Analysis of Resource Allocation Strategy For CoMP Mu-Mimo 5G Network

Mr.M.Rubas[1], Mr.G,Kannan[2]
[1] Dept of ECE
[2] Assistant professor, Dept of ECE
[1, 2] Parisutham Institute of Technology & Science,
Thanjavur.

Abstract- *Coordinated Multipoint (CoMP) in Long Term Evolution-Advanced (LTE-Advanced) improves the cell-edge data rates and the network spectral efficiency through base station coordination. In order to achieve high quality of service (QoS) in CoMPnetwork, resource allocation approach is one of the main challenges. The resource allocation strategies of cells in CoMP network affect each other's performance. Thus, the resource allocation approach should consider various diversities offered in multiuser wireless networks, particularly in frequency, spatial and time dimensions. The primary objective of this research is to develop resource allocation strategy for CoMP network that can provide high QoS. The resource allocation algorithm is developed through three phases, namely Low-Complexity Resource Allocation (LRA), Optimized ResourceAllocation (ORA) and Cross-Layer Design of ORA (CLD-ORA). The LRA algorithm is a three-step resource allocation scheme that consists of user selection module, subcarrier allocation module and power allocation module which are performed sequentially in a multi-antenna CoMP network. The proposed ORA algorithm enhances throughput in LRA while ensuring fairness. ORA is formulated based on Lagrangian method and optimized using Particle Swarm Optimization (PSO). The design of CLD ORA algorithm is an enhancement of the ORA algorithm with resource block (RB) scheduling scheme at medium access control (MAC) layer. Simulation study shows that the ORA algorithm improves the network sum-rate and fairness index up to 70% and 25%, respectively and reduces the average transmit power by 41% in relative to LRA algorithm. The CLD-ORA algorithm has further enhanced the LRA and ORA algorithms with network sum-rate improvement of 77% and 33%, respectively. The proposed resource allocation algorithm has been proven to provide a significant improved performance for CoMP LTE- Advanced network and can be extended to future 5G network.*

Keywords- CLD ORA, CoMP network.

I. INTRODUCTION

The primary objective of this research is to develop resource allocation strategy for CoMP network that can provide high QoS. The resource allocation algorithm is developed through three phases, namely Low-Complexity Resource Allocation (LRA), Optimized Resource Allocation (ORA) and Cross-Layer Design of ORA (CLD-ORA). The LRA algorithm is a three-step resource allocation scheme that consists of user selection module, subcarrier allocation module and power allocation module which are performed sequentially in a multi-antenna CoMP network. The proposed ORA algorithm enhances throughput in LRA while ensuring fairness.

II. LITERATURE SURVEY

Non-orthogonal multiple access (NOMA) has been considered as a highly efficient communication technology in the fifth generation (5G) networks by serving multiple users concurrently through non-orthogonal sharing communication resources. NOMA can be combined with both massive multiple input multiple output (MIMO) and relaying technologies to further improve 5G system efficiency at the cost of increased complexity. These combinations rely on the efficient utilization of three-dimensional (3D) communication resources. In the first part of this paper, we investigate highly efficient 3D resource allocation for massive MIMO-NOMA systems. Due to hardware complexity constraints and channel variation in the massive MIMO-NOMA system, efficient antenna selection and user scheduling algorithms are proposed for sum rate maximization. In the second part of this paper, a collaborative NOMA assisted relaying (CNAR) system is proposed to serve multiple cell-edge users by 3D resource utilization. To reduce the relaying complexity in CNAR system, a simplified-CNAR (S-CNAR) system is proposed as an alternative NOMA enabled relaying strategy. Numerical results show that our antenna selection and user scheduling algorithms achieve similar performance to existing methods with reduced complexity. Under high target rate, CNAR obtains better performance over other transmission strategies and S-CNAR reaches similar performance by simplified relaying scheme. To support explosive proliferation of smart devices and drastically increased data traffic, 5G networks are expected to provide 1,000-fold capacity enhancement .With very limited radio resources, increasing user density and network complexity, the success of 5G networks rely on both highly efficient technologies, including non-orthogonal multiple access (NOMA) and massive multiple input multiple output (MIMO), as well as cost-effective deployment solutions like relay and cooperative communications. [1].

In a group touring scenario, the group leader can enable his handheld device's Wi Fi hot spot function to let other members to connect with. Then, the group leader can download Point Of Interests' (POIs') data from the content server through3G/3.5G/4G cellular network and then forward those downloaded data to the connected clients using Wi Fi.

That is, the group leader also plays the role of a mobile proxy. Nevertheless, mobile users may move randomly such that they may leave their current group leader and move toward the other group leader. This work proposed a handoff mechanism such that mobile users can move from the currently connected Wi Fi hot spot, for which the received signal strength is becoming weak, and to a new Wi Fi hotspot/mobile proxy, for which the received signal strength is becoming stronger. Since the current handheld device only allows a limited number of handheld devices to This work devised a K-CAMP clustering scheme to tackle the handoff issue exists in the aforementioned group-based touring scenario. Mobile users can. [2].

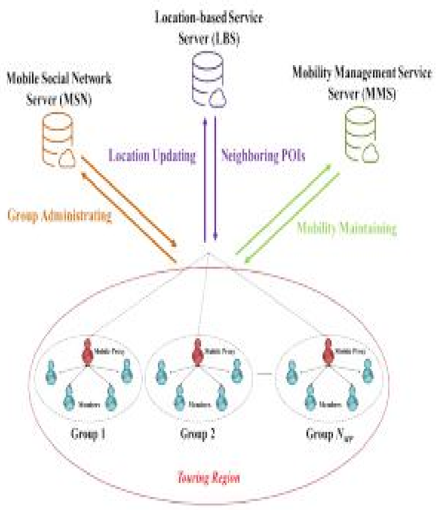

FIG: The abstract architecture of the proposed system.

This paper investigates the application of 5G wireless multicast to the big data system. In particular, we propose a hybrid unicast/multicast transmission scheme using 3D massive multi-input multi-output (MIMO) technique. The proposed scheme employs multicast beam forming in the multicast group and multi-user MIMO (MU-MIMO) linear precoding in the unicast group. It also applies the null space based interference Cancellation to eliminate the signal leakage generated by other groups. Simulation results show that the proposed system can significantly improve the system throughput with an antenna array configuration, precoding / beam forming schemes and user grouping strategies. Exponential growth of data services in industry and academia has ushered in the so-called big data era, in which mobile communication systems play a crucial role. The universal interest in smart mobile devices has inevitably led to a surge of mobile data traffic. According to a report by Cisco, the number of mobile subscribers is expected to reach 5.5 billion by 2020, accounting for 70% of the global population, and it is predicted that the number of the mobile data traffic volume will continuously grow up to 6 times from2015 to 2020 with a compound annual growth rate (CAGR) of over 50%. As illustrated in Fig. 1. Consequently, big data is becoming increasingly important in the upcoming 5G cellular communication.

Modern wireless communication networks are facing the challenge to pursue higher performance gain and driving greater system operational efficiency. At this point, new techniques are required that can improve spectral efficiency and operational reliability. Massive or large-scale multiple-input multiple output (MIMO) antenna technologies are currently highly applied for substantially increasing throughput.

As one of the most efficient solutions to the 5G system, this technology can extremely increase data rate and assist fading link reliability of the wireless. It can do so without sacrificing bandwidth efficiency at both mobile terminals (MTs) and base stations (BSs) of high quality interactive internet and mobile wireless communication services[3].

Cellular relaying architecture is in an early stage for development and deployment. A restricted number of deployment scenarios are addressed in the LTE-A relay standard, though different design options in alternative deployment scenarios do potentially exist. Presently, the LTE-A relay standard is restricted to a single-hop relaying. The principal reason for opting for this architecture is to minimize system complexity. Nonetheless, multi-hop relay architecture could potentially provide greater capacity and coverage, in the future, particularly for urban sparse area deployment scenarios. However, many problems involving the complexity of multi-hop relaying paradigm need to be resolved, specifically resource management. In this paper, we focus on the resource management problem, and we propose a new resource allocation framework to overcome the additional challenges introduced by the multi-hop relay stations.

Numerical results are presented to demonstrate the validity of the proposed framework. Relaying is considered to be one of the key functionalities for3GPP releases 10 and 11 of Long Term Evolution-Advanced(LTE-A) in order to improve the cell-edge user throughput, and to extend coverage to new areas by flexible and easy deployment.

With relaying, the User Equipment (UE)communicates with the network via a relay station (RS) that is wirelessly connected to a macro cell using the LTE radio interface technology. The base station (BS) or evolvedNodeB (eNB) may serve one or several relays in addition to directly serving the macro UEs (M-UEs).In the current 3GPP relaying standard [3], LTE-A is limited to a single-hop relay scenario: a backhaul link from the BS to the RS, and an access link from the RS to the relay UE (RUE). Consequently, an RS is unable to use a different RS as its donor station. An RS has to directly connect to the BS, but without passing through several hops. The principal reason for choosing this architecture is to reduce system complexity and to minimize the impact on the existing LTE-A standard.

However, multi-hop relaying has been identified as a valuable wireless paradigm in the future releases of LTE, particularly for urban sparse area deployment scenarios in which it is able to improve coverage and network capacity due to the reduction of path loss by replacing the direct low quality link between the BS and UEs with multiple high-quality links through one or multiple RSs.[4].

Coordinated Multi-Point (CoMP) systems appear as advanced promising strategies to improve user throughputs, especially in interference limited regions, at cell edge. Whether CoMP consists in jointly processing data from multiple transmission points, or in smartly coordinating the allocation of resources, CoMP implementation requires significant computation effort, signaling exchange that may impact the bandwidth limited back-hauling resources. To alleviate signaling and computation cost, the solution consists in partitioning the cells into coordinating sets. The study proposes a novel approach to cluster the cells in to coordinated sets and to dynamically update it, based on data collected from the field. Clustering algorithm is based on spectral clustering and aims at grouping cells with high ’similarity’ between them. In the context of Dynamic Point Selection, users are dynamically switched from one cell to another one from the coordinating set, to take profit from macro diversity or load balancing gains. Similarity then captures the like likood of switching, through a combined distance metric based on geometrical distance and Handover frequency. Analysis is carried out from data mining tools, with input data from the field, in the dense wireless network of Manhattan, in New York. Geographical Information System application completes the interpretation of clustering results, by displaying cluster maps, and proves the capability of clustering thanks to this approach. [5].

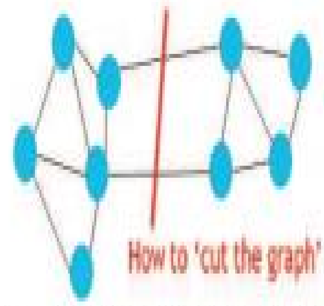

Figure 1. Graph Cutting with spectral clustering

Mobile data traffic grew by 74% in 2015 and it is expected to grow eight-fold by 2020. Future wireless networks will need to deploy massive number of small cells to cope with this increasing demand. Dense deployment of small cells will require advanced interference mitigation techniques to improve spectral efficiency and enhance much needed capacity. Coordinated multi-point (CoMP) is a key feature for mitigating inter-cell interference, improve throughput and cell edge performance. However, cooperation will need to be limited to few cells only due to additional overhead required by CoMP due to channel state information (CSI) exchange, scheduling complexity, and additional backhaul limitation. Hence, small CoMP clusters will need to be formed in the network. This paper surveys the state-of-the-art on one of the key challenges of CoMP implementation: CoMP clustering. As a starting point, we present the need for CoMP, the clustering challenge for 5G wireless networks and provide a brief essential background about CoMP and the enabling network architectures. We then provide the key framework for CoMP clustering and introduce self organization as an important concept for effective CoMP clustering to maximize CoMP gains. Next, we present two novel taxonomies on existing CoMP clustering solutions, based on self organization and aimed objective function. Strengths and weaknesses of the available clustering solutions in the literature are critically discussed. We then discuss future research areas and potential approaches for CoMP clustering. We present a future outlook on the utilization of big data in cellular context to support proactive CoMP clustering based on prediction modeling. Finally, we conclude this paper with a summary of lessons learned in this field. This paper aims to be a key guide for anyone who wants to research on CoMP

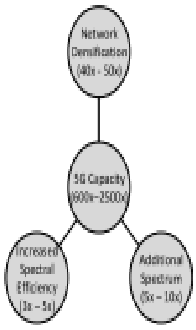

FIG: Capacity Enhancements for 5G.

1) Network Densification - Massive Small cell deployment
2) Increased Spectral Efficiency - CoMP, Multiple Input-Multiple Output (MIMO), Enhanced coding techniques
3) Additional Spectrum [6].

Long Term Evolution-Advanced (LTE-A) network exploit the Carrier Aggregation (CA) technique to achieve a higher data rate by allowing user equipments (UEs) to simultaneously aggregate multiple component carriers (CCs). Moreover, MIMO technologies have become increasingly mature and been adopted as a default choice of the 4G standards. However, most existing studies on resource allocation with carrier aggregation do not consider the MIMO capability of UEs. In this paper, we address the spectrum resource allocation problem with consideration of UEs' MIMO capability as well as modulation and coding schemes (MCSs) selection in carrier aggregation based LTE-A systems. We formulate the problem under both backlogged and finite queue traffic models as an optimization model, and prove its NP-hardness. As a result, a 1/2-approximation algorithm is proposed to find a suboptimal solution of resource allocation. Simulation results show that the proposed algorithm out performs the existing schemes, and performs fairly close to the optimal solution under the small-scale scenarios.[7].

We define and formulate the radio resource allocator, i.e.,RRA, problem in this section. We consider a LTE-A system with a set of UEs M, a set of CCs N, and a set of MCSs C. Each CC includes a set of RBs P, each of which can be assigned to one UE, and is 0.5 ms in time domain and 180 kHz in frequency domain. The RBs of a CC can be allocated to multiple UEs, and each UE can exploit carrier aggregation to access at most z CCs. LTE-A supports several MIMO modes, and our model considers three modes: SISO, transmit diversity and spatial multiplexing. Based on the LTE-A standard [1], for the SISO and transmit diversity modes, the RBs allocated to a UE form a single data unit, called Transport Block (TB), while, for the spatial multiplexing mode, the RBs allocated to a UE form two TBs, i.e., two concurrent streams, even when the UE has more than two antennas. of VR technology as a disruptive use case of 5G (and beyond)harnessing the latest development of storage/memory, fog/edge computing, computer vision, artificial intelligence, and others. In particular, the main requirements of wireless interconnected [8].

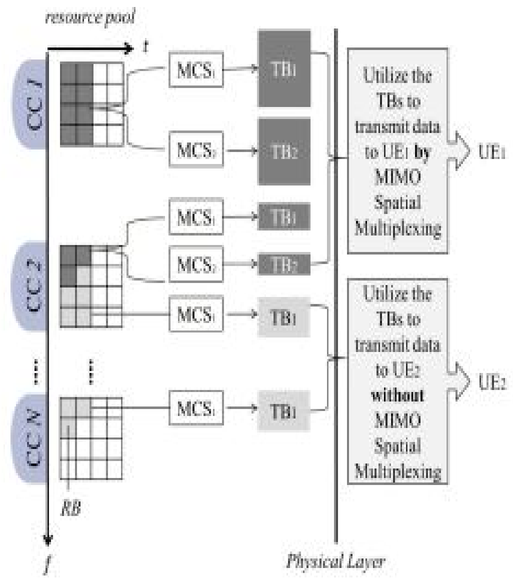

Fig. 1. Example of CC-MCS assignment for RBs per TB.

Wireless access networks are often characterized by the interaction of different end users, communication technologies, and network operators. This paper analyzes the dynamics among these "actors" by focusing on the processes of wireless network selection, where end users may choose among multiple available access networks to get connectivity, and resource allocation, where network operators may set their radio resources to provide connectivity. The interaction among end users is modeled as a non–cooperative congestion game where players (end users) selfishly select the access network that minimizes their perceived selection cost. A method based on mathematical programming is proposed to find Nash equilibria and characterize their optimality under three cost functions, which are representative of different technological scenarios. System level simulations are then used to evaluate the actual throughput and fairness of the equilibrium points. The interaction among end users and network operators is then assessed through a two–stage multi–leader/multi–follower game, where network operators (leaders) play in the first stage by properly setting the radio resources to maximize their users, and end users (followers) play in the second stage the aforementioned network selection game. The existence of exact and approximated sub game perfect Nash equilibria of the two–stage game is thoroughly assessed and numerical results are provided on the “quality” of such equilibria.[8]

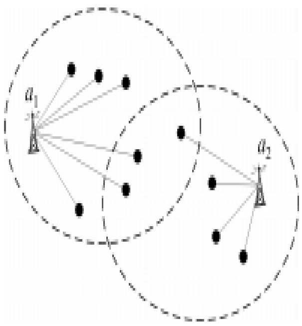

Fig. 1: A network with two access points.

LTE is the next generation of all-IP mobile communication system designed and developed by 3GPP. It offers unprecedented data transmission speed and low latency to support a variety of applications and services. However, compared to wire line networks, efficient QoS provisioning for diversified applications in wireless access networks such as LTE is challenging due to unreliable and resource-constrained radio interface. In this paper, we investigate an important problem of downlink resource allocation in recently enhanced LTE-Advanced systems where a newly added feature carrier aggregation provides more flexibility in radio resource management in addition to the existing resource block level packet scheduling. The resource allocation problem can be formulated as a complex combinatorial problem with multiple constraints and is solved every time slot.

We decompose this highly complex optimization problem and construct a two tier resource allocation framework which incorporates dynamic component carrier assignment and backlog based scheduling schemes with intelligent link adaptation. An efficient algorithm is developed to dynamically allocate component carriers to users to achieve load balancing. We also present novel backlog based scheduling policies and weighted-CQI based link adaptation scheme to obtain significantly better throughput and delay fairness. Performance of the proposed schemes is evaluated against the static round-robin component carrier assignment, the well-known proportional fairness scheduling rule and the existing link adaptation scheme. Extensive simulation results demonstrate that our schemes offer both better throughput and delay performance as well as user fairness.[9].

Non-Orthogonal Multiple Access (NOMA) is a promising multiple access technique for the 5th generation (5G)mobile communication systems. In this paper, an efficient power allocation scheme is derived for multiuser multiple input single output (MISO) downlink beam forming NOMA system to guarantee that successive interference cancellation (SIC) detection can remove completely the intra-cluster interference. In addition, a fairness-oriented user selection (NOMA-FOUS) algorithm is proposed to maximize the NOMA system sum rate and achieve high system fairness by selecting the two clustered users based on their NOMA data rate. Numerical results show that NOMAFOUS algorithm provides better system sum rate, weak users sum rate and fairness index performance than that of the other user clustering algorithms with a little increased computational complexity.

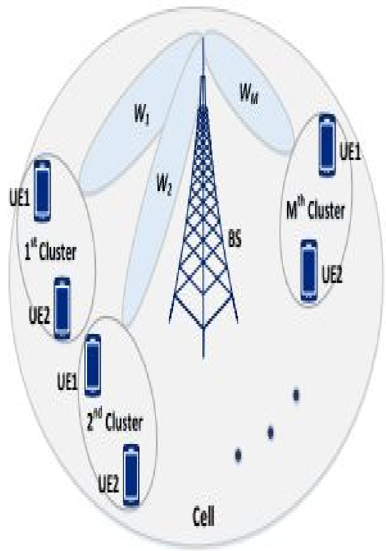

FIG: System Model.

Recently, many researchers have tried to exploit the idea of employing both NOMA and zero-forcing beam form in (ZFBF). In ZFBF, the cellular system is partitioned into clusters and the transmitted messages from each cluster are multiplied by a specific beam forming (BF) vector and sent through multiple antennas. If the BF vectors are optimally found, inter-cluster interference can be totally eliminated. Unfortunately, finding the optimal beam forming vectors is a complex no convex optimization problem. Consequently, many suboptimal beam forming schemes have been proposed for efficiently choosing the beam forming users that maximizes the system sum rate. [10].

This paper considers network capacity and user coverage improvement in Internet of Things (IoT) oriented massive MIMO systems. In literature, user grouping approaches have been used in massive MIMO to improve the network capacity, where users are generally divided into non-overlapping groups, and those users with less favourable channel conditions are dropped for capacity optimization. As a result, users may suffer from unpredicted interruptions and delays, even long time disconnection from the network. Moreover, non-over lapping user grouping also leads to unnecessary resource waste. As an effort to overcome these limitations, in this paper, we introduce the concept of overlapping user grouping by exploiting the favourable propagation property in massive MIMO.

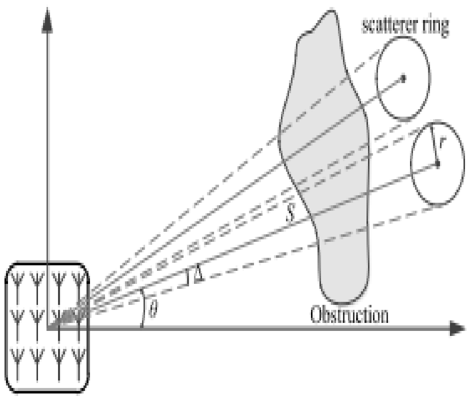

FIG:One-ring MIMO channel model with shadow fading.

More specifically, we propose two new user grouping approaches. First, we present a greedy search based user grouping method by allowing overlapping among the selected subgroups. Second, we introduce a new channel similarity measure, and develop a low complexity overlapping user grouping approach based on the spectral clustering algorithm in machine learning. Both the theoretical and numerical results demonstrate that: overlapping user grouping can achieve much higher network capacity, and can ensure that at any given time, each IoT device will be served in at least one subgroup.[11]

III. CONSLUCTION

In this paper are analysis of different type of Coordinated Multipoint (CoMP) in Long Term Evolution-Advanced (LTE-Advanced) improves the cell-edge data rates and the network spectral efficiency through base station coordination and the resource allocation algorithm is developed through three phases are explained in this survey paper clearly.

REFERENCES

[1] H. Kayama and H. Jiang, “Evolution of LTE and New Radio Access Technologies for FRA (Future Radio Access),” in 2014 48th AsilomarConference on Signals, Systems and Computers, Nov 2014, pp. 1944– 1948.

[2] Q. C. Li, H. Niu, A. T. Papathanassiou, and G. Wu, “5G NetworkCapacity: Key Elements and Technologies,” IEEE Veh. Technol. Mag., vol. 9, no. 1, pp. 71–78, March 2014.

[3] Y. Saito, Y. Kishiyama, A. Benjebbour, T. Nakamura, A. Li, and K. Higuchi, “Non-Orthogonal Multiple Access (NOMA) for Cellu-
lar Future Radio Access,” in Vehicular Technology Conference (VTCSpring), 2013 IEEE 77th, June 2013, pp. 1–5.

[4] Z. Ding, Z. Yang, P. Fan, and H. V. Poor, “On the Performance of Non-Orthogonal Multiple Access in 5G Systems with Randomly Deployed
Users,” IEEE Signal Process.Lett., vol. 21, no. 12, pp. 1501–1505, Dec2014.

[5] S. Huang, H. Yin, J. Wu, and V. C. M. Leung, “User selection for multiuser MIMO downlink with Zero-Forcing beamforming,” IEEETransactions on Vehicular Technology, vol. 62, no. 7, pp. 3084–3097, Sept 2013.

[6] J. Nam, A. Adhikary, J. Y. Ahn, and G. Caire, “Joint spatial divisionand multiplexing: Opportunistic beamforming, user grouping and simplified downlink scheduling,” IEEE Journal of Selected Topics in SignalProcessing, vol. 8, no. 5, pp. 876–890, Oct 2014.

[7] W. L. Shen, K. C. J. Lin, M. S. Chen, and K. Tan, “SIEVE: Scalable user grouping for large MU-MIMO systems,” in IEEE Conference on Computer Communications, Apr 2015, pp. 1975–1983.

[8] H. Q. Ngo, E. G. Larsson, and T. L. Marzetta, “Aspects of favourable propagation in massive MIMO,” in European Signal Processing Conference, Sept 2014, pp. 76–80.

[9] M. S. Sim, J. Park, C.-B.Chae, and R. W. Heath, “Compressed channel feedback for correlated massive MIMO systems,” Journal of
Communications and Networks, vol. 18, no. 1, pp. 95–104, 2016.in Proc. IEEE Int. Conf. Syst., Man, Cybern., 2013, pp. 3585–3591.

[10] K. Premkumar. and A. Kumar, “Optimum Association of Mobile Wireless Devices with a WLAN–3G Access Network,” in Proc. IEEE ICC, 2006, pp. 2002–2008.

[11] W. Shen and Q.-A.Zeng, “Cost-function-based network selectionstrategy in integrated wireless and mobile networks,” IEEE T VEH TECHNOL, vol. 57, no. 6, pp. 3778–3788, 2008.

[12] Q. Song and A. Jamalipour, “Network selection in an integrated wireless LAN and UMTS environment using mathematicalmodelling and computing techniques,” IEEE WIREL COMMUN,

vol. 12, no. 3, pp. 42–48, 2005.IEEE TRANSACTIONS ON MOBILE COMPUTING, SUBMITTED TO 14

[13] D. Charilas, O. Markaki, D. Nikitopoulos, and M. Theologou, “Packet-switched network selection with the highest QoS in 4G networks,” COMPUT NETW, vol. 52, no. 1, pp. 248–258, 2008.

[14] F. Bari and V. Leung, “Automated network selection in a heterogeneous wireless network environment,” IEEE NETWORK, vol. 21,no. 1, pp. 34–40, 2007.

[15] M. Bernaschi, F. Cacace, G. Iannello, S. Za, and A. Pescape,“Seamless internetworking of WLANs and cellular networks: architecture and performance issues in a mobile IPv6 scenario,” IEEE WIREL COMMUN, vol. 12, no. 3, pp. 73–80, 2005.

[16] Y. Bejerano., S.-J. Han, and L. Li, “Fairness and Load Balancing in Wireless LANs Using Association Control,” IEEE ACM T NETWORK, vol. 15, no. 3, pp. 560–573, 2007.

[17] N. Blefari-Melazzi, D. D. Sorte, M. Femminella, and G. Reali, “Autonomic control and personalization of a wireless access network,” COMPUT NETW, vol. 51, no. 10, pp. 2645–2676, 2007.

[18] Y. Lee and S. C. Miller, “Network selection and discovery of service information in public WLAN hotspots,” in Proc. ACMWMASH, 2004, pp. 81–92.

[19] Y. Fukuda and Y. Oie, “Decentralized Access Point Selection Architecture for Wireless LANs,” IEICE TRANS COMMUN, vol. E90-B, no. 9, pp. 2513–2523, 2007.

[20] [20] H. Gong, K. Nahm, and J. Kim, “Distributed Fair Access Point Selection for Multi-Rate IEEE 802.11 WLANs,” IEICE TRANS INF & SYST, vol. E91-D, no. 4, pp. 1193–1196, 2008.

[21] M. R. Bhatnagar, “On the capacity of decode-and-forward relaying overRician fading channels,” IEEE Commun.Lett., vol. 17, no. 6, pp. 1100- 1103, Jun. 2013.

[22] S. Boyd and L. Vandenberghe, Convex Optimization, Cambridge, U. K.:Cambridge Univ. Press, 2004.

[23] I. S. Gradshteyn and I. M. Ryzhik, Table of Integrals, Series, and Products, 7th ed. New York, NY, USA: Academic, 2007.

[24] Expeditions Pioneer Program, developed by Googlehttps://www.google.com/edu/expeditions/

[25] Ronald Aylmer Fisher.The design of experiments. 1935.

[26] Roger E Kirk. Experimental design.Wiley Online Library, 1982.