AUTHORIZED ACCESS APPROACH TO IMPROVE THE QOS OF HETEROGENEOUS WIRELESS NETWORKS

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ABSRACT
A noteworthy test of cutting edge wireless systems is to facilitate diverse kinds of existing systems. These days number of remote correspondence advancements is pushing toward heterogeneous overlay organizes because of the fast improvement and sending. To give consistent network to versatile hubs vertical handoff process is more vital. The integration of Wi-Fi with LTE is by all accounts promising methodology because of their corresponding attributes. In this paper we research a few critical issues for the internetworking of Wi-Fi and LTE systems. We address issue of Co-presence of WiFi-LTE in unlicensed band degrades the vertical hand off execution fundamentally. This paper proposes a strategy called Authorized Access Approach which working in unlicensed band so as to enhance the execution of different remote innovation working in authorized band to limit SNIR for RSS computation. By this the utilization of unlicensed range is turning into an imperative supplement for administrators to take care of the developing activity demand and furthermore enhance QoS of Heterogeneous wireless networks.

I. INTRODUCTION

As two noteworthy players in earthly remote correspondences, Wi-Fi frameworks and cell systems have diverse beginnings and have to a great extent advanced independently. Inspired by the exponentially expanding remote information request, cell systems are advancing towards a heterogeneous and little cell organize engineering, wherein little cells are relied upon to give high limit. Nonetheless, because of the constrained authorized range for cell organizes, any push to accomplish limit development through system densification will confront the test of extreme between cell obstruction.

In perspective of this, current institutionalization advancements have begun to consider the open doors for cell systems to utilize the unlicensed range groups, including the 2.4 GHz and 5 GHz groups that are at present utilized by Wi-Fi, Zigbee and some other correspondence frameworks.

In recent years the bursty nature of wireless data traffic makes traditional network planning for capacity obsolete. Amongst both operators and vendors alike, small cells (e.g., picocells, femtocells and relay nodes) have been considered as a promising solution to improve local capacity in traffic hotspots, thus relieving the burden on overloaded macrocells. A lot of research and development efforts have been made to efficiently offload excess traffic from macrocells to small cells, especially in indoor environments.

Due to the scarcity of licensed spectrum for cellular networks, small cells are expected to share the same spectrum with macrocells even when they are deployed within the coverage area of a macrocell. The envisaged large-scale deployment of small cells is likely to be hampered by the potentially severe co-channel interference between small cells and the umbrella macrocell and between neighboring small cells in dense deployment.In view of this, the wireless industry is examining the efficient utilization of all possible spectrum resources including unlicensed spectrum bands to offer ubiquitous and seamless access to mobile users.

The unlicensed 2.4 GHz and 5 GHz bands that Wi-Fi systems operate in have been considered as important candidates to provide extra spectrum resources for cellular networks. The initially targeted 5 GHz unlicensed band has potentially up to 500 MHz of spectrum available.Nowadays, most mobile devices such as smartphones and tablets support Wi-Fi connectivity,while the proliferation of Wi-Fi access points continues. The Wi-Fi access point density in developed urban areas has reached over 1000 per square km. Widely deployed Wi-Fi systems are playing an increasingly more important role in offloading data traffic from the heavily loaded cellular network, especially in indoor traffic hotspots and in poor cellular coverage areas.Wi-Fi access points have even been regarded as a distinct tier of small cells in heterogeneous cellular networks. However, since Wi-Fi systems are wireless local area networks (WLANs) based on the IEEE 802.11 standards, they have usually been designed and deployed independently from the cellular networks. Now that the wireless industry is seeking to explore the unlicensed spectrum currently used by Wi-Fi systems for LTE/LTE-A and future cellular networks' usage as well, the coexistence and interworking of Wi-Fi and heterogeneous cellular networks become an area requiring extensive research and investments. The joint deployment of Wi-Fi and cellular networks in the unlicensed spectrum can increase the overall capacity of a heterogeneous network, provided that the mutual interference between Wi-Fi and cellular systems is properly managed so that both can harmoniously coexist.

II.LITERATURE REVIEW

Benefits promised by the coexistence of Wi-Fi and cellular networks in unlicensed spectrum have started to attract interest from the research community. In [1], the authors proposed a quality of service (QoS) based strategy to split the unlicensed spectrum between Wi-Fi and femtocell networks. Although the unlicensed spectrum splitting scheme considers fairness between Wi-Fi access points and femtocells, the split use of the spectrum between two systems prohibits a high cross-network throughput.

In [2], the authors investigated the deployment of a heterogeneous vehicular wireless network consisting of IEEE 802.11b/g and IEEE 802.11e inside a tunnel for surveillance applications, and specifically evaluated the handover performance of the hybrid Wi-Fi/WiMAX vehicular network in an emergency situation. In [3], time-domain resource partitioning based on the use of Authorized Access Approach (AAA) was proposed for LTE networks to share the unlicensed spectrum with Wi-Fi systems. Qualcomm has recently proposed to deploy LTE-A in the unlicensed 5 GHz band currently used mostly by Wi-Fi.Moreover, it has been shown that by estimating the number of co-channel transmitters and knowing the deployment density of network nodes in a region, the average channel quality at any point in a coverage area can be inferred introduced the basic building blocks of cross-system learning and provided preliminary performance evaluation in an LTE simulator overlaid with Wi-Fi hotspots.

For the unlicensed spectrum sharing deployment of Wi-Fi and LTE-A systems, the co-channel interference between Wi-Fi tier and LTE-A tier can be mitigated by using ABSs, in which the interfering tier is not allowed to transmit data, and the victim tier can thus get a chance to schedule transmissions in the ABSs with reduced cross-tier interference. To date there has been only very limited research on the coexistence of LTE and WiFi in unlicensed bands. There has been some work from a physical layer point of view that evaluates the interference among the two technologies, see for instance. In the performance is studied from an experimental point of view, therefore no optimal channel allocation is provided. An attempt to provide fair allocation in an LTE-U and WiFi scenario.

III. Heterogeneous Network Architecture

For providing radio access, the macrocell, small cells and Wi-Fi access points share the unlicensed spectrum. The network architecture in Fig. 1 integrates the coexistence of Wi-Fi and cellular networks and facilitates smart management of data traffic in mobile operators' networks .For instance, the data traffic could be dynamically routed to the optimal radio interface for a particular application and user, with network congestion, reliability, security, and taken into account. As can be seen from, the primary carrier always uses licensed spectrum to transmit control signaling, user data and mobility signalling, while the secondary carrier(s) use unlicensed spectrum to transmit best-effort user data in the downlink and potentially the uplink. the network architecture where several Wi-Fi access points and small cells coexist in the coverage area of a macrocell. The macrocell, small cells, and Wi-Fi access points share the same unlicensed spectrum for providing radio access to users, millimeter-wave radio is small-cell backhaul links, and device-to-device (D2D) communications are supported based on Wi-Fi Direct or LTE Direct. As shown in Fig. 1, the control plane (C-plane) and user plane(U-plane) are split on the radio links associated with small cells. Specifically, the C-plane of use requipments (UEs) associated with a small cell is provided by the macro evolved Node B (eNB) in a low frequency band, while the U-plane of UEs associated with a small cell is provided by their serving small cell in a high frequency band.

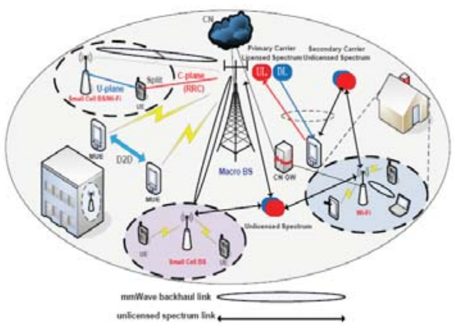

Fig:1

More spectrum is needed for cellular operators to meet the increasing traffic demand. Although licensed spectrum is always preferable for providing better user experience, unlicensed spectrum can be considered as an effective complement. A Wireless technology that is operating in unlicensed band in order to improve performance of another (or can be the same) wireless technology operating in licensed band LTE as LAA is preferred over WiFi Better traffic offloading, Higher user experience, Tighter interworking with licensed and unlicensed bands (Single RAT) and Better spectrum efficiency compared to WLAN

Dynamic frequency selection (DFS) and Transmit power control (TPC) to overcome interference to Radar transmission and other technologies basically proposed to avoid interfering with Radar. But can use with other technologies. Detection threshold is specified to detect signals from Radars that can be interfered by max EIRP of UE or eNB transmitter. If DL only secondary CC, then only eNB needs to implement DFS

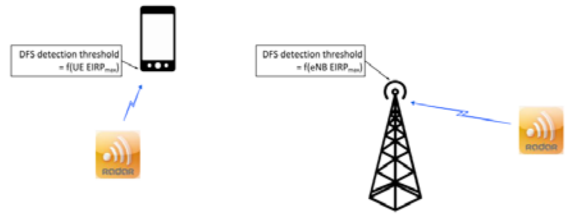

Fig:2

IV. Handover Procedure between Wi-Fi and LTE/LTE-A

Seamless mobility is one of the key aspects of interworking between Wi-Fi and LTE/LTE-A systems. During the handover process, there should be no package loss or radio link failure in order to ensure the user's QoS. In current Wi-Fi systems, interworking between Wi-Fi and LTE/LTE-A systems is not supported, although it is badly needed due to users' frequent mobility between the coverage areas of Wi-Fi access points and cellular networks. In 3GPP Rel-11, trusted WLAN access to the Enhanced Packet Core (EPC) is based on S2a-based Mobility over GPRS Tunnelling Protocol (SaMOG), which is enhanced in 3GPP Rel-12 to provide traffic steering and mobility between LTE-A and Wi-Fi networks and to optimize the use of network resources. The 3GPP standard TS 23.401 describes seamless and non-seamless handover solutions between3GPP and non-3GPP access networks.

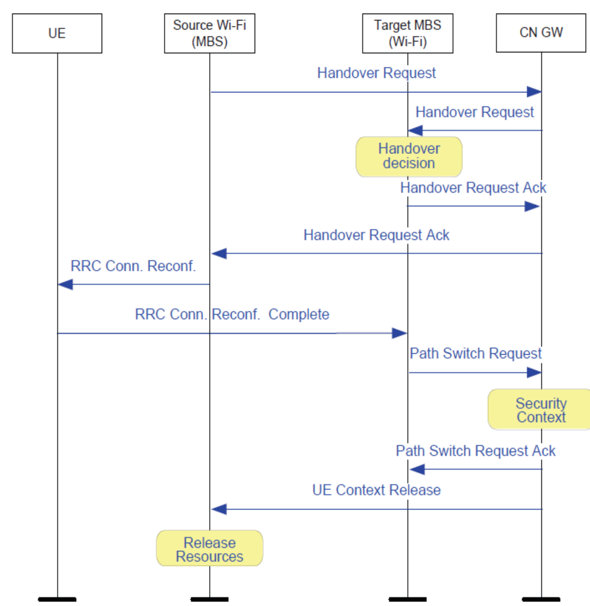

Fig:3

These standards enable users to continue using data services when they pass across macro cells, small cells and Wi-Fi hotspots. In the network architecture shown in Fig. 1, a UE can handover between Wi-Fi and cellular networks through the core network (CN) gateway (GW). In Fig. 2, the CN GW based handover procedure between a source Wi-Fi (macrocell) and a target macrocell (Wi-Fi) is given. Since the C-plane of Wi-Fi users is managed by the macrocell, the RRC signallings of Wi-Fi users are transmitted from the macrocell, and the handover signalling overhead between the Wi-Fi access point and the macrocell can be much reduced.

V. RANDOM FRAME ALLOCATION

In the licensed bands, there is a clear notion of the primary and secondary users, where by spectrum sensing techniques are employed by secondary users to avoid causing interference to primary users. This can be achieved by identifying primary transmissions using spectrum sensing
or geo-location database operations. However, there is a lack of research activities examining how secondary users associated with different RATs can avoid or mitigate co-channel interference to each other. In the unlicensed bands without the concepts of primary and secondary users, a similar challenge exists between different RATs sharing the same spectrum. In this article, we refer to the coexistence of two RATs without priority ranking as coexistence without priority. More specifically, we focus on allowing cellular communications to co-exist with Wi-Fi communications on an equal basis, i.e., no discrimination between primary and secondary users.

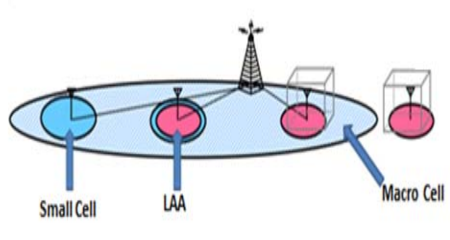

Fig:4

What is new here is the coexistence of two disparate RATs that were not designed to being coexistence, together with the impact of this on the interference map. Whilst the coexistence of contention based systems have been explored (e.g., IEEE 802.11 and IEEE 802.15 systems), the coexistence of a non-contention system (LTE) with a contention system (Wi-Fi) is not well explored, especially when no priority ranking between them is given. In fact, a reasonable suspicion is that the allocation based transmission protocols of LTE may completely block the collision based protocols of Wi-Fi.

Coupled with the growing density of small cells, this lack of interpretability on the same spectrum band can cause severe capacity issues In multiple RAT coexistence, communication protocols can operate in either their default normal mode or a coexistence mode. The latter is triggered when another RAT is sensed nearby and action is needed. Coexistence mechanisms can be divided into two groups: i) those that require message exchange between nodes or RATs, and ii) those that do not. In general, cross-RAT coordination is difficult due to the disparate protocol development processes and vendor differences. Therefore, in the following sub-section we will review a non-collaborative coexistence mechanism that allows LTE to co-exist with Wi-Fi in the unlicensed spectrum.

VI. ESTIMATION OF INTERFERENCE AVOIDANCE FUNCTION.

Interference estimation technique that does not require information sharing between BSs or UEs was devised based on each BS sensing the spectrum and estimating the number of co-channel transmissions in a defined observation zone. By estimating the number of co channel transmitters and knowing the cell density in the region, the average channel quality at any random point in a coverage area can be inferred. As the expressions are tractable, the computational complexity is extremely low. The methodology can be applied to a K-tier heterogeneous network by leveraging a stochastic geometry framework and an opportunistic interference reduction scheme, which was shown to approach the interference estimation accuracy achievable by information exchange on the X2 interface. The inference framework assumes that each cell is equipped with a spectrum sensing device. On each frequency band f, the sensor at each cell (located at distance h from the BS) is able to detect the power density Pf from all co-channel transmitters in an unbounded region.

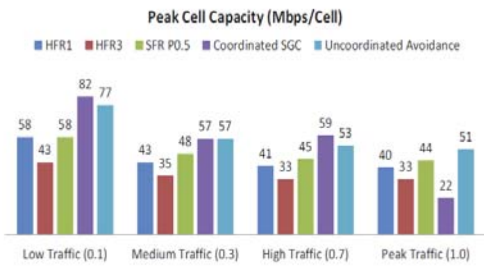

Fig:5

Simulation results of peak cell capacity versus normalized cell traffic load for a variety of static and dynamic interference mitigation schemes. The baseline is a hard frequency reuse 1 (HFR1) scheme, which shows a peak capacity of 58 Mbps/cell when the cells are unloaded (i.e., minimum inter-cell interference). This value falls steadily to 40 Mbps/cell for fully loaded cells without interference mitigation (i.e., maximum inter-cell interference).

A similar trend exists for HFR3. The soft frequency reuse with a power backoff factor 0.5 (SFR P0.5) performs better than the previous two schemes. We can see from that the TDD-based sequential game coordinated (SGC) interference avoidance scheme achieves a much higher peak cell capacity than the HFR and SFR schemes at low and medium cell traffic loads. The uncoordinated interference avoidance scheme proposed in provides the highest peak cell capacity at high traffic loads and achieves over 90% the peak cell capacity of the SGC interference avoidance scheme that requires channel state information

CONCLUSION

The ABS mechanism and an interference avoidance scheme have been presented to mitigate the interference between Wi-Fi and LTE/LTE-A systems when both transmitting in the same unlicensed spectrum. Simulation results have shown that with the proper use of ABS mechanism and interference avoidance schemes, heterogeneous and small cell networks can improve their capacity by using the unlicensed spectrum used by Wi-Fi systems without affecting the performance of Wi-Fi

REFERENCES

[1] S. Hajmohammad and H. Elbiaze, “Unlicensed spectrum splitting between Femtocell and WiFi,” in IEEE International Conference on Communications

[2] M. Charitos and G. Kalivas, “Heterogeneous hybrid vehicular WiMAX-Wi-Fi network for in-tunnel surveillance implementations,” in IEEE International Conference on Communications (ICC), pp. 6386–6390, June 2013.

[3] E. Almeida, A. Cavalante, R. Paiva, F. Chaves, F. Abinader, R. Vieira, S. Choudhury, E. Tuomaala and K. Doppler, “EnablingLTE/Wi-Fi coexistence by LTE blank subframe location,” in IEEE International Conference on Communications (ICC),pp. 5083–5088, June 2013.

[4].S. Wang, W. Guo and M. McDonnell, “Downlink interference estimation without feedback for heterogeneous avoidance,” in IEEE International Conference on Telecommunications (ICT), pp. 1–6, 2014.

[5].Y.-S. Liang, W.-H. Chung, G.-K. Ni, Y. Chen, H. Zhang, and S.-Y. Kuo, “Resource allocation with interference avoidance in OFDMA femtocell networks,” IEEE Trans. Veh. Technol., vol. 61, no. 5, pp. 2243–2255, 2012.

[6] M. Bennis, M. Simsek, A. Czylwik, W. Saad, S. Valentin and M. Debbah, “When cellular meets WiFi in wireless smallcell networks,” IEEE Commun. Mag., vol. 51, no. 6, pp. 44–50, 2013.

[7] R. C. Paiva, P. Papadimitriou, and S. Choudhury, “A physical layer framework for interference analysis of LTE and Wi-Fi operating in the same band,” in Asilomar Conference on Signals, Systems and Computers,2013, pp. 1204–1209.

[8] F. Liu, E. Bala, E. Erkip, and R. Yang, “A framework for femtocells to access both licensed and unlicensed bands,” in International Symposium on Modeling and Optimization in Mobile, Ad Hoc and Wireless Networks (WiOpt), 2011, pp. 407–411

[9] Z. Ning, M. Saisai, X. Jing, Z. Bin, and Z. Wei, “Unlicensed Spectrum Usage Method for Cellular Communication Systems,” in International Conference on Wireless Communications, Networking and Mobile Computing (WiCOM), 2012, pp. 1–6.

[10] S. Hajmohammad, H. Elbiaze, and W. Ajib, “Fine-tuning the Femto cell performance in unlicensed bands: Case of WiFi Co-existence,” in Inter-national Wireless Communications and Mobile Computing Conference (IWCMC), 2014, pp. 250–255