Resource Allocation Scheme for Balancing QoS in Wireless Mobile Communication

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***Abstract*—Mobile communication standards are growing up day by day and improvements in the wireless technology environment leads to increase the number of user requirements. According to that many researches are going on to provide efficient and user friendly network to the end user. Resource allocation is the one to get the effective system by the user, according to their needs. But, under the heterogeneous network environment of 4G systems, the resource allocation is somewhat difficult to perform. In this paper, various resource allocation schemes were discussed and the concept of resource allocation scheme using multiple parameters was proposed for the 4G systems. Weighted SNR function is acquired taking into account numerous QoS parameters according to user needs. This resource allocation scheme provides the efficient communication to the user environment, which has shown by simulation results done by network simulator.**

Keywords*—QoS, Resource allocation, Next Generation Network.

I. Introduction

Consistently expanding data rate help alongside the characteristic preferences of wireless access networks, for example, simple adaptability and ease of organization and maintenance, have prompted the rise of broadband wireless access (BWA) as a prevalent option to the wire-line access infrastructure. The data rate historic points in Fourth Generation (4G) wireless broadband access networks, in the same way as Long Term Evolution-Advanced (LTE−An) and World-wide Interoperability for Microwave Access Mobile (WiMAXMobile), are situated around 1 Gbps in downlink and 300 Mbps in uplink according to International Mobile Telecommunications Advanced (IMT-Advanced) determinations. To attain to and keep up these high rates in a wireless domain, mobile devices/stations (MSs) are obliged to change the base station (BS), if there exists one inside the range of the MS, with, for instance, a superior connection quality. This system is called handoff. Handoff is performed on the premise of some metric threshold, which can be picked according to the correspondence framework necessities, application imperatives of an individual MS, and speed.

Next generation wireless networks target omnipresent high data rates, proficient asset (e.g., range and power) use and economical network deployment. Given the way that radio range is turning into a rare asset in wireless communications, the orthogonal frequency division multiple accesses (OFDMA) has been proposed as a state-of-the-art air interface innovation to empower high range productivity and adequately battle frequency-selective fading. Because of its guaranteeing features, OFDMA is embraced in numerous rising cell frameworks, for example, the Long Term Evolution (LTE) and IEEE 802.16m for attaining to those aspiring targets of next generation networks. Keeping in mind the end goal to understand the adaptability on access of radio assets, OFDMA represents another test for radio resource management (RRM). A decent RRM plan, including subcarrier assignment, planning and power control, is urgent to ensure a high framework execution for OFDMA based networks. On traditional configuration of RRM, most distributed work focus on the single cell situation where assets are dispensed to convey a local performance optimization. In future wireless networks, nonetheless, denser cell arrangement with a lower frequency reuse element is requested. This has moved the pattern to the advancement of RRM for multicell frameworks. In the multi-cell setting, inter-cell interference (ICI) has turned into a real issue of concern following the frequency reuse-1 is concurred as the favored frequency arranging organization for modern OFDMA based cell networks. Because of the same spectral utilization in contiguous cells, ICI can bring about extreme execution corruption to clients of reuse-1 OFDMA networks, especially those at the phone edge. Along these lines, creating RRM plans with an accentuation on ICI lessening in the multicell situation is of huge enthusiasm for recent research work.

With the expanding prominence of smartphones, notepads, and different wireless-ready gadgets, mobile cellular networks are encountering sensational upgrade in activity. Different rough guesses demonstrate that mobile data use will expand 13 times somewhere around 2012 and 2017. This approaching development will include stupendous increments in mobile network capacity. To take care of the foreseen limit demand in the existing model of settled assets including static authorized range, mobile network operators, in the setting of 4G Long Term Evolution (LTE) , are investigating numerous procedures, for example, higher information rate broadband air interface advances with MIMO and little cells. These methods expand the capital and working consumptions and multifaceted nature of the system. On the other hand, expanding limit by gaining extra asset regarding new static permitting range additionally obliges expansive forthright speculation. This motivates the standard of asset imparting, where assets are pooled and powerfully imparted for regular advantages.

In this paper, we study the related work done on the trust system in wireless mobile communication in Section II, the implementation details in Section III where we see the system architecture, modules description, mathematical models, algorithms and experimental setup and at last, we provide a conclusion in section IV.

II. Related Work

In [1] Pan et al. shows various dispersed asset distribution plans for settled hand-off stations in a network based on orthogonal frequency-division multiple accesses(OFDMA). A novel iterative barrier-constrained water filling algorithm is proposed to address the data rate confinements forced by poor base-station-to-relay channels. The proposed method offers quick merging, and complexity is decreased by a conveyed execution over the network. At last, a novel conveyed subcarrier and power designation algorithm is proposed.

In [2] Ksairi et al. propose a distributed practical resource allocation algorithm with low complexity. They contemplate the asymptotic behavior of both this streamlined resource allocation algorithm and the optimal resource allocation algorithm of Part I as the quantity of clients in each one cell has a tends to infinity. Their examination permits to demonstrate that the proposed rearranged algorithm is asymptotically ideal i.e., it attains to the same asymptotic transmit control as the optimal algorithm as the quantity of clients in each one cell has a tendency to limitlessness. As a result of their examination, they describe the ideal estimation of the frequency reuse factor.

Ma et al. [3] propose a productive power assignment and scheduling algorithm for simultaneous transmissions that can enhance network throughput with reasonableness thought. They first plan the ideal optimal power and scheduling issue, and convert the original non-convex issue into a progression of convex issues utilizing a two stage approximation technique. At that point, they propose the power and channel allocation with fairness (PCAF) algorithm to take care of the issue effectively.

In [4] Yu et al. proposes a novel load distribution aware soft frequency reuse (LDA-SFR) plan for inter−cell interference relief and execution enhancement in next generation wireless networks. Our proposed plan aims to give a solution for adequately accomplish inter−cell interference relief while keeping up high range effectiveness to all clients in the cell. The proposed plan comprises of two novel algorithms: edge bandwidth reuse and center bandwidth compensation. Utilizing the edge bandwidth reuse algorithm, cell edge clients can exploit uneven traffic load and client dispersions inside each one cell to grow their resource allocations. The center bandwidth compensation algorithm, then again, gives an insurance component to cell-center clients to stay away from comprehensive edge bandwidth expansion.

LTE: the evolution of mobile broadband [LTE part II:3GPP release 8] [5] article gives a review of the LTE radio interface, recently affirmed by the 3GPP,together with an all the more top to bottom portrayal of its features, for example, range adaptability, multi-antenna transmission, and inter-cell interference control.

In [6] Boudreauet al.gives a diagram of contemporary and forward-looking inter-cell interference coordination strategies for 4G OFDM frameworks with a particular accentuation on executions for LTE. Reasonable methodologies incorporate the utilization of power control, opportunistic spectrum access, intra and inter-base station interference cancellation, adaptive fractional frequency reuse, spatial antenna strategies, for example, MIMO and SDMA, and adaptive beam forming, and recent developments in decoding algorithms. The appropriateness, intricacy, and performance gains possible with each of these strategies based on simulations and experimental estimations will be highlighted for particular cell topologies important to LTE macro, pico, and Femto organizations for both standalone and overlay networks.

Mao et al. [7] proposes a decentralized adaptive soft frequency reuse plan for the uplink of a 4G long-term evolution (LTE) framework. While universal frequencies reuse (UFR) is being focused for next generation multi-cellular wireless networks, progressing endeavors supporting the LTE standard have demonstrated that genuine executions of UFR in LTE lead to unsuitable impedance levels experienced by client supplies close to the cell edge region in a multi-cell arrangement. The thus proposed adaptive soft frequency reuse plan is a venture forward towards compelling inter-cell interference coordination (ICIC) in next-generation wireless networks. Their solution for the uplink ICIC issue emerges from its two fundamental features that comprise of physical resources block (PRB) reuse evasion/minimization and cell-edge bandwidth breathing which can be actualized at the expense of an immaterial data trade over the X2 obstruction.

As OFDMA is essentially a mix of FDM and TDM, it experiences overwhelming inter-cell impedance if neighboring base stations utilize the same frequency range. On the other hand, it is attractive to reuse the complete, accessible frequency range in every cell with a specific end goal to boost the asset usage. One conceivable way to explain this contention is the utilization of beamforming antennas in blend with interference coordination components between base stations. Beginning with a worldwide impedance coordination plan with full framework information, in [8] Necker et al. first examine how spatially restricted obstruction coordination influences the framework execution. Consequently, they study a few feasible impedance coordination plans and demonstrate that a provincially implementable plan can just about match the execution of the worldwide plan concerning the division throughput. Adaptive Subcarrier allocation and adaptive regulation for multiuser orthogonal frequency division multiplexing (OFDM) is considered [9]. The optimal subcarrier and bit distribution issues, as nonlinear advancements, are changed over into straight ones and solved by integer programming (IP). An imperfect approach that independently performs subcarrier distribution and bit stacking is proposed. It is demonstrated that subcarrier designation in this methodology can be streamlined by the linear programming (LP) relaxation of the IP.

In [10] (J. Jang and K. Lee, 2003)build up a transmit power adaptation strategy that boosts the aggregate information rate of multiuser orthogonal frequency division multiplexing (OFDM) frameworks in a downlink transmission. They for the most part, plan the data rate maximization issue by permitting that a subcarrier could be imparted by various clients. The transmit power adjustment plan is determined by tackling the augmentation issue by means of two steps: subcarrier task for clients and power allocation for subcarriers. They has observed that the data rate of a multiuser OFDM framework is amplified when every subcarrier is assigned to stand out client with the best channel pick up for that subcarrier and the transmit power is conveyed over the subcarriers by the water-filling arrangement. So as to diminish the computational intricacy in figuring water-filling level in the proposed transmit power adaptation strategy, they likewise propose a basic system where clients with the best channel pick up for every subcarrier are chosen and afterward the transmit power is similarly dispersed among the subcarriers.

III. Proposed System

A. System Overview

Our problem is formulated as an optimal joint resource allocation for the multi-cell OFDMA-based downlink network. Therefore, a feasible suboptimal resource allocation scheme is proposed. The resource allocation scheme is divided into two steps in order to reduce the complexity: radio resource and power allocations.

In this section, we first describe the development of heuristic algorithms for coarse ICIC and fine PRB assignment to achieve a centralized radio resource allocation in the network. In the multi−cell context, the resource allocations have to start with the global ICIC schemes as effective ICI mitigation cannot be achieved only by power control especially for those cell−edge users who are close to each other in the network. Thus, the first phase of our proposed radio resource allocation is to develop an ICIC scheme using a simple but effective graph-based framework. Our objective is to construct a graph that reflects major interference occurring in the real-time network environment.

The proposed two-phase subcarrier allocation approach is dedicated to addressing the problem that cell- edge users suffer from heavy ICI and relatively low performance in the multicell OFDMA networks. A low- Complexity graphic framework is first constructed to prevent from the same subcarrier being used by the cell−edge users, who may heavily interfere with each other. Thus effectively minimizing the impact of ICI in the system. Then a heuristic algorithm is designed to perform a fine subcarrier assignment by taking account of instantaneous channel conditions. In order to approach the performance optimality, the algorithm is conducted in a centralized manner with consideration of fairness between cell-edge and cell-center users in the system.

Given the solution of subcarrier assignment, the resource allocation turns into an independent power allocation problem. Instead of performing global optimization, this work is focused on using power allocation to optimize the performance of cell edge users, which is considered as the bottleneck of achieving high performance in overall networks. Meanwhile, the performance requirement of cell-center users is taken into account as an important constraint in the formulated problem. Thus, the Performance balance between cell-edge and cell-center clients in the framework can be arrived at.

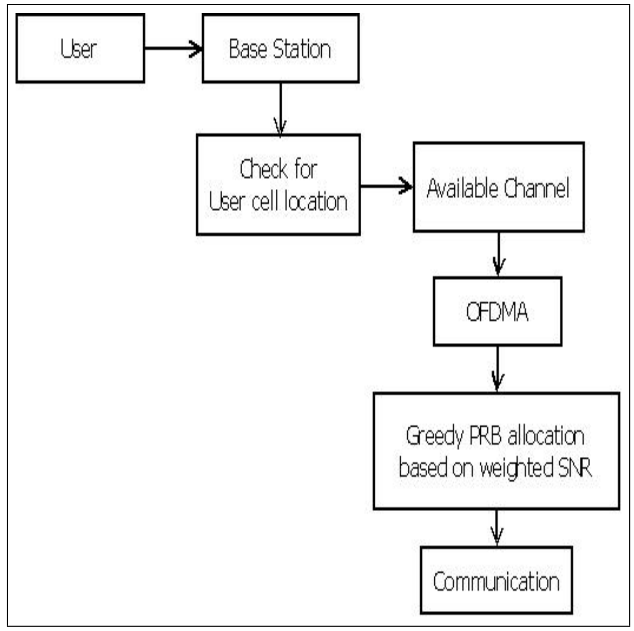


Fig.1: System Architecture

The performance of the proposed plans is dissected completely in a multi-cell network. The plans are additionally assessed under diverse situations concerning uneven client distribution and different traffic loads. Extensive simulation shows that the proposed plans can give performance improvement to both cell-edge and cell-center clients contrasted and existed plans. It is additionally demonstrated that considerable reasonableness can be further tended to by the proposed plans as far as accomplishing balanced performance between cell-edge and cell-center clients in the network.

B. Mathematical Model for Proposed Work

1) Resource allocation: For a cell j where jϵJ, let $A^j_{M_j XN} = [a^j_{mn}]$ and $P^j_{M_j XN)} = [P^j_{mn}]$ be PRB and power allocation matrices, respectively, with elementsa$^j_{mn}$ and P^j_{mn} defined as

$$a^j_{mn} = \{^{1, if PRB n is allocated to user m}_{0, Otherwise}$$

And

$P^j_{mn} = \{^{p\epsilon(0,p_{max})}{}_{0,otherwise}, a^j_{mn} = 1$

Where, Pmax denotes the maximum transmission power of each BS. Since the same PRB will not be assigned to more than one user at the same time in each cell, we have $\Sigma^{M_j}_{m=1} a^j_{mn} = 1$

2) Interference Evaluation: The performance of multi cell networks with ICI can be evaluated using SINR instead of SNR for interference limited networks. The data rate achieved by user m of cell j can be calculated by Shannon's formula and expressed as:

$R^j_m = \Sigma^N_{n=1} B.log_2(1 + \gamma^j_{mn})$ [bits/sec]

C. Algorithm

Algorithm 1 Greedy PRB allocation based on the weighted SNR

Input: G (V, E): Graph of the Network with
V: Nodes in network represented as user.
E: Edges which Connect Nodes or User Output: $A^j_{M^j N}$ for jϵJ is the PRB allocation Matrix.

```
Initialize A^j_{M^j N} =0,∀_j ϵ J
For n = 1 to N do % PRB loop
k = 1;Δ^n_k=V
Δ^n_k is the updating set defined in Algorithm
while k ≤ J and Δ^n_k ≠0
do
m*= argmax_{mϵΔ^n_k}(w_m SNR^n_m)
w_m is the weighting factor
a^{j*}_m = 1; %j* is the serving cell of user m* a^{j*}_{m*n} : PRB allocation Elements.
R_{m*}=ϕ;
R_{m*} is set of users who are allowed to have the same PRB
For m=1 to Σ^J_{j=1} M^j do % user loop M^j − Total No of users in cell j
If m ≠ m* and E(m*, m)=0 then
R_{m*} = R_{m*} ∪ {m} ;
R_{m*}: Data Rate for user m.
End IF
End For
K=k+1;
Δ^n_k= Δ^n_{k−1} ∪ R_{m*}; % update the set Δ^n_k ;
End While
End
```

D. Experimental Setup

The system is built using Java framework (version JDK 6) on Windows platform. The Netbeans IDE (version 6.9) and jungare used as a development tool. The system does not require any specific hardware to run; any standard machine is capable of running the application

IV. Results and Discussion

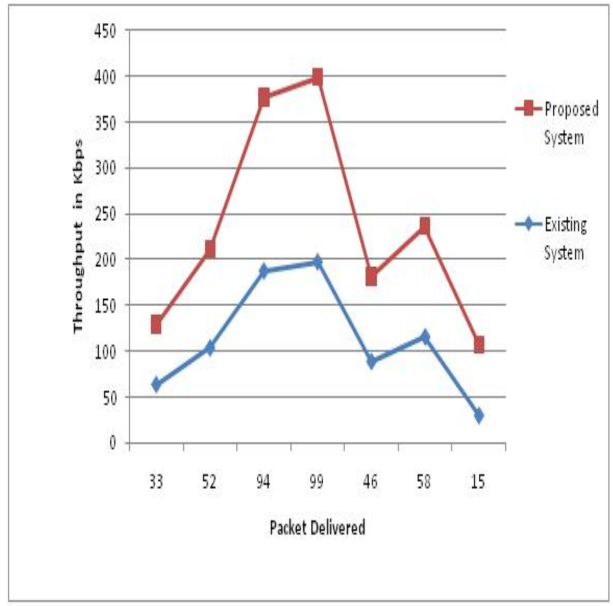
This is the packet delivery vs throughput graph which shows that our proposed system has more throughput as compared to the existing system. As we are increasing the throughput by using PRB algorithm for the power allocation.

TABLE I. Comparison Table

Parameters	Existing System	Proposed System
Throughput	moderate	High
Performance	Low	High
Interference	Can not Handled	Handle by Power allocation

V. Conclusion

In this work, a comprehensive resource allocation plan has been proposed for downlink multi-cell OFDMA systems. The plan incorporates radio asset and power designations, which are executed independently to address the planned issue with



reduced complexity. For radio resource allocation, the graph-based system consolidated with fine-scale PRB task algorithms are proposed to effectively manage ICI and enhance execution of the system in a concentrated way. Given the arrangement of radio resource allocation, the optimal power allocation is performed freely in each one cell to maximize performance of its own cell-edge clients under the condition that execution of cell-center clients of nearby cells are not degraded much. The propose system increases the performance and throughput.

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