Review on Mobile Communication by Clustering with Optimization in OFDM Channel

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Abstract- The current status of the 5G technology for cellular systems is very much in the early development stages. Very many companies are looking into the technologies that could be used to become part of the system. In addition to this a number of universities have set up 5G research units focussed on developing the technologies for 5G. In addition to this the standards bodies, particularly 3GPP are aware of the development but are not actively planning the 5G systems yet. Many of the technologies to be used for 5G will start to appear in the systems used for 4G and then as the new 5G cellular system starts to formulate in a more concrete manner, they will be incorporated into the new 5G cellular system. The major issue with 5G technology is that there is such an enormously wide variation in the requirements: superfast downloads to small data requirements for IoT than any one system will not be able to meet these needs. Accordingly a layer approach is likely to be adopted. As one commentator stated: 5G is not just a mobile technology. It is ubiquitous access to high & low data rate services.

Keywords- 5G, optimization, MIMO, channel

I. INTRODUCTION

The next generation cellular wireless networks (i.e., 5G networks) are expected to be deployed around 2020 which are envisioned to provide higher data rate, lower end-to-end latency, improved spectrum/energy efficiency, and reduced cost per bit. In general, addressing these requirements will require significantly larger amount of spectrum, more aggressive frequency reuse, extreme densification of small cells, and the wide use of several enabling technologies (e.g., full-duplex, massive MIMO, C-RAN, and wireless virtualization) [1]. 5th generation mobile networks or 5th generation wireless systems, abbreviated 5G, are the proposed next telecommunications standards beyond the current 4G/IMT-Advanced standards. An initial chip design by Qualcomm in October 2016, the Snapdragon X50 5G modem supports operations in the 28 GHz band, also known as millimeter wave (mmW) spectrum. With 800 MHz bandwidth support, it is designed to support peak download speeds of up to five gigabits per second. 5G planning aims at higher capacity than current 4G, allowing a higher density of mobile broadband users, and supporting device-to-device, ultra reliable, and massive machine communications. If 5G appears and reflects these prognoses, then the major difference, from a user point of view, between 4G and 5G must be something other than faster speed (increased peak bit rate). For example, higher number of simultaneously connected devices, higher system spectral efficiency (data volume per area unit), lower battery consumption, lower outage probability (better coverage), high bit rates in larger portions of the coverage area, lower latencies, higher number of supported devices, lower infrastructure deployment costs, higher versatility and scalability, or higher reliability of communication [3]. With the 4G telecommunications systems now starting to be deployed, eyes are looking towards the development of 5th generation or 5G technology and services. Although the deployment of any wireless or cellular system takes many years, development of the 5G technology systems is being investigated. The new 5G technologies will need to be chosen developed and perfected to enable timely and reliable deployment. The new 5th generation, 5G technology for cellular systems will probably start to come to fruition around 2020 with deployment following on afterwards.

5G mobile systems status

5G cellular systems overview

As the different generations of cellular telecommunications have evolved, each one has brought its own improvements. The same will be true of 5G technology.

- ***First generation, 1G:*** These phones were analogue and were the first mobile or cellular phones to be used. Although revolutionary in their time they offered very low levels of spectrum efficiency and security.
- ***Second generation, 2G:*** These were based around digital technology and offered much better spectrum efficiency, security and new features such as text messages and low data rate communications.
- ***Third generation, 3G:*** The aim of this technology was to provide high speed data. The original technology was enhanced to allow data up to 14 Mbps and more.
- ***Fourth generation, 4G:*** This was an all-IP based technology capable of providing data rates up to 1 Gbps.

Any new 5th generation, 5G cellular technology needs to provide significant gains over previous systems to provide an adequate business case for mobile operators to invest in any new system. Facilities that might be seen with 5G technology include far better levels of connectivity and coverage. The term World Wide Wireless Web, or WWWW is being coined for this. For 5G technology to be able to achieve this, new methods of connecting will be required as one of the main drawbacks with previous generations is lack of coverage, dropped calls and low performance at cell edges. 5G technology will need to address this.

5G specifications

Although the standards bodies have not yet defined the parameters needed to meet a 5G performance level yet, other organisations have set their own aims, that may eventually influence the final specifications.

Typical parameters for a 5G standard may include:

SUGGESTED 5G WIRELESS PERFORMANCE	
PARAMETER	SUGGESTED PERFORMANCE
Network capacity	10 000 times capacity of current network
Peak data rate	10 Gbps
Cell edge data rate	100 Mbps
Latency	< 1 ms

These are some of the ideas being put forwards for a 5G standard, but they are not accepted by any official bodies yet.

Current research

There are several key areas that are being investigated by research organisations. These include:

- ***Millimetre-Wave technologies:*** Using frequencies much higher in the frequency spectrum opens up more spectrum and also provides the possibility of having much wide channel bandwidth - possibly 1 - 2 GHz. However this poses new challenges for handset development where maximum frequencies of around 2 GHz and bandwidths of 10 - 20 MHz are currently in use. For 5G, frequencies of above 50GHz are being considered and this will present some real challenges in terms of the circuit design, the technology, and also the way the system is used as these frequencies do not travel as far and are absorbed almost completely by obstacles. *Read more about* ***5G millimetre wave links***

- ***Future PHY / MAC:*** The new physical layer and MAC presents many new interesting possibilities in a number of areas:
  - ***Waveforms:*** One key area of interest is that of the new waveforms that may be seen. OFDM has been used very successfully in 4G LTE as well as a number of other high data rate systems, but it does have some limitations in some circumstances. Formats being proposed include: GFDM, Generalised Frequency Division Multiplexing, as well as FBMC, Filter Bank Multi-Carrier, UFMC, Universal Filtered MultiCarrier. Each has its own advantages and limitations and it is possible that adaptive schemes may be employed, utilising different waveforms adaptively for the 5G mobile systems as the requirements dictate. This provides considerably more flexibility for 5G mobile communications. *Read more about* ***5G waveforms***
  - ***Multiple Access Schemes:*** Again a variety of new access schemes are being investigated for 5G technology. Techniques including OFDMA, SCMA, NOMA, PDMA, MUSA and IDMA have all been mentioned. *Read more about* ***5G multiple access schemes***
  - ***Modulation:*** Whilst PSK and QAM have provided excellent performance in terms of spectral efficiency, resilience and capacity, the major drawback is that of a high peak to average power ratio. Modulation schemes like APSK could provide advantages in some circumstances. *Read more about* ***5G modulation schemes***

II. RELATED WORK

Kun Zhu et.al. [1] In this paper, aim to address this two-level hierarchical resource allocation problem while satisfying the requirements of efficient resource allocation, strict inter-slice isolation, and the ability of intra-slice customization. To this end, design a hierarchical combinatorial auction mechanism, based on which a truthful and sub-efficient resource allocation framework is provided. Specifically, winner determination problems (WDPs) are formulated for the InP and MVNOs, and computationally tractable algorithms are proposed to solve these WDPs. Also, pricing schemes are designed to ensure incentive compatibility. The designed mechanism can achieve social efficiency in each level even if each party involved acts selfishly. Numerical results show the effectiveness of the proposed scheme.

Zhijian Lin et.al. [2] in this paper, proposed two types of D2D device discovery and access procedure for the 5G cellular network, presented the system model based on the Markov process, designed an access control algorithm, and provided the performance analysis. Moreover, conducted extensive simulations using the Vienna Matlab platform. In this analysis, this obtained the relationship between the access probability and the collision probability for different maximum number of collisions. A reasonable trade-off between the allowable maximum number of collisions and the collision probability was discussed, and the simulation results showed that the average access latency increased as the number of either preambles or users increase.

Zhijian Lin et. al. [4] in this paper, two strategies of D2D device discovery and access procedure for the 5G cellular networks are proposed with the mathematical model based on two dimensional discrete time Markov process. In addition, it provides the performance analysis. Furthermore, we conduct extensive simulations using the Matlab platform. In our analysis, we obtain the relationship between the accessing probability, collision probability and the maximum number of collisions. A reasonable trade-off between the allowable maximum number of collisions and the collision probability is discussed and the simulation results show that the average accessing latency increases as the growing number of preambles or the decreasing number of accessing users.

Gang Liu et. al. [5] in this article, first give a brief survey of them. For in-band FDR, a historic perspective, the self-interference cancellation technologies, and the merits are discussed. For wireless virtualization, present the basic idea and a multi-dimensional perspective. Then propose virtual resource management architecture for in-band FDR networks. It is demonstrated that the proposed scheme can substantially improve the performance of virtualized FDR networks, where SPs, MNOs, and users can benefit from these two emerging technologies in 5G cellular networks.

Jian Qiao et.al. [6] in this article, focus on building D2D communications over mmWave 5G cellular networks. Discuss the mmWave propagation characteristics and the corresponding challenges to enable D2D communications. The future 5G cellular network architecture and MAC structure are described. A resource sharing scheme to allocate time slots to concurrent D2D links to increase network capacity is proposed. Then conclude the article with a summary and a brief discussion of future work.

THEODORE S. RAPPAPORT et.al. [7] this work presents data collected in the urban environments around the University of Texas at Austin (38 GHz) and New York University (28 GHz). Outage studies conducted at 28 GHz and 38 GHz showed that consistent coverage can be achieved by having base stations with a cell-radius of 200 meters. Path loss was larger in New York City than in Austin, due to the nature of the denser urban environment. In New York City, reflection coefficients for outdoor materials were significantly higher, for example, 0.896 for tinted glass, and 0.740 for clear non-tinted glass, compared with those of indoor building materials. Similarly, penetration losses were larger for outdoor materials in New York City. Since signals cannot readily propagate through outdoor building materials, indoor networks will be isolated from outdoor networks and this suggests that data showers, repeaters, and access points may need to be installed for handoffs at entrances of commercial and residential buildings.

Mattia Rebato et.al. [8] In this paper, discuss resource sharing, a key dimension in mmWave network design in which spectrum, access and/or network infrastructure resources can be shared by multiple operators. It is argued that this sharing paradigm will be essential to fully exploit the tremendous amounts of bandwidth and the large number of antenna degrees of freedom available in these bands, and to provide statistical multiplexing to accommodate the highly variable nature of the traffic. In this paper, investigates and compare various sharing configurations in order to capture the enhanced potential of mmWave communications. The results reflect both the technical and the economical aspects of the various sharing paradigms. It deliver a number of key insights, corroborated by detailed simulations, which include an analysis of the effects of the distinctive propagation characteristics of the mmWave channel, along with a rigorous multi-antenna characterization. Key findings of this study include (i) the strong dependence of the comparative results on channel propagation and antenna characteristics, and therefore the need to accurately model them, and (ii) the desirability of a full spectrum and infrastructure sharing configuration, which may result in increased user rate as well as in economic advantages for both service provider.

Vincenzo Sciancalepore et. al. [9] this paper focus on dissemination of contents, and aim at the minimization of the total transmission time spent by base stations to inject the contents into the network. It leveraged the almost blank subframe technique to keep under control the intercell interference in such a process. It formulated an optimization problem, prove that it is NP-hard and NP-complete, and propose a near-optimal heuristic to solve it. Our algorithm substantially outperforms classical intercell interference approaches, as we evaluate through the simulation of LTE-A networks.

Ahmed Iyanda Sulyman et.al. [10] this article presents empirically-based largescale propagation path loss models for fifth generation cellular network planning in the millimeter-wave spectrum, based on real-world measurements at 28 GHz and 38 GHz in New York City and Austin, Texas, respectively. It consider industry-standard path loss models used for today's microwave bands, and modify them to fit the propagation data measured in these millimeter-wave bands for cellular planning. Network simulations with the proposed models using a commercial planning tool show that roughly three times more base stations are required to accommodate 5G networks (cell radii up to 200 m) compared to existing 3G and 4G systems (cell radii of 500 m to 1 km) when performing path loss simulations based on arbitrary pointing angles of directional antennas.

Waqas Bin Abbas et. al. [11] In this work, we argue that analog beamforming can still be a viable choice when context information about mmWave base stations (BS) is available at the mobile station (MS). We then study how the performance of analog beamforming degrades in case of angular errors in the available context information. Finally, we present an analog beamforming receiver architecture that uses multiple arrays of Phase Shifters and a single RF chain to combat the effect of angular errors, showing that it can achieve the same performance as hybrid beamforming.

detection in cotton plant. This work is based on the identification of cotton bug on cotton plant. The detection process is done by using hybrid fuzzy c-means method and thresholding method. The proposed approach divides the image into segment it enhances the accuracy of detection. The detection is done on the features like orientation, length and area. In this work neural network classifier is used for classification which enhances the accuracy in results. Zhang et al. [4] presented the method of leaf diseases detection by using the concept of K-mean clustering algorithm and pyramids of histogram method. In this work the image is divided into the super pixel clusters by using super pixel clustering algorithm. After this K-mean clustering algorithm is applied on the super pixels cluster. The PHOG features are extracted from the segmented image and then concatenate the 4-PHOG descriptor as a vector. The result of the proposed approach shows its effectiveness and proves that it works properly in diseases detection. Hossian et al [5] worked on the disease's detection and recognition on the Tea plant leaves. The detection process is done by using the support vector machine classifier.

The detection process is based on the 11features for the images and later these features are used for the classification process. On the basis of image features diseases is analyzed and every time the image of leaves is uploaded into the SVM database. The uploaded image is matched with the images in the database for diseases recognition. The result of this process shows it takes less computation time with high accuracy and enhances the efficiency of detection and recognition. Shariff et al [6] presented disease detection and classification approach which is based on the weighted segmentation and feature selection . This work is based on the detection of citrus diseases in fruits. In this work firstly detection of lesion spot on the citrus fruit and leaves and after this classification of diseases is done. The lesion spots are extracted by using optimized weighted segmentation method. The effective features are selected by using the hybrid feature selection method which consist of entropy, PCA score and skewness-based covariance vector. After this process Multi class-SVM classifier is used for classification. This approach gives the high accuracy. Singh et al. [7] presented a review on the plant diseases detection techniques. This is done because diseases detection is an important part in the field of agriculture for this traditionally people observes by naked eyes but all time it is not possible to effectively classify the diseases this problem is solved by using the latest technologies. This review presented the different algorithms of machine learning and their working in diseases detection for effective accuracy. Khan et al. [8] proposed a diseases detection method by using the concept of multilevel segmentation and expectation maximization algorithm. In this work salient regions are extracted from the images by using binary partitioned tree. And it utilizes the principle of eigen vector. The accuracy of the proposed approach is higher than the existing approach.

Table.1 Existing Scheduling Model

Paper	Algorithm	parameters	Gap
Purushothaman, K. E., Madhuvathani, V., & Nagarajan, V. (2019, April). Design and Simulation of OFDMA Transceiver for High Speed 5G Wireless Network using Immense PSO-GA. In *2019 International Conference on Communication and Signal Processing (ICCSP)* (pp. 0975-0979). IEEE.	Orthogonal Frequency Division Multiple Access(OFDMA) transceiver by reduce power and energy consumption, also number of nodes using PSO and GA algorithm	Average user rate:20-30% increase CCDF:10%	• Not analysis the bandwidth changes according to distance • Not improve BER according to SNR
Lu, W., Fang, S., Hu, S., Liu, X., Li, B., Na, Z., & Gong, Y. (2018). Energy efficiency optimization for OFDM based 5G wireless networks with simultaneous wireless information and power transfer. *IEEE Access*, *6*, 75937-75946.	energy efficiency optimization problem for the orthogonal frequency-division multiplexing-based 5G wireless networks with SWIPT, in which the subcarrier and power allocation are jointly optimized to maximize the system energy efficiency for single user and multiple user cases	Energy: 20% reduce Ber: 10^{-3} CCDF:9%	• Not improve the spectrum of communication • Resource utilization ignore
Qin, D. Z., Ren, J. A., & Xu, Y. H. (2018, April). An Efficient Pruning Algorithm for IFFT/FFT Based on NC-OFDM in 5G. In *2018 Second International Conference on Inventive Communication and Computational Technologies (ICICCT)* (pp. 432-435). IEEE.	innovative pruning algorithm based on Radix-2/4 and SRFFT, which can ignore random zero inputs/outputs with the help of pruning matrix intelligently	BER:10^{-4} CCDF:8.5%	• No improve the energy and resource efficient

III. CONCLUSION

Infrastructure resources can be shared by multiple operators. It is argued that this sharing paradigm will be essential to fully exploit the tremendous amounts of bandwidth and the large number of antenna degrees of freedom available in these bands, and to provide statistical multiplexing to accommodate the highly variable nature of the traffic. In this paper, investigates and compare various sharing configurations in order to capture the enhanced potential of mmWave communications. The results reflect both the technical and the economical aspects of the various sharing paradigms. It deliver a number of key insights, corroborated by detailed simulations, which include an analysis of the effects of the distinctive propagation characteristics of the mmWave channel, along with a rigorous multi-antenna characterization. Key findings of this study include (i) the strong dependence of the comparative results on channel propagation and antenna characteristics, and therefore the need to accurately model them, and (ii) the desirability of a full spectrum and infrastructure sharing configuration, which may result in increased user rate as well as in economic advantages for both service provider.

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