

A novel diversified Energy Efficient Ultra dense network through PCID cell Assignment

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Abstract

Next-generation wireless networks are going to have highly dense, small cell structure with a large number of femtocells which is termed as Ultra-Dense Femtocellular Networks. In ultra-dense Femtocellular networks (UDNs), large-scale deployment of femto base stations is an important technique for improving the network throughput and quality of service (QoS). A multidimensional resource allocation algorithm is an efficient method to manage inter-small-cell interference while establishing a realistic scenario of three-tier heterogeneous network architecture. However on deployment of the above mentioned architecture leads to several challenges data collision, Energy degradation during waiting time and bandwidth wastages. In order to mitigate those challenges, Spatial and Temporal Clustered Network Inference mechanism is proposed which deploy the network under different deployment strategies in terms of spatial and temporal preferences. The overlapping clusters is created in Ultra-dense femtocellular networks in order to reduce the inference, where each cluster head runs the distributed randomized PCID allocation algorithm and locally monitors the conflicts to avoid the collision and confusion constraints. Simulation analysis demonstrates the efficiency of the proposed algorithm against state of art approaches in terms of throughput, overhead and packet delivery ratio.

Keywords: Ultra dense network, Femtocell, PCID Assignment, LTE –A Network, Collusion and Confusion Constraints

I.INTRODUCTION

UDN is defined as a network where the BS (or AP) density potentially reaches or even exceeds the user density [1]. UDN is characterized as a network where the inter-site distance is only a few meters. DN is identified as a network reaching the point where its capacity grows sub-linearly, due to the growing impact of interference, as the BS density increase. Due to the traffic load fluctuation, turning off the BSs in the cells with low or no traffic load is an essential way for UDNs in improving EE as well as reducing interference [2].

Utilizing the massive amount of radio resources optimally in an UDN becomes increasingly complex. Misallocation of increased radio resources can cause higher interference, unbalanced load distributions, and higher power consumption. Furthermore, due to interference, local radio resource allocation may have a global impact to a UDN[3]. Non-localized impact of interference in an UDN requires a large-scale optimization problem to be efficiently solved. Scalable algorithms have been pursued including transforming a non-convex programming into a sequence of convex programming, and distributed decision making with network-wide iterations [4].

In this paper, we propose a multidimensional resource allocation algorithm which is an efficient method to manage inter-small-cell interference while establishing a realistic scenario of three-tier heterogeneous network architecture. Today deepening of the research, challenges to mitigate the interference is considered through inclusion of spatial and temporal preferences.

The remaining paper is summarized into sections as related work on ultra dense network and PCID allocation in the section 2, describing the proposed methodology in the section 3. Experimental analysis in section 4 and finally conclusion of the paper is presented in the section 5

II. RELATED WORK

This Section analyses the importance and availability of the Ultra dense femtocellular network and its impacts on various categories

A. Millimeter Wave Communications for Future Mobile Networks

Millimeter wave (mmWave) communications have recently attracted large research interest, since the huge available bandwidth can potentially lead to the rates of multiple gigabit per second per user and due to importance high data by applications. It summarizes on recent channel measurement campaigns and modeling results. Then, recent progresses in multiple input multiple output transceiver design for mmWave communications has been discussed [5]. After that, an overview of the solution for multiple access and backhauling is provided, followed by the analysis of coverage and connectivity to model an ultra dense network using femtocell.

B. Resource allocation method in ultra-dense network

A multidimensional resource allocation algorithm based on nonco-operation game theory is proposed to manage the resource allocation in UDNs, including transmission point association, user channels, and power. The algorithm derives a multidimensional resource optimization model and converts into a noncooperation game model according to the analysis of transmission point association user channel and power allocation [6].

III. PROPOSED MODEL

This section discusses about design and implementation of the proposed inference management framework on basis on spatial and temporal preferences has been described

A. Physical Cell ID assignment Algorithm

It is an important configuration parameter of a radio cell. The PCID allocation helps in radio communication also helps the user equipment (UE) to detect a particular cell at the time of handover from one cell to another. Figure 1 represents the architecture of the proposed model.

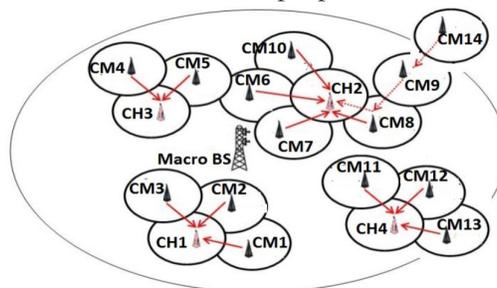


Figure 1: Architecture diagram of the proposed model

The total available PCIDs is sufficient for eNBs but becomes very challenging for highly dense femtocellular network, because the number of femtocells goes very high compared to 504 PCIDs [7].

B.Randomized distributed k-hop clustering algorithm

It is proposed for PCID assignment in ultra dense large scale femtocellular networks. Average number of rounds for a femtocell to get a PCID is given by

$$\text{Femtocell assignment} = \text{Rounds} < 2 (\beta+1)e^{0.5T}$$

Grand-round is the time duration of resending PCID assignment request if earlier request fails. The worst-case message and time complexity of the proposed algorithm is defined as $O(\beta)$. Upper bound on maximum number of required PCIDs are $\beta+1$ which is independent of total number of femtocells in the network [8].

Algorithm: PCID Assignment

Input = one-hop view of each node and total available colors

Output = k-hop clustered colored nodes such that any two nodes within two-hop distance are not assigned the same color

Process

Initially Nodes are initialized to 0 as Assign Colour

Where node maintains information about available colors in the system

If ($R < TH$)

Node changes from IDLE to CH and Node broadcasts blurb message

flag value to 1 and wait timer to t

If ($R > TH$)

Node changes from IDLE to NCH

Flag value to 0 and wait timer t2

Optimal resource allocation taking into account of traffic distribution, interference, and performance requirements such as total latency have shown considerable improvement in network resource utilization efficiency, which in turns causes less interference and leads to higher SE

IV.EXPERIMENT ANALYSIS

The proposed model of the research is simulated using the Dotnet environment towards generation of the Network Animator tool for explaining the working of the ultra dense network on PCID assignment. The GUI design is developed to explain the deployment of network and its node propagation [9].

In order to analyze the performance of proposed algorithms, we have considered a large number of femtocells are deployed underlying a macrocell region of LTE-A network. These features facilitate fast load balancing/shifting across BSs and carriers, as well as fast interference coordination and avoidance across BSs and carriers.

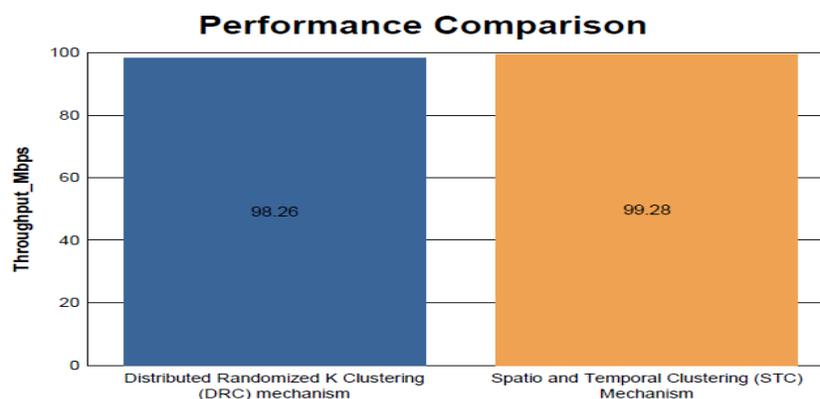


Fig.2.Performance Analysis of the PCID assignment models through Throughput

From the result, we can also conclude that variation of k does not put any effect on the number of messages per femtocell in the network [10]. Figure 2 and Table 1 provides the value of the experimental part carried out against the proposed and existing system.

TABLE 1
Performance Evaluation of the PCID assignment

Technique	Throughput In mbps	Network Overhead in mb	Packet Delivery Ratio in mbps	Energy Consumption in joules
Distributed Randomized K Clustering (DRC) mechanism –Existing System	98.26	5mb	56	10
Spatio and Temporal Clustering (STC) Mechanism – Proposed System	99.28	2mb	68	16

A randomized algorithm for PCID allocation in large scale of femtocells networks is proposed and efficiency of the results has been described through randomized clustering.

CONCLUSION

We design and implemented the interference elimination and energy depletion mechanism through Spatial and Temporal Clustered Network Inference mechanism. It is proposed on the network under different deployment strategies in terms of spatial and temporal preferences. The overlapping clusters has been created in Ultra-dense femtocellular networks in order to reduce the inference through bandwidth and queue management, where each cluster head runs the distributed randomized PCID allocation algorithm and locally monitors the conflicts to avoid the collision and confusion constraints. Simulation analysis demonstrates the efficiency of the proposed algorithm against state of art approaches in terms of throughput, overhead and packet delivery ratio.

REFERENCE

- [1] B.-J. Chang and S.-H. Liou, "Adaptive cooperative communication for maximizing reliability and reward in ultra-dense small cells lte-a toward 5g cellular networking," *Computer Networks*, 2017.
- [2] Z. Li, D. Grace, and P. Mitchell, "Traffic-aware cell management for green ultradense small-cell networks," *IEEE Transactions on Vehicular Technology*, vol. 66, no. 3, pp. 2600–2614, 2017.
- [3] T. Han, X. Ge, L. Wang, K. S. Kwak, Y. Han, and X. Liu, "5g converged cell-less communications in smart cities," *IEEE Communications Magazine*, vol. 55, no. 3, pp. 44–50, 2017.
- [4] 3GPP standardization, "Scenarios and Requirements for Small Cell Enhancements for E-UTRA and E-UTRAN," TR 36.932 v13.0.0, 2015..
- [5] M. B. Shabab and A. A. Bhatti, "Neural networks based physical cell identity assignment for self organized 3gpp long term evolution," in *Telecommunications and Signal Processing (TSP), 2012 35th International Conference on*, pp. 173–177, IEEE, 2012.
- [6] O. Teyeb, G. Mildb, and A. Furusk'r, "Physical cell identity assignment in heterogeneous networks," in *Vehicular Technology Conference (VTC Fall), 2012 IEEE*, pp. 1–5, IEEE, 2012.

- [7] A. H. Zabran, "Extended synchronization signals for eliminating pci confusion in heterogeneous lte," in *Wireless Communications and Networking Conference (WCNC)*, 2012 IEEE, pp. 2588–2592, IEEE, 2012.
- [8] A. Prataḡ, R. Misra, and U. Gupta, "Randomized graph coloring algorithm for physical cell id assignment in lte-a femtocellular networks," *Wireless Personal Communications*, vol. 91, no. 3, pp. 1213–1235, 2016.
- [9] H. Li, X. Xu, D. Hu, X. Qu, X. Tao, and P. Zhang, "Graph method based clustering strategy for femtocell interference management and spectrum efficiency improvement," in *Wireless Communications Networking and Mobile Computing (WiCOM)*, 2010 6th International Conference on, pp. 1–5, IEEE, 2010
- [10] M. Youssef, A. Youssef, and M. Younis, "Overlapping multihop clustering for wireless sensor networks," *IEEE transactions on parallel and distributed systems*, vol. 20, no. 12, pp. 1844–1856, 2009.