5G BASED MIMO CELLULAR NETWORKS WITH RETRANSMISSIONS USING SWARM INTELLIGENCE ALGORITHM

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Abstract- Spatial modulation (SM)-MIMO exploits the pattern of one or several simultaneously active antennas out of all available transmit antennas to transmit extra information. Spatial modulation (SM)-MIMO exploits the pattern of one or several simultaneously active antennas out of all available transmit antennas to transmit extra information. In radio network, secondary users access channels temporarily unused by primary users, and the existence of a communication link between two secondary users depends on the transmitting and receiving activities of nearby primary users. Using theories and techniques from continuum percolation and ergodicity , analytically characterize the connectivity of the secondary network defined in terms of the almost sure finiteness of the multihop delay, and show the occurrence of a phase transition phenomenon while studying the impact of the temporal dynamics of the primary traffic on the connectivity of the secondary network. Specifically, as long as the primary traffic has some temporal dynamics caused by either mobility and/or changes in traffic load and pattern, the connectivity of the secondary network depends solely on its own density and is independent of the primary traffic; otherwise, the connectivity of the secondary network requires putting a density-dependent capon the primary traffic load. It show that the scaling behavior of the multihop delay depends critically on whether or not the secondary network is instantaneously connected. In particular, we establish the scaling law of the minimum multihop delay with respect to the source–destination distance when the propagation delay is negligible.

Keywords- Handover measurement, level crossing, Long Term Evolution, mobile communication, mobility management, Poisson point process, stochastic modeling.

1. Introduction

cognitive radio is a transceiver which automatically detects available channels in wireless spectrum and accordingly changes its transmission or reception parameters so more wireless communications may run concurrently in a given spectrum band at a place. This process is also known as dynamic spectrum management. It is a software defined radio with a cognitive engine brain. Cognitive radio is considered as a goal towards which a software-defined radio platform should evolve: a fully reconfigurable wireless transceiver which automatically adapts its communication parameters to network and user demands. Cellular network bands are overloaded in most parts of the world, but other frequency bands (such as military, amateur radio and paging frequencies) are insufficiently utilized. Independent studies performed in some countries confirmed that observation, and concluded that spectrum utilization depends on time and place. Moreover, fixed spectrum allocation prevents rarely used frequencies (those assigned to specific services) from being used, even when any unlicensed users would not cause noticeable interference to the assigned service. Therefore, regulatory bodies in the world have been considering to allow unlicensed users in licensed bands if they would not cause any interference to licensed users. These initiatives have focused cognitive-radio research on dynamic spectrum access.

While aggregation increases the overall efficiency of the sensor network, the aggregator nodes themselves use more resources than the regular sensor nodes. For this reason, it is desirable to change the aggregators from time to time, and thereby, to better balance the load on the sensor nodes. For this purpose, aggregator node election protocols can be used in the sensor network that allow dynamic re-assignment of the aggregator role.

2. LITERATURE SURVEY

2.1 Waveform design for 5G wireless systems

It has been recognized that the OFDM waveform currently adopted in the long-term evolution (LTE) standard has several limitations in supporting the 5G requirements [8]. Specifically, 5G traffic is expected to have very diverse characteristics and requirements in data column, communications rate, delay, and reliability. For example, applications such as video streaming and augmented reality demand very high communication rates for real-time communications. Moreover, various emerging M2M applications such as those for smartgrids have sporadic and bursty traffic with small amount of data to be delivered in each transmission. Other wireless applications such as vehicular communications and robotics control require highly reliable and ultra low delay. Finally, the number of wireless connections supporting future M2M and Internet-of-Things applications is expected to be significantly larger than that due to mostly human-type communications in today's wireless networks.

2.2 Ultra-dense wireless networks exploiting microwave and mmwave communications

Ultra-dense deployment of small cells, relays, distributed antenna systems operating on different frequency bands (e.g., microwave and mmWave) based on multiple RATs in a multi-tier heterogeneous network (HetNet) architecture provides a fundamental way to meet the capacity demand of future 5G wireless networks . This heterogeneous network architecture also enables efficient traffic offloading among different network tiers and RATs to better support the growing mobile traffic with enhanced QoS, communication rates, and energy efficiency .In fact, research on multi-tier HetNets where communications among different network tiers (e.g., macro, micro and small-cell tiers) share the same microwave spectrum has been one of the most active research topics over the past years [5]. One very important research theme in this direction is interference management, which can be performed using time, frequency, spatial, and power control approaches. Three papers published in our special issue address different analysis and design issues for wireless HetNets. Specifically, the outage analysis for cognitive HetNets is performed by using the stochastic geometry technique in [3]. Moreover, the work [4] proposes enhanced inter-cell interference coordination (eICIC) techniques for the two-tier HetNet where the optimal cell range expansion bias and almost blank subframe rate are obtained to achieve the fair resource sharing and interference management between two network tiers. The paper [5] studies different interference management solutions for the multi-antenna moving network where it shows that the high-performance moving network can be indeed realized with minimal impacts on the regular outdoor communications.

2.3 Massive and full-dimension MIMO technologies

While the MIMO technology has played a very important role in current 3G/4G wireless systems, massive MIMO and full-dimension MIMO present significant innovations for this technology to fundamentally increase the spectrum and energy efficiency of wireless systems [8]. Moreover, massive MIMO can potentially simplify the ways we manage the radio resource allocation and co-channel interference in the multi-cell and multi-tier wireless network.

Many existing works design high energy-efficient massive MIMO systems. The number of users and transmit power were jointly optimized in [8]. The energy efficiency (EE) of massive MIMO systems depends greatly on the circuit power consumption. The number of antennas, users, and transmit power were respectively optimized for the single-cell massive MIMO system with zero-forcing beamforming (ZFBF) in [8]. The optimal transmit power increases with the number of antennas, which means that the transmit power is an important design parameter for high EE massive MIMO systems. In [9], the GEE considering both the uplink and downlink of a multi-cell massive MIMO system, subject to channel estimation errors, pilot contamination, and correlated channel paths, with either maximum ratio combining (MRC)/MRT or ZF transmission/reception is optimized.

Many existing designs for traditional MIMO systems must be re-thought for these new MIMO systems such as channel estimation, beamforming design, and signal detection. Moreover, there are also various arising challenges to resolve such as the channel estimation and pilot contamination issues, suitable multi-cell coordination and hardware imperfection [7] to name a few. Three papers published in our special issue address some of these research issues. Specifically, the work [8] proposes a low-complexity subspace detection technique for the multi-stream MIMO communications. In [9], a novel semi-orthogonal pilot design for massive MIMO wireless systems is developed to reduce the pilot resource consumption where a successive interference cancelation (SIC)-based channel estimation is employed to manage the interference between data and pilot. Moreover, the work [10] develops a joint channel coding, modulation, and MIMO communication scheme by using the rotated modulation and space-time component interleaver.

Furthermore, the inter-cell coordination in multi-cell massive MIMO systems is addressed in various works, either suppressing the inter-cell interference and inter-user interference completely [1] by coordinated beamforming. Another technique introduced in [2, 3] allows interference suppression with smaller excess of base station antennas. In [1], a multi-cell MIMO downlink channel is studied and a distributed interference alignment (IA) algorithm is proposed to suppress or minimize the interference to non-intended users. Also, [1] develops an IA technique for a downlink cellular system with CSI exchange and feedback within each cell. In [6, 7], conditions for the feasibility of IA and degree of freedom (DoF) for MIMO cellular networks are investigated.

To reduce the complexity and CSI requirement, the concept of grouping-based IA (GIA) is proposed for a two-cell single-stream interfering MIMO-BC in [10].

2.4 C-RAN

Cloud radio access network (C-RAN) presents a major paradigm shift in the design of future wireless systems where various network functionalities in both access and core networks can be realized in the cloud [1]. Due to the high cost-efficiency, flexibility, and utilization efficiency, it is regarded as one of the most promising solutions to meet the huge capacity demand in 5G wireless networks. In a C-RAN, plenty of distributed remote radio heads (RRHs) are distributed within a specific geographical area and connected to a centralized centralized baseband unit (BBU) pool through high bandwidth fronthaul links. In such a system, enhanced energy efficiency can be achieved from shortened distances between RRHs and users as well as improved spectral efficiency per unit area. Moreover, since all baseband processings are performed at the BBU, it is possible to employ CoMP transmission [118] for capacity enhancement by exploiting the increased spatial degrees of freedom and beamforming gain [9, 10].

There are numerous open research issues to address in this interesting research domain including efficient radio resource management (e.g., power control, bandwidth allocation, beamforming desing), fronthaul compression, efficient design, and utilization of computing resources in the cloud to name a few. Some key open research issues are elaborated below.

3 SYSTEM ANALYSIS

3.1 EXISTING SYSTEM

Spectrum Radio technology is a promising solution to enhance the spectrum utilization by enabling unlicensed users to exploit the spectrum in an opportunistic manner. Since unlicensed users are temporary visitors to the licensed spectrum, they are required to vacate the spectrum when a licensed user reclaims it.In previous method , they are using only reactive method to find the free channel for further communication, so it will make problem to secondary users and as well as primary user. Due to the randomness of the appearance of licensed users, disruptions to both licensed and unlicensed communications are often difficult to prevent, which may lead to low throughput of both licensed and unlicensed communications.

3.2 PROPOSED SYSTEM

we propose ProSpect, a proactive spectrum handoff framework for CR ad hoc networks. we first describe the decentralized network coordination schemes. we incorporate two types of channel rendezvous and coordination schemes into the spectrum handoff protocol design and investigate the impact of different network coordination schemes on the network performance. A distributed channel selection scheme to eliminate collisions among unlicensed users in a multiuser spectrum handoff scenario is proposed.

3.3 ALGORITHM

3.3.1 Swarm intelligence

In many proposed cognitive radio paradigms is the need for a central infrastructure or base station. Inaddition, coordination often needed between cogn itive radio users result in communication overhead and transmission delay. These challenges can be addressed using bio-inspired paradigms, such as, swarm intelligence. Swarm intelligence optimization has been used in many branches of computer science. It has successfully been applied to routing in computer networks. The two main swarm intelligence paradigms are ant colony optimization (ACO) and particle swarm optimization (PSO). These paradigms represent a collective behavior of self-organizing social insects. Ant colony optimization captures the dynamics of for aging ants and is the most commonly used paradigm. Global complex tasks are solved using simple local rules applied by each ant. Except for indirect communication, in the form of pheromone trails, there is no coordination amongst the population. Ants perform a random search for food. If an ant _nds a food source, it will return to the nest using its own path and mark it by emitting pheromone. Other ants will stochastically follow a pheromone trail. An increased number of ants following the same path intensi_es the pheromone trail. Since pheromone evaporate over time, ants will not follow the _rst path found to the food source, but rather, the shortest path to the food source. Particle swarm optimization similarly provides a distributed society where local interactions solve a global problem. In PSO, each particle randomly moves through a search space with a velocity which is updated based on the particles best performance as well as the leaders best performance. In the following two section, proposed swarm intelligence based algorithms aredescribed that capture primary-secondary dynamics and secondary-secondary dynamics for both interweave and underlay spectrum sharing.

3.3.1 ACO

The heterogeneity of cognitive radio users can be captured using swarm intelligence where each individual in the swarm will performing tasks which they are better equipped for, i.e. division of labor. This is referred to as adaptive task allocation. In spectrum sharing is addressed using a adaptive task allocation model of an insect colony. The proposed biologically-inspired algorithm (BIOSS) is distributed and therefore scalable. In addition, there is no coordination or information exchange between nodes, i.e. no information exchange overhead or need for an dedicated control channel. The algorithm is based on collective intelligence of an ant colony where each ant perform a task most suitable to its ability. If a task stimuli *s* reaches a threshold _ an ant is triggered to perform the task. The stimuli can be pheromone deposited by other ants indirectly communication that a task The stimuli can be pheromone deposited by other ants indirectly communication that a task has to be performed. The probability of performing a task is de_ned using the threshold response function

$$T_\theta(s) = \frac{s^n}{s^n + \theta^n}, n > 1.$$

The following mapping is used to apply adaptive task allocation optimization for foraging ant societies to

cognitive radio networks

- Insect ! Cognitive radio user
- Task ! Channel not occupied by primary user
- Stimuli ! Power level allowed in channel *Pj*
- Response Threshold ! Required transmission power *pij*

The probability of performing a certain task, in this case selecting a channel for transmission, is adjusted as follows:

$$T_{ij} = \frac{{P_j}^n}{{P_j}^n + \alpha {p_{ij}}^n + \beta {L_{ij}}^n}, n > 1.$$

where *Lij* is the learning factor of channel QoS based on previous experience by the cognitive radio and positive constants.

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3.3.2 PSO

Particle swarm optimization (PSO) algorithms are used to describe the social behavior of _sh schools or bird ocks. In PSO the best solution so far, called the leader of the ock, guide solutions called particles moving around in a search space. Each particle evolves by memorizing its personal best performance (local position) in addition to the leaders position (global position). To achieve global optimization, an iterative process lets particles change their velocity toward the best solution. In the socio-cognitive particle swarm optimization (SCPSO) algorithm is used to address spectrum sharing in an underlay system. The SCPSO is based on the binary particle swarm optimization algorithm. The proposed spectrum etiquette is assumed for cellular bands, such as LTE, where the focus lies on the uplink direction. The Objective is to maximize the system transmission rate for an estimated number of secondary users coexisting with primary users in a spectrum underlay model.

3.3.2.1 SCPSO algorithm:

1. Randomly initialize matrices $X; X'; P; P'; V$ and the spectrum status vector.
2. Loop.
3. Compute particle _tness $f(X'_i)$ and $f(P'_i)$ where $f(X'_i)$ is the current _tness and $f(P'_i)$ is the best
_tness for particle i.
4. If current _tness $f(X'_i)$ is better than the local best $f(P'_i)$, update $f(P'_i)$ by setting it to $f(X'_i)$.
5. Find the globally best solution $f(P'_g)$ by looping through the swarm's local best solutions $f(P'_j)$.
6. Update the velocity V_i and bitmap X_i for each secondary link where velocity is based on the distance
of both the local and global best positions.
7. Based on the outcome of the velocity, update bitmap X'_i by randomly allocating channels from PC if
$x_{id} = 1$ in X_i.
8. Repeat step 3 until end of swarm.
9. Repeat step 2 until stopping criterion is met.

4. MODULE DESCRIPTION

4.1 SPECTRUM SENSING

It is first module of our project.In spectrum sensing, the data are sensed by spectrum. In sense, The data are move from nodes(users) to spectrum.

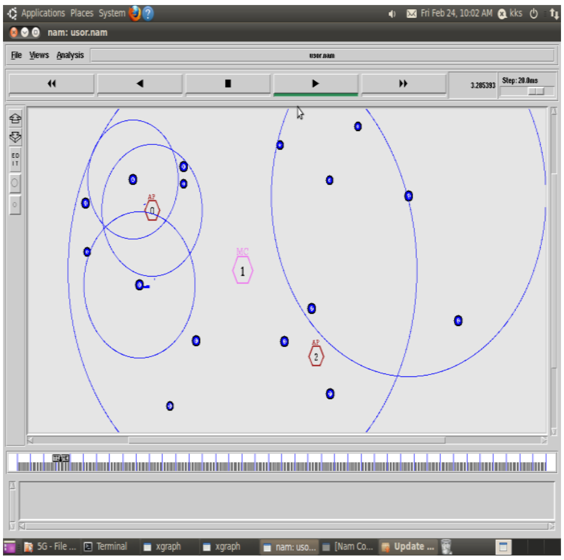

Fig 4.1 Spectrum Sensing

4.2 POWER CONSUMPTION

The Cognitive radio, the data are send to all licensed and unlicensed users. The licensed users are located on the spectrum. At the same time, the unlicensed users are also located on the spectrum. In that time, the power consumption will occur. To avoiding this problem , first send the data to licensed users. After that, we send the data to unlicensed (private) users.

4.3 AVOID INTERFERENCE

The data are send to all licensed and unlicensed users. The licensed users are located on the spectrum. At the same time, the unlicensed users are also located on the spectrum. In that time, the unwanted interference will occur. To avoiding this problem , first send the data to licensed users. After that, we send the data to unlicensed (private) users.

4.4 SPECTRUM HANDOFF

The most basic form of handover is when a phone call in progress is redirected from its current cell (called *source*) to a new cell (called *target*). In terrestrial networks the source and the target cells may be served from two different cell sites or from one and the same cell site (in the latter case the two cells are usually referred to as two *sectors* on that cell site). Such a handover, in which the source and the target are different cells (even if they are on the same cell site) is called *inter-cell* handover. The purpose of inter-cell handover is to maintain the call as the subscriber is moving out of the area covered by the source cell and entering the area of the target cell.

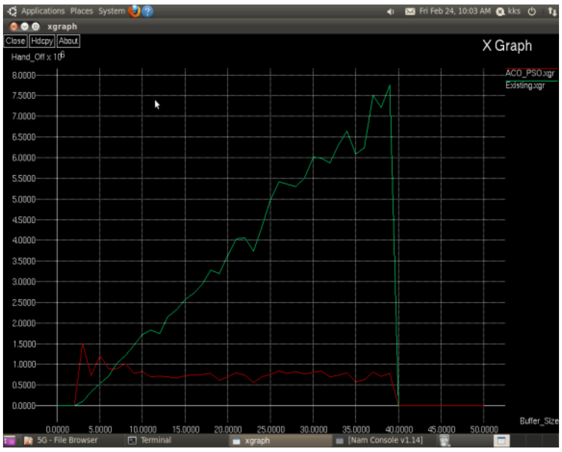

Fig 4.4.1 Spectrum Handoff

5.CONCLUSION

There have been some significant research advances in different 5G enabling wireless technologies and these research outcomes will form strong foundations for the 5G standardization activities, which are expected to start soon. Until then, it is desirable to develop a unified 5G architecture for wireless access and core networks that enable to integrate many advanced wireless technologies to meet the 5G requirements: realizing Gigabit, real-time, and ultra-reliable communications, supporting an extremely large number of wireless connections for both human and machine wireless applications, diverse set of mobile traffic with different characteristics, and QoS, and achieving more spectrum, energy, and cost-efficiency. There would be no single technology that can deliver these performance expectations. Therefore, a number of enabling 5G wireless technologies must be developed and jointly implemented on the newly developed 5G architecture. In this paper, we have reviewed the 5G requirements and discussed several key enabling 5G wireless technologies with their open research challenges. Moreover, we have also described research papers in our special issue in the corresponding 5G network and technology contexts.The unified analysis is achieved by Gaussian signaling approximation along with an equivalent SISO-SINR representation for the

considered MIMO schemes. The accuracy of the proposed model is verified against Monte-Carlo simulations. To this end, we shed lights on the diversity loss due to temporal interference correlation and discuss the diversity-multiplexing tradeoff imposed by MIMO configurations. Finally, we propose ACO and PSO methodology uto choose the appropriate diversity, multiplexing, and number of antennas to meet a certain design objective.

6. FUTURE ENHANCEM

Increase capacity and flexibility of wireless systems in recent years. Typical examples include directional and smart antennas, multiple input multiple output (MIMO) systems, and multi-radio/multi-channel systems. To further improve the performance of a wireless radio and control by higher layer protocols, more advanced radio technologies, such as reconfigurable radios, frequency agile/cognitive radios, and even software radios, have been used for wireless communication. Although these radio technologies are still in their infancy, they are expected to be the future platform for wireless networks due to their dynamic control capability. These advanced wireless radio technologies all require a revolutionary design in higher-layer protocols, especially MAC and routing protocols.

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