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Study on Resource Management System for Interference Mitigation in Femtocell Networks

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ABSTRACT: Cellular phones play an important part in modern day life. At present it's very uncommon to see a person without using mobile phones. Due to increasing mobile users across globe, rising trend of multifloor and intricate designed apartments in inner-city area, poor coverage found as a key issue. To surmount this femtocell allows service providers to extend service coverage inside of home especially where access would otherwise be limited or unavailable. It also decreases backhaul costs since it routes cellular phone traffic through the IP network. A femtocell is a miniature cellular primary station intended for use in inhabited or small industry environments. A femtocell is sometimes referred to as a residential base station, way in point base station, 3G way in point, miniature cellular primary station and private 2G 3G base station. WIMAX STD IEEE 802.16 and Long Term Evolution (LTE) femtocells provide a variety of high data rate service to the end users. LTE femtocell is being considered as the future equipment at the indoor environment[2]. Interfering alleviation between neighbouring femtocells and between the femtocell and macrocell is taken as one of the major challenges in femtocell networks because femtocells allocate the same accredited frequency spectrum with macrocell. This report provides an analysis on the different state of the art methodology for noiseless and resource management in Orthogonal Frequency Division Multiple Access (OFDMA) based femtocell networks and offers an optimal solution[13]. One of the most crucial issues is the design of a very capable scheduling algorithm which synchronizes all other QoS related well designed entity.

I. INTRODUCTION

Femtocells have been planned for improving the performance of indoor users to provide enhanced indoor coverage and spatial salvage gains in the 4G networks. On the one hand, users like high-quality links, on the other hand, Service providers reduce the Operational Expenditure (OPEX) and Capital Expenditure (CAPEX) due to the traffic off-load and users self-deployment of Femtocell Base Stations (FBSs). As Femtocells can meet users requirement and indoor coverage condition well, they have been widely used in many wireless communication standards, such as WiMAX STD IEEE 802.16, and LTE. Multi-user account of Orthogonal Frequency Division Multiplexing (OFDM) is digital modulation scheme[3]. In this research WiMAX (STD IEEE 802.16) is used. It is one of the latest broadband wireless expertise advancement today. It delivers broadband access services to residential and enterprise customers in a reasonable way.

International Journal of Innovative Research in Science, Engineering and Technology

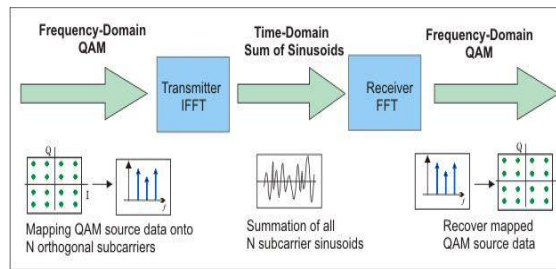
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Vol. 5, Issue 6, June 2016

Specifications:[7]

1. Frequency 10-66 GHz
2. Std-IEEE802.16 specifications.
3. WiMAX is expected to offer originally up to about 40 Mbps capacity[4]

LTE(Long Term Evolution)[11] is developed by the 3rd Generation Partnership Project (3GPP) in order to make sure the effectiveness of its standards in the long term. Recently it is also known as 4th generation technology. LTE is , also called as Universal Mobile Telecommunications System (UMTS). The main challenges for LTE is to come up with new radio access technology so that high data rates, low latency can be offered. LTE is also known as E-UTRAN (Evolved UMTS Terrestrial Radio Access Networks). For indoor coverage enhancement the LTE has grown a femtocell.[5]



Simplified OFDMA System Block Diagram
Fig.1 OFDMA Block Diagram

Figure 1 refers that Input bits are clustered and mapped to source data symbols that are a complex number (e.g., the BPSK or QAM symbols). They are in the frequency-domain and key inputs to an IFFT block that transform the data into the time-domain. The IFFT takes in N source symbols at a time where N is the number of subcarriers in the system. The output of the IFFT is N orthogonal sinusoids. At the receiver, an FFT block is used to process the received signal and carry it into the frequency domain which is used to regain the original data bits. [14]

Multi-user account of Orthogonal Frequency Division Multiplexing (OFDM) is digital modulation scheme. Figure 2 refers OFDMA Multiple carriers (called subcarriers) carry the information stream and Multiple subcarriers within the same single channel. Sub-carriers are orthogonal to each other[1], meaning that crosstalk between the sub-channels is eliminated. Guard interval are inserted to avoid interference.

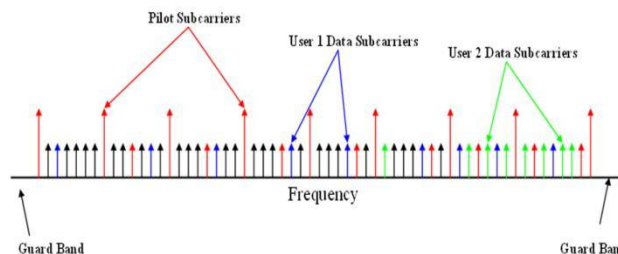


Fig.2 OFDMA by assigning subsets of subcarriers to individual users

A. Femtocell Interference Scenarios

1. Femtocells interfering with base stations on the same frequency.
2. Base stations interfering with femtocells on the same frequency.
3. Closely spaced femtocells interfering with each other
4. User equipment transmitting with a sufficiently high

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Vol. 5, Issue 6, June 2016

power such that it is received by more than one base station. 1. Macrocell UE - Femtocell BS
2. Macrocell BS - Femtocell UE 3. Femtocell UE - Macrocell BS 4. Femtocell BS -
Macrocell UE
5. Femtocell "A" UE - Femtocell "B" BS 6. Femtocell "A" BS - Femtocell "B" UE
Slno 1 to 4 – Cross tier
Sl no 5 and 6 – Co tier[15]

Solution to Interference Problems

1. Dynamic femtocell receiver gain management[6]
2. Mobile phone uplink power capping
3. Extended femtocell receiver dynamic range

II. DETAIL EXPERIMENTAL

A. QoS support in Wi-Max

In real-time communications huge sufficient bandwidth is necessary for transmitting high resolution digital videos and images in mobile automatic systems. Providing QoS in IEEE 802.16/WiMAX network is a challenging problem. The necessitate for efficient interworking between IEEE 802.16/WiMAX and IEEE 802.11/WLAN arise in order to sustain QoS for delay-sensitive and bandwidth-intensive applications. IEEE 802.11e employ a channel access function, hybrid coordination function (HCF), to support QoS provisioning in IEEE 802.11/WLAN networks.

QoS define six different types of services for different types of traffic flow as follows :

1. Unsolicited grant service (UGS) supports stable bit rate traffic, such as voice over IP (VoIP).
2. Real-time poll service (rtPS) ropes real-time service flows which make variable size data packet.
3. On a periodic basis (e.g., MPEG video). This system can guarantee QoS service to meet delay requirements time.
4. Extended real-time polling service (ertPS) is a recent scheduling algorithm for Voice over Internet Protocol services with variable data rates and silence suppression.
5. Non-real-time poll service (nrtPS) is intended to maintain non real-time service flows that involve variable size data yielding burst types on a normal basis, such as higher bandwidth FTP.
6. Best effort (BE) supports forces that do not provide QoS guarantees (e.g., Web and email traffic).

B. Scheduling algorithms

Round Robin as a scheduling algorithm is the most essential and least complex scheduling algorithm. Basically the algorithm services the log jammed queues in a round robin fashion. Each time the scheduler pointer stop at a particular line up sequence, one packet is dequeued from that and then the scheduler pointer goes to the next queue is shown in Figure 3. It distributes channel resources to all the SSs without any priority. The RR scheduler is uncomplicated and trouble-free to implement. However, this technique is not proper for systems with different levels of priority and systems with powerfully varying sizes of traffic.

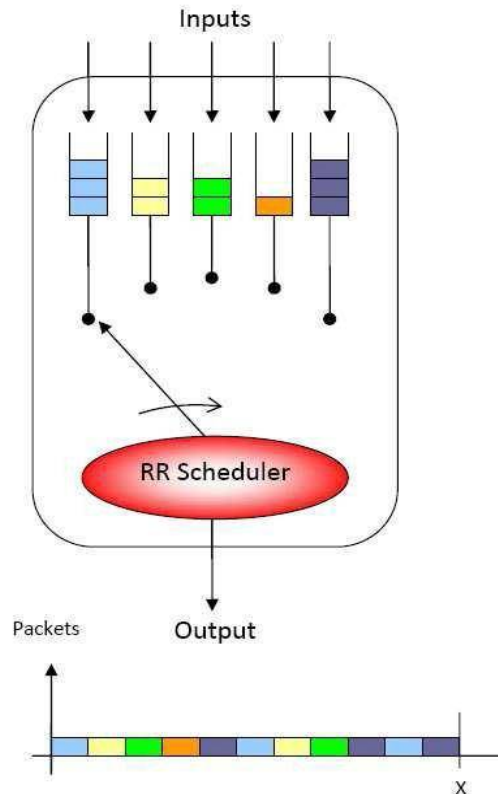


Fig.3 RR Scheduler

III. RESULTS AND DISCUSSION

A. Simulation discussion

This section present the simulation outcome for the algorithms scheduling. For testing performance of algorithms, the introduce algorithms are implemented in the NS-2(Network Simulator) and WiMAX unit that is based on the WiMAX NIST module. Also implement the most significant MAC signalling messages, such as UL-MAP and DL-MAP, authentication (PKM), capabilities (SBC), REG (Registration), DSA (Dynamic Service Addition), and DSC (Dynamic Service Change). Table 1 shows present slot size for different modulations and channel coding type. The purpose of this development is to make sure that the scheduler at the BS takes the service class into account and allocate slots based on the QoS requirements and the request sizes sent by SSs. Another point is to test that the scheduler at the BS takes the MAC overhead into account.[12]

TABLE I. Slot size for OFDM PHY

Lot size(byte)	Channel coding	modulation
108	3/4	64-QAM
96	2/3	64-QAM
36	3/4	QPSK
24	1/2	QPSK

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B. Comparison with Previous Research

A hybrid network base on IEEE 802.11/WLANs and IEEE 802.16/WiMAX is a strong contender since both technology are designed to supply everywhere low cost, high speed data rates, Quality Of Service (QoS) provisioning, and broadband wireless Internet access[9]. In earlier research IEEE 802.11/WLAN standard is used to present sensible to high pace data communications in a short range generally within a building. In this IEEE 802.16/WiMAX standard[10] is used to offer broadband wireless services require high-rate transmission and strict QoS requirements in both indoor and outdoor environments. Also, IEEE 802.16/WiMAX network is a promising result to provide backhaul support for IEEE 802.11/WLAN hotspots.

The technology behind WiMAX is appropriate for wider geographic networks than Wi-Fi. The WiMAX Forum has projected that new WiMAX equipment will be competent of sending high speed data over long distance (40 Mbit/s over 9 kilometers in a line-of sight stable environment). At these distance, WiMAX equipment could lay key role in helping link the digital divide as long-distance wireless links could help deliver higher-speed access to areas usually out of reach of fixed-line networks. WiMAX also act as a destructive technology that may impact permanent and mobile markets in both their data and voice segments. Finally, WiMAX has also been use as a potential key component of next-generation converge or everywhere in networks.

IV. CONCLUSION

Initial analysis of the WiMAX interference problem indicates a dependence upon a process (scheduling) which cannot be modeled exactly[8]. Consider a Preemptive Scheduling approach. However, further study shows that the details of this dependence are not relevant to the engineering question. So treat the scheduler operation as a stochastic process and concentrate instead on the elements of the problem which are well defined and easily calculated using traditional simulation techniques. For these reasons EDX's simple calculation approach, beginning with a fixed traffic definition, and evaluate the frame stochastics directly results in a fast and efficient algorithm that produces a reliable, consistent, and practical result.

In future this research aims at fulfilling the 4G and 5G requirements by the ITU IMT-Advanced requirements.

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REFERENCES

- [1]. Arslan M Y, Yoon J, Sundaresan K, Krishnamurthy S. V and S. Banerjee
2012 Nov, "A resource management system for interference mitigation in enterprise OFDMA femtocells," *IEEE/ACM Trans. Netw.*, vol. 21,no. 5, pp. 1447–1460.
- [2]. Chandrasekhar V, Andrews J, and Gatherer A, 2008 Sep "Femtocell networks: A survey," *IEEE Commun. Mag.*, vol. 46, no. 9, pp. 59–67.
- [3]. Chang R, Tao Z, Zhang J, and Kuo C, 2009 Jun, "A graph approach to dynamic fractional frequency reuse (FFR) in multi-cell OFDMA networks," in *Proc. IEEE Int. Conf. Commun.*, pp. 1–6.
- [4]. Elsherif A R, Chen W, Ito A, and Ding Z, 2013 Jun "Adaptive small cell access if licensed and unlicensed bands," in *Proc. IEEE ICC*, pp. 6327–

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6332. [5]. Erturk M C, Guvenc I, Mukherjee S, and Arslan H, 2013, "Fair and QoS-oriented resource management in heterogeneous networks," *Wireless Commun. Netw.*, vol. 2013, no. 121, pp. 1–14.
- [6]. Gur V, Bayhan S, and F. Alagoz, 2010 Aug "Cognitive femtocell networks: An Overlay architecture for localized dynamic spectrum access," *IEEE Wireless Commun. Mag.*, vol. 17, no. 4, pp. 62–70.
- [7]. Hu P *et al.*, 2012 Sep "Downlink resource management based on cross-cognition and graph coloring in cognitive radio femtocell networks," in *Proc. 76th IEEE VTC Fall*, , pp. 1–5.
- [8]. Hossain E, Rasti M, Tabassum H, and Abdelnasser A, 2014 Mar, "Evolution toward 5G multi-tier cellular wireless networks: An interference management perspective," *IEEE Wireless Commun.*, vol. 21, no. 3, pp. 118–127.
- [9]. Kamal Gakhar, Annie Gravey and Alain Leroy, "IROISE: A New QoSArchitecture for IEEE 802.16 and IEEE 802.11e Interworking", Department Of Computer Science, ENST Bretagne, 29238 Brest Cedex 3, France, 2006.
- [10]. Kauffmann, *etal.* 2007, May, "Measurement-based self organization of interfering 802.11 wireless access networks," in *Proc. IEEE INFOCOM*, pp. 1451–1459.
- [11]. Kishiyama Y, Benjebbour A, Nakamura T, and Ishii H, Feb. 2013, "Future steps of LTE-A: Evolution toward integration of local area and wide area systems," *IEEE Wireless Commun.*, vol. 20, no. 1, pp. 12–18,.
- [12]. Ling J, 2011 Nov "A distributed MAC based on maximal packing," in *Proc. IEEE Int. COMCAS*, , pp. 1–6.
- [13]. Ling J, Chizhik D, and Valenzuela R, 2009 Nov, "On resource allocation in dense femto-deployments," in *Proc. IEEE Int. COMCAS*, pp. 1–6.
- [14]. Loz-Perez D, Chu X, and Zhang J, 2012 Oct, "Dynamic downlink frequency and power allocation in OFDMA cellular networks," *IEEE Trans. Commun.*, vol. 60, no. 10, pp. 2904–2914.
- [15]. Pantisano F, Ghaboosi K, Bennis M, and Verdone R, 2010 Sep. "A self-organizing solution for interference avoidance in TDD underlay femtocells," in *Proc. 44th Asilomar Conf. Signals, Syst. Comput.*, , pp. 175–179.