF).

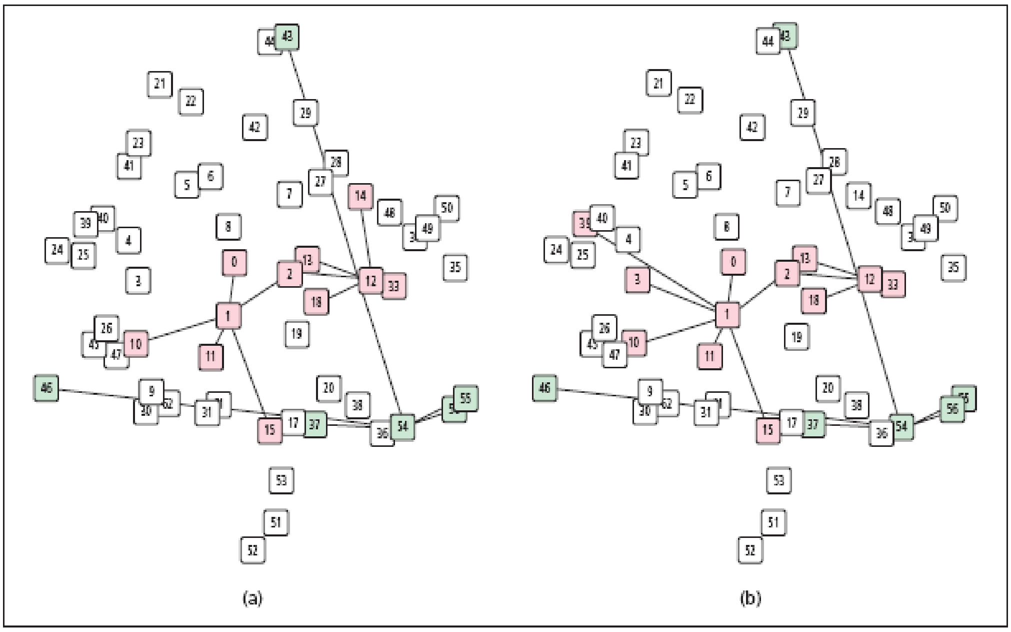


**Fig.2.1.** RCG graphs of 57 base stations with IDT values.

For the 57 users having locations of vertically mirrored an users SE threshold is set to 0.001. the users are randomly dropped at locations and picked from locations such that the threshold should be one user at every voronoi cell on an average. Strong SE base station serves each user. In fig 2.1 base stations are represented by squares. 54-43 and 54-46 are long links are because of wrapped around effect of SINR map.

## III. Dynamic Radio Clustering

A base station that experiences congestion is called primary base station. Each base station has the RC capability which indicates how it is capable in radio coordination. RC capability can be measured by different factors depending on specific RC schemes, e.g. available power, bandwidth, loading. The average RC capability of member base station is called RC capability of cluster. Both incremental local filtering (ILF) and recursive collective filtering (RCF) attempt to build RCG. This contains maximum number of valid connected components and which we consider as a cluster.

## IV. Filtering Algorithms

There are two filtering algorithms incremental local filtering (ILF) and recursive collective filtering (RCF). The incremental local filtering (ILF) and recursive collective filtering (RCF) are called filtering algorithms because they do filtration of non dominant interference relation during the RCG construction. Filtering is done by setting proper interference dominance threshold values at radio nodes, which are selected through efficient binary search in value range. Incremental local filtering (ILF) and recursive collective filtering (RCF) have an average complexity in *O*(*mn*3log□ □ /□ □ ). From this equation the computational complexity can be derived , here m indicates total number of base stations. The cubic term contains dominance interference set.

In Reasults we have considered three clustering schemes dynamic clustering, direct clustering, and fixed clustering. The incremental local filtering (ILF) and recursive collective filtering (RCF) algorithms work in dynamic clustering to find out the clusters. The direct interfering node of a congested node in clusters and clusters may overlap in direct clustering. Three disjoint same size static clusters are previously determined in fixed clustering. and radio coordination is performed in clusters were congestion happens.

## V. Matlab Reasults

In this work, we propose results via numerical calculations on MATLAB platform. For computing we have used the 57 Omni-antennas. The radio nodes which are present randomly and are covered by 19 three sectors macro LTE BBU with ISD of 250 m. Radio nodes operation uses LTE specifications 46 dBm maximum frequency is transmitted by every radio node in 10 MHZ bandwidth.

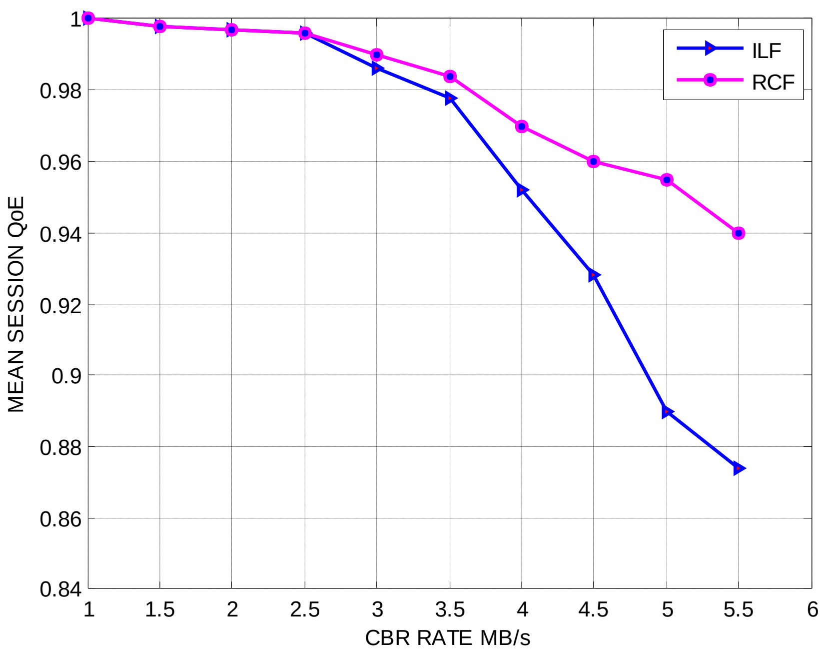


**Figure 4.** Mean session QoE: a) ILF vs. RCF.

Graph plots CBR on x-axis and mean session QOE on y-axis. We have taken the 2 filtering approaches for comparison incremental local filtering (ILF) and recursive collective filtering (RCF). We used these filtering approaches to improves the quality of experience (QOE) so that we get more percentage of happy users. Here we get QOE improved up to .94 which is very high as compared to earlier. For filtering we use the in-house algorithm. CBR range we take from 1mbps to 6 mbps.

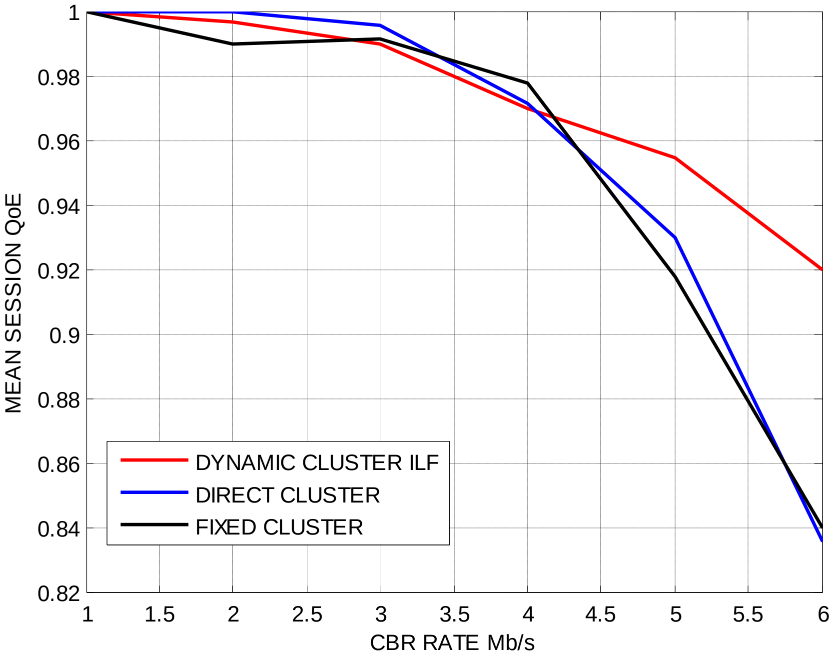


**Figure 4.** Mean session QoE: b) Dynamic vs. Direct vs. fixed

The graph shows performance of QOE for three different schemes like dynamic, direct and fixed clustering. Mean session QOE has binary values and it's performance gives percentage of happy users. Clustering is done to detect congestion and reduces RC complexity and improves QOE. For fixed one the QOE performance starts to decrease while for others it is 100 percent direct one has power instability so the dynamic is best clustering technique gives improved QOE up to .92.

## VI. Conclusion And Future Scope

The proposed work called Dynamic Clustering for Radio Coordination to Improve Quality of Experience by Using Frequency Reuse, Power control and Filtering as a effective technique to improve system performance. It has been shown via numerical calculations on MATLAB platform that proposed work provides significant QOE performance improvement almost up to .94 for dynamic clustering as compared to fixed and direct. As research on this concept has been going on in future, we can improve QOE performance further especially for more complex techniques. By using more advanced congestion detection techniques.

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