International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 9 Issue 4 ǁ 2021 ǁ PP. 03-06

Survey on Power Efficiency in Wireless Communication for 5g Systems

Vishnu teja M [A,1] and Leones Sherwin Vimal Raj [b]

[a]*PG Scholar, Dept of ECE, Panimalar Engineering College, Chennai*
[b]*Associate professor, Dept of ECE, Panimalar Engineering College, Chennai*

ABSTRACT: *Green communication is one of the major attribute of 5G systems, as power consumption from the information and communication technology sector is expected to increase significantly by 2028. Appropriately, energy efficient SCNs design has attracted significant attention from researchers in recent years. In addition, to enable the omnipresent deployment of dense small cells, service providers require energy-efficient connecting solutions. This paper shows the various power consumption parameters of green communication model. In the green communication model power consumption will be reduced but without disturbing the other performance matrices like capacity, bit error rate etc.,*

KEYWORDS: *Small cell networks(SCNs), Heterogeneous networks (Het Nets).*

Date of Submission: 28-03-2021 Date of acceptance: 11-04-2021

I. INTRODUCTION

Green communication is a enhancing research area in wireless communication. To make an energy efficient wireless communication without disturbing the other performance matrices like Capacity, BER etc. It is the practice of selecting power efficient communications and networking technologies and products, reducing resource used whenever possible in all branches of communication.

Global wireless data traffic shows no signs of decreasing and is expected to maintain its rapid growth in the future due to the accretion of smart devices and applications. Emerging applications such as high-resolution video streaming, palpable internet, remote monitoring, road safety and real time control applications, are expected to produce more amount of data traffic. In addition, various proposed services, such as connected cars and moving robots must be supported in efficient climbable ways. The present 4G wireless communication system is not equipped to meet this explosive growth in traffic demand. Consequently, comprising major international mobile operators, infrastructure manufacturers, and academic institutions have booked in the 5G wireless communication system design, planning, and implementation. A public private partnership for 5G-PPP has been represented to deliver standards, architecture, and technologies for omnipresent 5G infrastructure. The goal is to develop, by 2022, a system that can support 999 times increase in capacity, 999 times higher mobile data volume per area, 99 times more connected devices, and 5 times reduced end-to-end delay than 4G network . To reach these challenges, some potential design considerations include multi-tier radio access technologies (Multi-RAT), device-to-device communication (D2D), massive multiple-input-multiple-output (M-MIMO), network function virtualization (NFV), prioritized spectrum access, and base station (BS) condensation. For BS condensation in 5G systems, a small cell network based heterogeneous network is considered as a original solution.

In 5G wireless cellular communication, the main aim is to improve capacity, energy efficiency, and sum rate of the system. As the cellular communication generations is advancing, cellular users in the network are increasing. In recent survey, the 5G needs to serve 10 to 100 times of cellular devices than now. Therefore, future 5G wireless systems have huge capacity demands. The way to increase system capacity is to, replace the omni-directional antenna at the base station (BS) , to the directional sector antennas. Cell-sectorization helps in transmitting of a single desired direction decreasing co-channel interference and increasing signal-to-interference noise ratio (SINR). Hence, it improves capacity of the system.Finally, we throw light on the open opportunities yet to be investigated and grasped in future developments.

.

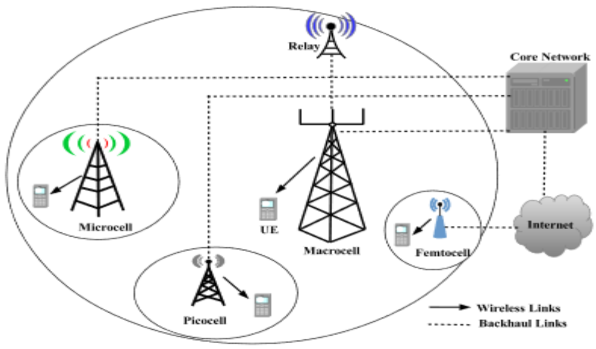

Figure 1. Network Architecture of a 5G Heterogeneous Networks.

II. RELATED WORKS

Figure 1 shows the network architecture of a 5G Heterogeneous Network, where an access network is contained of a macro-cell and several small cell networks (e.g., micro-cells, pico-cells, and femto-cells).A backhaul network is created by connecting the core network to the base stations through various backhauling solutions including wired, wireless or mixed architecture of present technologies.

Multiple Many research projects have been conducted in recent years to increase the energy efficiency for multi-tier Heterogeneous Networks. Evaluated the influence of power consumption by varying the microsite density for a required system level performance in a macro-micro Heterogeneous Networks. The optimum deployment strategy in a macro pico type Heterogeneous Networks was investigated to decrease power consumption in terms of area power consumption with a specified area spectral efficiency. An analysis framework to calculate the macro offloading uses was proposed to raise the energy efficiency for this Heterogeneous Networks formulated the spectrum sharing and resource allocation as a three-stage Stackel berg game model for improving energy efficiency in heterogeneous cognitive radio networks. To quantify the energy efficiency gain, several issues such as frequency plan, mobility, scheduling are surveyed. However, all of these studies were conducted for peak traffic demand scenarios in a HetNet system. During peak traffic scenarios, some SCNs can be turned off without creating coverage holes. The QoS of the SCNs can be assured by offloading the traffic either horizontally to neighboring cells or vertically to higher layer cells. Base station sleep mode strategies and network management schemes have been proposed for traffic-aware energy-efficient HetNet designs. Ashraf et al. proposed three different sleep mode strategies to reduce power consumption in a HetNet based on network element characteristics. Marsan et al. developed an analytical model for optimal switch-off time based on the dynamic traffic profile. An architecture using two sleep strategies was developed in , by vertical offloading of traffic from SCNs to a macrocell. However, none of the above-mentioned articles provide the optimal number of SCNs that need to be active during various hours of the day to meet the traffic demand and minimize power consumption at the same time. In addition, existing energy-efficient techniques do not take into account the power consumption of backhaul networks.

Many authors have addressed backhaul issues including capacity, cost, and power consumption .A recent survey revealed the ubiquitous unavailability of optical fiber connection around the globe. Several studies have identified the millimeter wave (mmWave) technology (E-band or V-band) as a promising alternative backhauling solution on the basis of its high capacity, low cost, and ubiquitous availability The throughput and energy efficiency of a 5G wireless backhaul network were analyzed using mmWave and microwave band under two deployment scenarios, i.e., central and distributed . In , millimeter wave technology was used for access and backhaul network functions and the authors highlighted a holistic design requirement approach. Mesodiakaki et al. analyzed the backhaul power consumption, with mmWave, microwave, and sub6 GHz band, for outdoor small cell backhauling under different deployment scenarios. In a related study, the optimal user association problem for HetNet was demonstrated to maximize the energy efficiency and spectrum efficiency by using mmWave technology. Self-backhauling and energy harvesting techniques are also used to further improve the energy efficiency in small cell networks.

This model [1] considers both the access and back haul network elements. It formulate and present an analytical model to calculate the optimum number of small cells that need to be kept active at various times of the day in order to minimize power consumption. It formulate and present an analytical model to calculate the optimum number of small cells that need to be kept active at various times of the day in order to minimize power consumption.

In this paper [2] downlink power consumption depends probabilistic on the population of the active mobile users in both the macro cell and small-cell networks such that the regulating factor is referred to as active user population factor (AUPF). This paper investigates the end-to-end downlink power consumption of the

Heterogeneous Networks, which consists of the power consumed by the macro cell and small-cell base stations and the backhaul to carry the traffic from the access to the core network. In this paper, a probabilistic traffic model is proposed in order to find the number of active SBS, and thereby control the downlink power consumption of Heterogeneous Networks. The power consumed here is 4.4 terawatt-hour.

In this paper [3] optimum deployment strategy in a macro-Pico type Heterogeneous Networks was investigated to decrease power consumption in terms of area power consumption with a specified area spectral efficiency. Evaluated the influence of power consumption by varying the microsite density for a required system level performance in a macro-micro Heterogeneous Networks. The power consumption of the macro cells increases significantly with a reduced number of supported users per macro cell as a result of more user data rates.

This model [4] decreasing power efficiency of macro cellular technologies with increasing user demand for high data rates is discussed. It is shown that a joint deployment of macro- and publicly accessible residential pico cells can reduce the total power consumption by up to 62% in an urban area with this technology. In this paper the effects of a joint deployment of macro cells for area coverage and publicly accessible residential pico cells on the total energy consumption of the network is investigated. The result is a significant reduction of the network power consumption as the user demand for high data rates will be increasing.

In this paper [5] the energy-efficient resource allocation problem in heterogeneous cognitive radio networks with femtocells as a Stackelberg game will be getting. A gradient based iteration algorithm is proposed to obtain the Stackelberg equilibrium solution to the energy-efficient resource allocation problem. In this paper, we study the energy efficiency aspect of spectrum sharing and power allocation in heterogeneous cognitive radio networks with femtocells. Simulation results are presented to demonstrate the Stackelberg equilibrium is obtained by the proposed iteration algorithm and energy efficiency can be improved significantly in the proposed scheme.

Here in this model [6] first introduce the main system model and framework that are considered in most of the existing green scheduling works. Then describe the main contributions on green scheduling as well as summarize their key findings. For instance, green scheduling schemes have demonstrated that they can significantly decrease transmit power and improve the energy efficiency of cellular systems. Here also provide a performance analysis of some of the existing schemes in order to highlight some of the challenges that need to be addressed to make green scheduling more effective in Het Nets[6].

This paper [7] shows that the power efficiency is fulfilled through traffic perception by each base station in its dynamically changes monitoring area. Simulation results show that the proposed adaptive scheme is able to enhance the network stability and significantly improve energy saving for various traffic density levels while maintaining a good Quality of Service. It is evident that the scheme can sustain at least 1.1 Gbps/km ^{2} /MHz traffic, and consume 41% less power at low traffic loads than with no topology management and consume 15% less power compared to the best static scheme in which each base station adopts traffic perception in a fixed monitoring area.

This paper [8] shows Power consumption problem has become one of the most challenging problems due to the fast expansion of wireless network scale. Traditionally, network operators are more concerned about the coverage and capacity problem when planning cellular networks, rather than the energy efficiency of the network. In this paper, proposed an energy-efficient micro base station (BS) planning strategy based on realistic traffic data in Heterogeneous Networks architecture. A genetic algorithm (GA) is introduced to solve the optimization problem. By carefully selecting algorithm parameters, the algorithm can produce a set of near optimum solutions. The simulation results show that the power efficiency and traffic coverage ratio are both improved by the deployment of micro BSs.

This paper [9] analyse the wireless backhaul traffic in two typical network architectures adopting small cell and Milli meter wave communication technologies. Furthermore, the energy efficiency of wireless backhaul networks is compared for different network architectures and frequency bands. Numerical comparison results provide some guidelines for deploying future 5G wireless backhaul networks in economical and highly energy-efficient ways.

In this paper [10] Small cells (SCs) are expected to be densely deployed during the next few years to increase the network capacity of future heterogeneous networks . Due to their dense deployment, not all SCs are expected to have a direct connection to the core network. As a result, some SCs will forward their traffic to the neighbouring SCs until they reach the core network, thus forming a multi-hop backhaul (BH) network. Due to the large number of BH links, the BH is expected to be one of the main difficulties that future Heterogeneous Networks will have to face. At the same time, traffic demands are growing exponentially resulting in more power consumption. Therefore, how to achieve high network power efficiency becomes of utmost importance. To that end, in this paper, the role of BH in future outdoor HetNets aiming to answer to whether or not it could constitute an energy bottleneck for the HetNet. To gain insights, the BH energy consumption impact compared to the access network under different traffic distribution scenarios and BH technologies.

In this paper, [11] the user association problem aiming at the joint maximization of network energy efficiency (EE) and spectrum efficiency (SE), without compromising the user quality of service .The problem is formulated as an constraint problem, which considers the transmit power consumption both in the access network, i.e., the links between the users and their serving cells, and the BH links. The optimal Pareto-front solutions of the problem are analytically derived for different BH technologies, and insights are gained into the EE and SE tradeoff. The proposed optimal solutions, despite their high difficulty, can be used as a benchmark for the performance evaluation of user association algorithms. In this paper they also propose a heuristic algorithm, which is compared with reference solutions under different traffic scenarios and BH technologies. Simulated results motivate the use of mm Wave BH, whereas the proposed algorithm achieves near-optimal performance.

The paper [12] aim is green small cell networks by jointly achieving self-backhaul and energy harvesting. In addition, full-duplex and massive multiple-input and multiple-output technologies are also exploited to increase the system performance. In order to improve the power efficiency (PE) further, a novel precoding scheme is designed to remove both the inter-tier and multi-user interference. Based on the proposed precoding scheme, formulate the cell association and power allocation problem as an optimization problem to optimize the system PE performance, with the power arrival rate and remaining battery power in SBSs involved. Extensive simulation results are presented to justify the effectiveness of the proposed scheme with varied system configurations.

III. CONCLUSION

Using this Green communication model energy consumption will be decreased up to 48.1% than other system. This paper concludes various research papers power consumption and shows how to save power using green communication model.

REFERNCES

[1]. Md Munjure Mowla, ,IEEE, Iftekhar Ahmad, Daryoush Habibi, and Viet Phung," A Green Communication Model for 5G Systems" IEEE TRANSACTIONS ON GREEN COMMUNICATIONS AND NETWORKING, VOL. 1, NO. 3, SEPTEMBER 2017

[2]. A. R. Ekti, M. Z. Shakir, E. Serpedin, and K. A. Qaraqe, "End-toend downlink power consumption of heterogeneous small-cell networks based on the probabilistic traffic model," in Proc. IEEE WCNC, Istanbul, Turkey, Apr. 2019, pp. 1138–1142.

[3]. H. Claussen, L. T. W. Ho, and F. Pivit, "Effects of joint macrocell and residential picocell deployment on the network energy efficiency," in Proc. IEEE 19th Int. Symp. PIMRC, Cannes, France, Sep. 2018, pp. 1–6.

[4]. Y. Hou and D. I. Laurenson, "Energy efficiency of high QoS heterogeneous wireless communication network," in Proc. IEEE 72nd VTC Fall, Ottawa, ON, Canada, Sep. 2017, pp. 1–5.

[5]. R. Xie, F. R. Yu, H. Ji, and Y. Li, "Energy-efficient resource allocation for heterogeneous cognitive radio networks with femtocells," IEEE Trans. Wireless Commun., vol. 11, no. 11, pp. 3910–3920, Nov. 2017.

[6]. T. Yang, F. Heliot, and C. H. Foh, "A survey of green scheduling schemes for homogeneous and heterogeneous cellular networks," IEEE Commun. Mag., vol. 53, no. 11, pp. 175–181, Nov. 2017.

[7]. Z. Li, D. Grace, and P. Mitchell, "Traffic perception based topology management for 5G green ultra-small cell networks," in Proc. IEEE 1st Int. CCS Workshop, Duisburg, Germany, Sep. 2017, pp. 1–5.

[8]. X. Li, X. Zhang, and W. Wang, "An energy-efficient cell planning strategy for heterogeneous network based on realistic traffic data," in Proc. IEEE ComManTel, Danang, Vietnam, Apr. 2017, pp. 122–127.

[9]. X. Ge, H. Cheng, M. Guizani, and T. Han, "5G wireless backhaul networks: Challenges and research advances," IEEE Netw., vol. 28, no. 6, pp. 6–11, Nov./Dec. 2016.

[10]. A. Mesodiakaki et al., "Energy impact of outdoor small cell backhaul in green heterogeneous networks," in Proc. IEEE 19th Int. CAMAD Workshop, Athens, Greece, Dec. 2016, pp. 11–15.

[11]. A. Mesodiakaki, F. Adelantado, L. Alonso, M. D. Renzo, and C. Verikoukis, "Energy-and spectrum-efficient user association in millimeter-wave backhaul small-cell networks," IEEE Trans. Veh. Technol., vol. 66, no. 2, pp. 1810–1821, Feb. 2017..

[12]. L. Chen et al., "Green full-duplex self-backhaul and energy harvesting small cell networks with massive MIMO," IEEE J. Sel. Areas Commun., vol. 34, no. 12, pp. 3709–3724, Dec. 2016.