

# Survey on Joint Uplink and Downlink Resource Allocation in OFDMA

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**ABSTRACT:** OFDMA is the entrance plan utilized as a part of the third and fourth era remote cell systems. Appropriate distribution of power and bandwidth is necessary for ensuring the optimal performance and utilization of the resources in the OFDMA based cellular systems. The asset assignment in uplink bearing and downlink course will require diverse methodologies. In uplink direction, distinctive classifications of calculations like static, dynamic, brought together, disseminated, immediate, stochastic, single cell, multi-cell, ideal, imperfect calculations are taken after. In this paper, scheduling and resource allocation techniques in both downlink and uplink of OFDMA are considered. Different resource allocation methods and the challenges faced are discussed.

**KEYWORDS:** OFDMA, Resource Allocation, Scheduling, Uplink and Downlink.

## I. INTRODUCTION

Present day Wireless cellular systems need to fulfil the expanding expectations for maximum data rate mobile services. Keeping in mind the end goal to meet the expanding number of cellular subscribers and the requirement for faster and more reliable information services, orthogonal frequency division multiple access (OFDMA) has been chosen as the multiple access scheme for wireless systems [1] for example, LTE and WiMAX. OFDM depends on the idea of multicarrier transmission. The broadband channel is divided into number of sub channels each with smaller bandwidth. The available data stream is divided into different small sub data streams of lower data rate, and then they are modulated and transmitted all the while on the subcarriers. In this paper, we discussed about different OFDMA resource allocation and scheduling schemes. We concentrate on both the directions, namely uplink and downlink. The increase in requirements of real-time applications, for example video telephony and voice-over-IP necessitates the efficient uplink and downlink scheduling calculations in wireless systems to be implemented. In a single user scheme, the total power used by the user to transmit on N subcarriers; the scheme is then dynamically adapting the modulation type and optimized by using the frequency selectivity of the channel and transmit power on each subcarrier [2].

Then again, in a different client arranges the new difficulties are increments progressively as the quantity of the clients in framework increments. These difficulties incorporate element subcarrier designation, scope organization, and versatile force portion and affirmation control. The last two are likewise considered to as radio asset designation. In an OFDM multiuser plan, to designate the force and the subcarrier to the clients the numerous entrance plans is required. In static subcarrier allotment strategies, every client is dispensed with foreordained recurrence groups or time spaces separately paying little respect to the channel position.

### System Model and Problem Statement

Let us take an OFDMA based cognitive radio networks a secondary user exits side by side bands of group of primary users. Let total bandwidth is Z then it is divided into M sub channels then each with bandwidth  $\Delta W = Z/M$ , the secondary user is permitted to use the total spectrum. Now consider there are P sub channels, underutilized by primary users. And Q sub channels there are unused by the primary users. Where  $P+Q=M$ , the Q overlay sub channels and P underlay sub channels are allocated side by side. N is the total available sub channels for the secondary users. Let  $P_m$  and  $h_m$  is the transmit power of the secondary user then the secondary user transmission rate on the nth sub channel can be expressed as

$$r_m = \Delta f \log_2 (1 + |h_m|^2 P_m / \sigma^2 + \gamma_m) \text{ ----- (1)}$$

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Where  $\sigma^2$ - Additive White Gaussian noise variance.  $\gamma_m$ - Interference power.

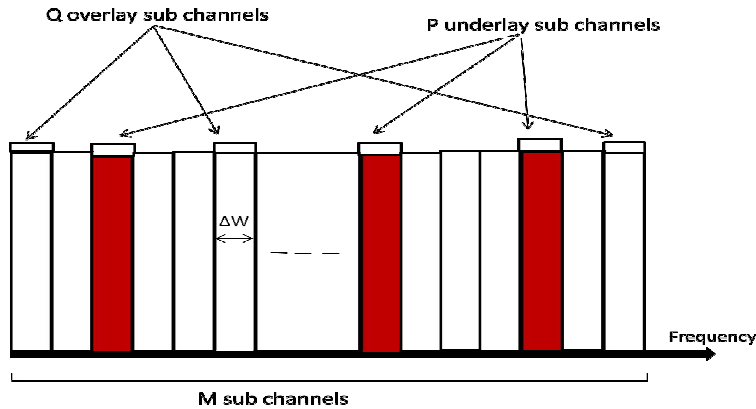
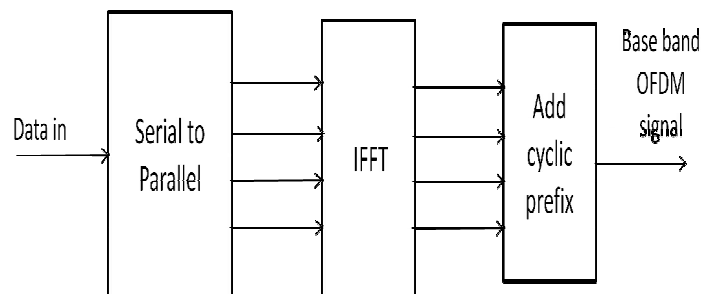


Fig1. underlay and overlay sub channels distribution.

## II. OFDMA

The disadvantage of OFDM is data through all the sub channels are transmitted by single user. The channels must be multiple accessed to accommodate more users. The channels ought to be various gets to oblige more users. In this scheme the main setback is that, in a given channel the behaviour of each user is different. OFDMA scheme allows, using a single OFDM symbol different users simultaneously transmit information through the different subcarriers. The subcarriers can be allocated flat to the users again. But this result will be, in particular frequency there is fading loss and a user may loss their information [3].

### OFDMA Transmitter



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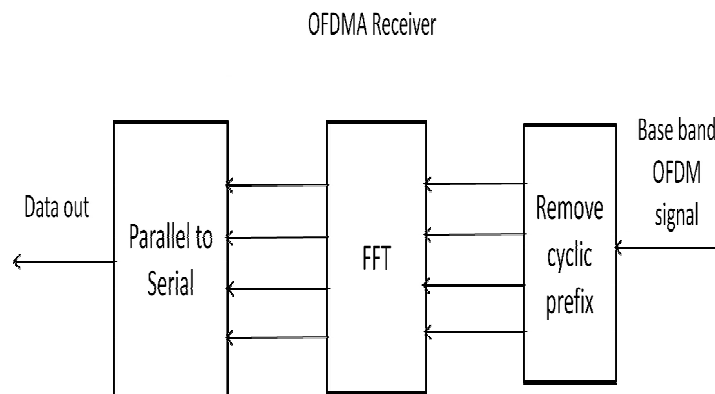


Fig 2. OFDMA block diagram.

### III. OFDMA RESOURCE ALLOCATION.

OFDMA is the multiple access schemes, the better improvement in these issues can be achieved by combining this scheme with dynamic resource allocation scheme. The most difficult part is how to assign a available subcarriers to the user and it explains the system performance. The algorithms of resource allocation, selected for uplink direction may not appropriate for downlink because uplink power constraints. The services such as video conference, mobile gaming etc needs symmetric quality in both ways.

The schemes such as game theory, mathematical optimization etc. According to many literatures the resource allocation shows poor performance for joint conditions. If the down link condition is good, correctly it receives the data; but suppose uplink condition is poor then, if channel is in good condition the resources assigned to the clients. Therefore others cannot be received information. The throughput of multiple access schemes can be improved by subcarrier dynamic allocation scheme [4].

Therefore, in this paper, we discussed about scheduling schemes in multiple access schemes for directions in both uplink and downlink.

### IV. RESOURCE ALLOCATION SCENARIOS

The issue of asset distribution can be moved nearer in two routes, specifically, edge flexible and rate adaptable [5]. Exactly when the fact of the matter is to extend the information rate keeping into thought the force limitations it is rate adaptable; and when the fact of the matter is to diminish the base transmit power it is named edge flexible.

#### A. scheduling in single cell:

##### 1] Distributed and Centralized:

In distributed scenario, the self-sufficiency decisions are made by mobile clients. This scheduling is suitable for sensor and relay based systems [6]. It increases the network capacity and coverage. The various remote relay heads are connected to main base station. Utilizing this system, the most extreme proportion consolidating in uplink will manufacture the point of confinement however on inverse the execution is ruined due to the proximity of intercell obstruction [7]. To destruction this issue the remote transfer heads with best channel condition is just picked.

In Centralized Scheduling scenario the base station is in capable of allocation resources, both in uplink and downlink directions. Choice made by the base station is then conveyed to the portable clients. Margin adaptive and rate adaptive methodologies under this situation have been generally explored in writing. For margin adaptive methodology, the traditional Shannon capacity theorem is utilized to demonstrate the rate, while in rate adaptive methodology, to minimize the transmit power bit loading is performed.

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The issue in resource allocation is detailed as a social gaming worldview known as SIRA [9]. The clients are considered as players associating with the base station which plays the part of the referee. It additionally presents a punishment based input component.

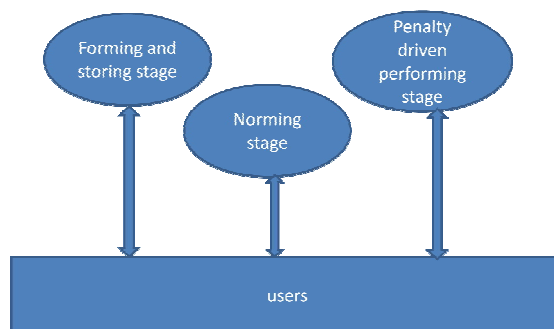


Fig 3. SIRA workflow

## 2] Instantaneous and Ergodic scheduling:

In instantaneous scheduling, the utilization capacity is raised at available instant, where as in ergodic scheduling a long haul execution is assessed. The water filling method demonstrates to have better throughput for instantaneous scheme while it falls flat in ergodic scheme [10]. A probabilistic method for allotment in both directions is considered in [11], the average values of signal to noise ratio at main base station is required. To calculate the optimal distribution, dual optimization scheme and Lagrangian function is used.

### B. Scheduling in Multicell:

In single cell scenario, the intercell obstruction is not considered. But in multicell scenario intercell obstruction is main issue [12]. Subsequently alongside scheduling, accentuation on moderation of intercell obstruction is additionally noticed in many works.

In [13], the distributed protocol configuration is considered in multicell network. The traffic in downlink and uplink is noticed on a packaging by packaging basis [14]. The uplink and downlink offer time is activated using online redesigned assets of the typical information rates in both directions. Initially calculate instantaneous values and then filters update the average values.

## V. CONCLUSION

In this paper different uplink and downlink resource allocation scheduling for OFDMA system have been talked about. If there should arise an occurrence of uplink resource allocation, different difficulties (e.g. Channel distribution and interference taking care of) are there in resource allocation for femto cells, Self-Organizing Networks and MIMO (Multi radio wire frameworks for Multiple Input and Multiple Output) which can be tended to by broadening the resource allocation scheduling specified previously. If there should arise an occurrence of downlink resource allocation scheme, work can be completed on enhancing the asset resource allocation scheme on noisy channels with channel state data.

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