Cognitive Radio Iut

HEAVEN GIOVANNA

The Engineering Foundations of Radio XML River Publishers
"Nowadays, radio spectrum is mostly crowded and occupied by many fixed wireless services. Therefore, there is less opportunity of finding a vacant band (spatially or temporally) for deploying new wireless communication services or enhancing already existing ones. The Telecommunications Regulatory Authority (TRA) allocation chart in UAE shows some overlapping allocation for services given the same band which reinforces the spectrum scarcity concept. Insufficient frequency spectrum allocation and the problem of spectrum scarcity are standing against the will of introducing more services to the wireless communication community. As a result, many measurement campaigns around the world have been conducted in order to investigate more about the spectrum utilization and characterization. Dynamic Spectrum Access (DSA) technologies have been introduced and promised to use the idle spectrum bands and utilize them efficiently. One form of DSA technologies is Cognitive Radio (CR) which is based on allowing an unlicensed (secondary) user to access an unoccupied portion of licensed spectrum and use it without causing interference with the licensed (primary) user in an opportunistic way. This thesis is mainly divided into two parts; in the first part, the occupancy of the frequency spectrum is studied through multiple measurement campaigns. These campaigns lasted for twenty days and conducted at the American University of Sharjah. These measurements were done over the ultra-high frequency (UHF) due its potential to be utilized by cognitive radio systems. The measurements indicated that large portions of the UHF band are not utilized efficiently. A Gaussian mixture model (GMM) analysis was carried out to obtain quantitative observations about the UHF occupancy levels. The second part of this thesis is about implementing a cognitive radio system based on real data collected using a prepared experimental setup consists of Universal Software Radio Peripheral (USRP) devices. An energy detector and polynomial classifier were implemented for spectrum sensing. A comparison between the two approaches shows that polynomial classifier has better performance over the energy detector in terms of the misclassification rate."--Abstract.
Reconfigurable Radio Systems Springer
Provides an in-depth coverage of TV White Space Technology (TVWS) and the various challenges of its new innovations This book covers the full spectrum of TVWS technology including regulations, technology, standardizations, and worldwide deployments. It begins with an introduction to cognitive radio and TVWS. The regulation activities in TVWS throughout North America, Europe, and Asia Pacific are covered in depth. After a discussion of regulations, the authors examine the standardizations developed to specify the enabling technologies of TVWS systems. The following chapter focuses on the key technologies that differentiate TVWS from a conventional wireless communication system. Describes various worldwide use cases and deployments based on the needs of the consumers Covers IEEE 802.19.1, IEEE 802.22, IEEE 802.11af, IEEE 802.15.4m, and IETF protocol for Accessing White Spaces Studies the market and commercial potential of TVWS and other spectrum sharing technologies Discusses technological trends in spectrum sharing and additional applications that could leverage on TVWS and other spectrum sharing technologies TV White Space: The First Step Towards Better Utilization of Frequency Spectrum is written for telecommunications/networks operators, researchers, engineers, government regulators, technical managers, and network equipment manufacturers. Ser Wah Oh is the Head of the White Space Communications Department at the Institute for Infocomm Research (I2R), Singapore. He is also the co-founder and co-chair of the Singapore White Spaces Pilot Group, co-chair of Singapore TVWS Task Force, and member of Singapore Telecom Standards Advisory Committee. He previously led a team to contribute to the Federal Communications Commission (FCC) TVWS field

trial in 2008 that helped to shape the TVWS landscape today.
Collaborative Spectrum Sensing in a Cognitive Radio System with Non-Gaussian Noise CRC Press
This book gives a comprehensive overview of the medium access control (MAC) principles in cognitive radio networks, with a specific focus on how such MAC principles enable different wireless systems to coexist in the same spectrum band and carry out spectrum sharing. From algorithm design to the latest developments in the standards and spectrum policy, readers will benefit from leading-edge knowledge of how cognitive radio systems coexist and share spectrum resources. Coverage includes cognitive radio rendezvous, spectrum sharing, channel allocation, coexistence in TV white space, and coexistence of heterogeneous wireless systems.
Challenges and Solutions Springer
Examine the challenges of 4G in the light of impending and crucial future communication needs, and review the lessons learned from an implementation and system operation perspective with an eye towards the next generation – 5G. You'll investigate key changes and additions to 5G in terms of use cases. You'll also learn about the applications for and explorations of the technology. Among all of the technological disruptions, two stand out in particular – mmWave and spectrum sharing technologies. Rolling Out 5G features detailed coverage of these two critical topics, and for the first time among 5G learning resources presents a holistic perspective on key ingredients for mobile communication in a 5G world. The authors represent highly experienced experts with valuable know-how in the field of wireless communications related research projects defining future technological trends. This unique group of talents will be able to consider the 5G technology evolution from all angles mentioned: long-term research, standardization and regulation, product design and marketization. This approach allows this much-needed book to capture the views of all key decision making stake-holders involved in the 5G definition process, and to serve readers in their roles connected with wireless communication's next generation of products and services. What You'll Learn See how 5G is expected to overcome 4G insufficiencies and challenges Examine expected 5G features, including usage of millimeter wave communication and licensed shared access Review key milestones of the next generation wireless communication technology including key standardization and regulation bodies Study new technologies and upcoming changes in feature sets and client expectations. Who This Book Is For Engineers of mobile device and infrastructure manufacturing industries, development engineers of semiconductor manufacturing industries, and engineers with a general interest in the field. Mobile network operators, along with students and business professionals in the telecommunications domain will also find the topic of interest.
From Software Radio to Cognitive Radio Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems
Software radio ideally provides the opportunity to communicate withany radio communication standard by modifying only the software,without any modification to hardware components. However, takinginto account the static behavior of current communicationsprotocols, the spectrum efficiency optimization, and flexibility,the radio domain has become an important factor. From this thinking appeared the cognitive radio paradigm. Thisevolution is today inescapable in the modern radio communicationworld. It provides an autonomous behavior to the equipment andtherefore the adaptation of communication parameters to bettermatch their needs. This collective work provides engineers, researchers and radiodesigners with the necessary information from mathematical analysisand hardware architectures to design methodology and tools, runningplatforms and standardization in order to understand this newcognitive radio domain.
Medium Access Control for Coexistence of Wireless Systems Springer
This book constitutes the thoroughly refereed proceedings of the 5th International Conference on e-Infrastructure and e-Services for Developing Countries, AFRICOMM 2013, held in Blantyre, Malawi, in November 2013. The 32 revised full papers presented were carefully reviewed and selected from 94 submissions. The papers discuss issues and trends, resent research, innovation advances and on-the-field experiences related to e-governance, e-infrastructure, and e-business with a focus on developing countries.
Third International Conference, MobiHealth 2012, Paris, France, November 21-23, 2012, Revised Selected Papers IGI Global
Today’s wireless services have come a long way since the roll out of the conventional voice-centric cellular systems. The demand for wireless access in voice and high rate data multi-media applications has been increasing. New generation wireless communication systems are aimed at accommodating this demand through better resource management and improved transmission technologies. The interest in increasing Spectrum Access and improving Spectrum Efficiency combined with both the introduction of Software Defined Radios and the realization that machine learning can be applied to radios has created new intriguing possibilities for wireless radio researchers. This book is aimed to discuss the cognitive radio, software defined radio (SDR), and adaptive radio concepts from several aspects. Cognitive radio and cognitive networks will be investigated from a broad aspect of wireless communication system enhancement while giving special emphasis on better spectrum utilization. Applications of cognitive radio, SDR and cognitive radio architectures, spectrum efficiency and soft spectrum usage, adaptive wireless system design, measurements and awareness of various parameters including interference temperature and geo-location information are some of the important topics that will be covered in this book. Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems is intended to be both an introductory technology survey/tutorial for beginners and an advanced mathematical overview intended for technical professionals in the communications industry, technical managers, and researchers in both academia and industry.
Building Trust Into Light-handed Regulations for Cognitive Radio John Wiley & Sons
Cognitive Radio Networks (CRNs) provide a solution for the spectrum scarcity problem facing the wireless communications community. However, due to the infancy of CRNs, further research is needed before we can truly benefit from CRNs. The basic concept of CRNs relies on utilizing the unused spectrum of a primary network, without interfering with the activity of primary users (PUs). In order to successfully achieve that, users in a CRN has to perform spectrum sensing, spectrum management, spectrum mobility, and spectrum sharing. The latter, which is the focus of our research, deals with how secondary users (SUs) share the unused spectrum. Furthermore, to be able to utilize CRNs in practical applications, a certain level of quality-of-service (QoS) should be guaranteed to SUs in such networks. QoS requirements vary according to the application. Interested in voice communications, we propose a packet scheduling scheme that orders the SUs' transmissions according to the packet dropping rate and the number of packets queued waiting for transmission. Two medium access control (MAC) layer protocols, based on the mentioned scheduling scheme, are proposed for a centralized CRN. In addition, the scheduling scheme is adapted for a distributed CRN, by introducing a feature that allows SUs to organize access to the available spectrum without the need for a central unit. Finally, extensive simulation based experiments are carried out to evaluate the proposed protocols and compare their performance with that of other MAC protocols designed for CRNs. These results reflect the effectiveness of our proposed protocols to guarantee the required QoS for voice packet transmission, while maintaining fairness among SUs in a CRN.
AICC 2018 John Wiley & Sons
This SpringerBrief discusses the applications of spare representation in wireless communications, with a particular focus on the most recent developed compressive sensing (CS) enabled approaches. With the help of sparsity property, sub-Nyquist sampling can be achieved in wideband cognitive radio networks by adopting compressive sensing, which is illustrated in this brief, and it starts with a comprehensive overview of compressive sensing principles. Subsequently, the authors present a complete framework for data-driven compressive spectrum sensing in cognitive radio networks, which guarantees robustness, low-complexity, and security. Particularly, robust compressive spectrum sensing, low-complexity compressive spectrum sensing, and secure compressive sensing based malicious user detection are proposed to address the various issues in wideband cognitive radio networks. Correspondingly, the real-world signals and data collected by experiments carried out during TV white space pilot trial enables data-driven compressive spectrum sensing. The collected data are analysed and used to verify our designs and provide significant insights on the potential of applying compressive sensing to wideband spectrum sensing. This SpringerBrief provides readers a clear picture on how to exploit the compressive sensing to process wireless signals in wideband cognitive radio networks. Students, professors, researchers, scientists, practitioners, and engineers working in the fields of compressive sensing in wireless communications will find this SpringerBrief very useful as a short reference or study guide book. Industry managers, and government research agency employees also working in the fields of compressive sensing in wireless communications will find this SpringerBrief useful as well.
Maximizing Available Spectrum for Cognitive Radios John Wiley & Sons
Cognitive radio is 5-G technology, comes under IEEE 802.22 WRAN (Wireless Regional Area Network) standards. It is currently experiencing rapid growth due to its potential to solve many of the problems affecting present-day wireless systems. The foremost objective of "Introduction to Cognitive Radio Networks and Applications" is to educate wireless communication generalists about cognitive radio communication networks. Written by international leading experts in the field, this book caters to the needs of researchers in the field who require a basis in the principles and the challenges of cognitive radio networks.
Cognitive Radio Technology Apress
In a cognitive radio network (CRN), bands of a spectrum are shared by licensed (primary) and unlicensed (secondary) users in that preferential order. It is generally recognized that the spectral occupancy by primary users exhibit dynamical spatial and temporal properties. In the open literature, there exist no accurate time-varying model representing the spectrum occupancy that the wireless researchers could employ for evaluating new algorithms and techniques designed for dynamic spectrum access (DSA). We use statistical characteristics from actual radio frequency measurements, obtain first- and second-order parameters, and define a statistical spectrum occupancy model based on a combination of several different probability density functions (PDFs). One of the fundamental issues in analyzing spectrum occupancy is to characterize it in terms of probabilities and study probabilistic distributions over the spectrum. To reduce computational complexity of the exact distribution of total number of free bands, we resort to efficient approximation techniques. Furthermore, we characterize free bands into five different types based on the occupancy of its adjacent bands. The probability distribution of total number of each type of bands is therefore determined. Two corresponding algorithms are effectively developed to compute the distributions, and our extensive simulation results show the effectiveness of the proposed analytical model. Design of an efficient spectrum sensing scheme is a challenging task, especially when false alarms and misdetections are present. The status of the band is to be monitored over a number of consecutive time periods, with each time period being of a specific time interval. The status of the sub-band at any time point is either free or busy. We proved that the status of the band over time evolves randomly, following a Markov chain. The cognitive radio assesses the band, whether or not it is free, and the assessment is prone to errors. The errors are modeled probabilistically and the entire edifice is brought under a hidden Markov chain model in predicting the true status of the band. After spectrum sensing, our research direction is on spectrum sharing using cooperative communication. We discuss allocation strategies of unused bands among the cognitive users. We introduce a cooperative N-person Game among the N cognitive users in a CRN and then identify strategies that help achieve Nash equilibrium. When licensed users arrive in any of those sub-bands involved in unlicensed user communication, the affected cognitive users in those bands remove them out of the N-person game and assess their optional strategies with the licensed users using the 2-person game approach for coexistence with the licensed users. In the sequel of spectrum sharing, we present three novel priority-based spectrum allocation techniques for enabling dynamic spectrum access (DSA) networks employing non-contiguous orthogonal frequency division multiplexing (NC-OFDM) transmission. The allocation of bandwidth to unlicensed users, without significantly increasing the interference on the existing licensed users, is a challenge for Ultra Wideband (UWB) networks. We propose a novel Rake Optimization and Power Aware Scheduling (ROPAS) architecture for UWB networks as multipath diversity in UWB communication encourages us to use a Rake receiver.
Radio Resource Allocation and Dynamic Spectrum Access Springer
We are currently witnessing an increase in telecommunicationsnorms and standards given the recent advances in this field. Theincreasing number of normalized standards paves the way for anincrease in the range of services available for each consumer.Moreover, the majority of available radio frequencies have alreadybeen allocated. This explains the emergence of cognitive radio (CR)– the sharing of the spectrum between a primary user and asecondary user. In this book, we will present the state of the artof the different techniques for spectrum access using cooperationand competition to solve the problem of spectrum allocation andensure better management of radio resources in a radio cognitivecontext. The different aspects of research explored up until now onthe applications of multi-agent systems (MAS) in the field ofcognitive radio are analyzed in this book. The first chapter beginswith an insight into wireless networks and mobiles, with specialfocus on the IEEE 802.22 norm, which is a norm dedicated to CR.Chapter 2 goes into detail about CR, which is a technical field atthe boundary between telecommunications and Artificial Intelligence(AI). In Chapter 3, the concept of the “agent” from Alis expanded to MAS and associated applications. Finally, Chapter 4establishes an overview of the use of AI techniques, in particularMAS, for its allocation of radio resources and dynamic access tothe spectrum in CR. Contents 1. Wireless and Mobile Networks. 2. Cognitive Radio. 3. Multi-agent Systems. 4. Dynamic

Spectrum Access. About the Authors Badr Benmammar has been Associate Professor at UABT (UniversityAbou Bekr Belkaïd Tlemcen), Algeria since 2010 and was aresearch fellow at CNRS LaBRI Laboratory of the University ofBordeaux 1 until 2007. He is currently carrying out research at theLaboratory of Telecommunications of Tlemcen (LTT), UABT, Algeria.His main research activities concern the cognitive radio network,Quality of Service on mobile and wireless networks, end-to-endsignaling protocols and agent technology. His work on Quality ofService has led to many publications in journals and conferenceproceedings. Asma Amraoui is currently a PhD candidate; she is preparing adoctoral thesis on a topic of research that explores the use ofartificial intelligence techniques in cognitive radio networks. Sheis attached to the Laboratory of Telecommunications of Tlemcen(LTT) in Algeria.

Developing the African Continent Through Space, Part 3 John Wiley & Sons

The aim of this book is to provide some useful methods to improve the spectrum sensing performance in a systematic way, and point out an effective method for the application of cognitive radio technology in wireless communications. The book gives a a state-of-the-art survey and proposes some new cooperative spectrum sensing (CSS) methods attempting to achieve better performance. For each CSS, the main idea and corresponding algorithm design are elaborated in detail. This book covers the fundamental concepts and the core technologies of CSS, especially its latest developments. Each chapter is presented in a self-sufficient and independent way so that the reader can select the chapters interesting to them. The methodologies are described in detail so that the readers can repeat the corresponding experiments easily. It will be a useful book for researchers helping them to understand the classifications of CSS, inspiring new ideas about the novel CSS technology for CR, and learning new ideas from the current status of CSS. For engineers, it will be a good guidebook to develop practical applications for CSS.

Queueing Based Resource Allocation in Cognitive Radio Networks Springer Nature

Cognitive radio has recently been proposed as a promising approach for efficient utilization of radio spectrum. However, there are several challenges to be addressed across all layers of a cognitive radio system design, from application to hardware implementation. From the physical layer point-of-view, two key challenges are spectrum sensing and an appropriate signaling scheme for data transmission. The modulation techniques used in cognitive radio not only should be efficient and flexible but also must not cause (harmful) interference to the primary (licensed) users. Among all the proposed signaling schemes for cognitive radio, orthogonal frequency division multiplexing (OFDM) has emerged as a promising one due to its robustness against multipath fading, high spectral efficiency, and capacity for dynamic spectrum use. However, OFDM suffers from high out-of-band radiation which is due to high sidelobes of subcarriers. In this thesis, we consider spectral shaping in OFDM-based cognitive radio systems with focus on reducing interference to primary users created by by out-of-band radiation of secondary users' OFDM signal. In the first part of this research, we first study the trade-o between time-based and frequency-based methods proposed for sidelobe suppression in OFDM. To this end, two recently proposed techniques, active interference cancellation (AIC) and adaptive symbol transition (AST), are considered and a new joint time-frequency scheme is developed for both single-antenna and multi-antenna systems. Furthermore, knowledge of wireless channel is used in the setting of the proposed joint scheme to better minimize interference to the primary user. This scheme enables us to evaluate the trade-o between the degrees of freedom provided by each of the two aforementioned methods. In the second part of this research, a novel low-complexity technique for reducing out-of-band radiation power of OFDM subcarriers for both single-antenna and multi-antenna systems is proposed. In the new technique, referred to as a phase adjustment technique, each OFDM symbol is rotated in the complex plane by an optimal phase such that the interference to primary users is minimized. It is shown that the phase adjustment technique neither reduces the system throughput, nor does increase the bit-error-rate of the system. Moreover, the performance of the technique in interference reduction is evaluated analytically in some special cases and is verified using numerical simulations. Due to high sensitivity of OFDM systems to time and frequency synchronization errors, performance of spectral shaping techniques in OFDM is significantly affected by timing jitter in practical systems. In the last part of this research, we investigate the impact of timing jitter on sidelobe suppression techniques. Considering AIC as the base method of sidelobe suppression, we first propose a mathematical model for OFDM spectrum in presence of timing jitter and evaluate the performance degradation to AIC due to timing jitter. Then, a precautionary scheme based on a minimax approach is proposed to make the technique robust against random timing jitter.

Introduction to Cognitive Radio Networks and Applications Springer

Opportunistic spectrum utilization without causing interference to the PUs is only possible if the SUs periodically sense the spectrum for the presence of PUs' signal. To minimize the effects of hardware capabilities, terrain features and PUs' transmission ranges, DSA is undertaken in a collaborative manner where SUs periodically carry out spectrum sensing in their respective geographical locations. Collaborative spectrum sensing has numerous security loopholes and can be favorable to malicious nodes in the network that may exploit vulnerabilities associated with DSA such as launching a spectrum sensing data falsification (SSDF) attack. Some CRN standards such as the IEEE 802.22 wireless regional area network employ a two-stage quiet period mechanism based on a mandatory Fast Sensing and an optional Fine Sensing stage for DSA. This arrangement is meant to strike a balance between the conflicting goals of proper protection of incumbent PUs' signals and optimum QoS for SUs so that only as much time is spent for spectrum sensing as needed. Malicious nodes in the CRN however, can take advantage of the two-stage spectrum sensing mechanism to launch smart denial of service (DoS) jamming attacks on CRNs during the fast sensing stage.

Applications, Architectures, and Challenges Springer Science & Business Media

"This book examines how wireless sensor nodes with cognitive radio capabilities can address these network challenges and improve the spectrum utilization, presenting a broader picture on the applications, architecture, challenges, and open research directions in the area of WSN research"--Provided by publisher.

Spectrum Occupancy Measurements and Cognitive Radio System Implementation John Wiley & Sons

This thesis introduces an incentive-based trust model to let wireless spectrum regulation embrace diverse current and future means of implementing cognitive radio. Cognitive radio has emerged as a way to combat inefficient spectrum use by allowing independently designed networks to share the same frequency band. This philosophy has been embraced by the FCC, which has already allowed cognitive use in the TV bands, and plans to make spectrum sharing the norm in other bands as well. To enact spectrum sharing, regulatory decisions, like band assignment, are made at runtime so that they can reflect local context. From a regulatory perspective, the most important question is how to trust that these decisions will be made and carried out correctly. Right now, the FCC guarantees correct decisions by directly testing that any deployed technologies are incapable of making bad decisions. This process of testing is called certification. But certification has limitations. For example, a network of nodes could sense for a TV signal and decide as a group that the TV tower is far enough away that their interference to TV receivers would be negligible. However, this network will never pass a certification test. There is no way to prove that the network will stay silent if all the nodes are blocked by the same building so they cannot sense the tower but can cause interference. This thesis provides a new model for trust that would allow networked sensing and any other novel spectrum sharing solution through light-handed regulations. The idea is to build a system that allows regulators to trust secondaries to follow sharing rules regardless of whether they are technically capable of finding spectrum holes. This is accomplished by an incentive mechanism, a spectrum jail, that will punish secondaries caught causing interference by degrading their quality of service. This thesis shows that for such a mechanism to work, cognitive radio must be thought of as a band-expander. If the same mechanism must apply to all radios, regardless of technology, there must be pretty good unlicensed or licensed bands that secondaries can use if they cannot share spectrum appropriately. The mechanism explored here is inspired by the ideas in the law and economics literature as well as the spectrum policy literature. This thesis takes these mostly rhetorical arguments and develops the first mathematical model for incentive-based trust in spectrum regulation. This model allows identification of the most difficult to enforce cases: the regulator must decide whether a primary will be protected even if it hardly ever uses its band. The regulator must also decide what constitutes harmful interference. Some interference is unavoidable when bands are shared; the regulator must decide how much interference the primary must accept in a shared environment. When these decisions are made, this thesis shows that trust can be guaranteed with a sanction set at certification time and which is applied to all cognitive devices regardless of technology. The model also gives quantitative performance metrics, measuring the ability for secondaries to reclaim spectrum holes, which illustrate the dependence on the regulator's ability to catch wrongdoers. In particular, this thesis shows that while trust depends on the ability to catch those causing interference, runtime performance depends on the wrongful conviction rate. So, even applying the same sanction, as spectrum sharing technology and catching technology improves, performance will improve as well. This model is extended to understand what role the primary can or must play in its own protection as new primary devices are developed to operate in a shared band. By controlling the cost of reporting, the regulator can trust a primary to report interference correctly. This also means that if a secondary is difficult to coexist with, the primary will not use the jail system to try to get rid of the secondary. It will instead hire a ``band-sitter, '' which is a preferred secondary system that coexists more easily with the primary. This thesis also addresses multiple secondaries and aggregate interference by giving a basic framework of results to guide research in this direction. The distribution of aggregate interference from randomly placed nodes is explored to understand placement risk: the threat of too much interference caused by clusters of secondaries too close to the primary. Then, the thesis develops strategies to use the secondary location information that TV whitespace databases already have to address the problem of placement risk. Finally, a basic queuing model is suggested as a future direction to extend spectrum jails to deal with multiple secondaries. Finally, this thesis answers the question of why jails? The original motivation is two-fold. First, jails lend themselves to simple modeling because the utility and the sanction are both measured in quality of service terms. Second, jails can actually be reasonably implemented. The FCC has allowed TV whitespace devices using databases to coordinate spectrum access. In order to actually secure this operation, databases will need to be able to identify malfunctioning devices and turn them off. These same identity and kill-switch technologies will also enable spectrum jails. Jails can even be implemented through the databases themselves as a denial of operating tokens. At a more philosophical level, in-kind and monetary sanctions are fundamentally different things. Which one is actually better suited to the spectrum sharing enforcement problem? The last chapter will apply the same performance-based understanding from the the rest of the thesis to understand when fines or in-kind punishments should be preferred. It shows that in cases of high uncertainty, or when primary protection is the most important consideration, in-kind sanctions are the right approach.

MMSE-Based Algorithm for Joint Signal Detection, Channel and Noise Variance Estimation for OFDM Systems Springer

[ANGLÈS] Recent studies have demonstrated a clearly visible fact in our environment: The boom of wireless networks traffic has made raise the need of more bandwidth, due to an increment of the usage of wireless resources; every time with more and more different devices. Otherwise, other studies show an inefficient occupation of radio electric spectrum inside commercial bands; that is, not all assigned channels are currently in use by their operators. UHF TV band is an example of this situation, compounded after analogue TV switching off. Putting two previous scopes together have induced a new evolution of wireless networks: Deploying a certain kind of devices able to operate at empty channels of commercial bands. This thesis shows a way for these wireless devices to find out empty channels of a certain band and geographical location. The way has been tried out at ETSETB TelecomBCN UPC Campus Nord facilities with successful expected results.

Opportunities and Challenges Cambridge University Press

This peer-reviewed book provides detailed insights into how space and its applications are, and can be used to support the development of the full range and diversity of African societies, as encapsulated in the African Union’s Agenda 2063. Following on from Part 1 and 2, which were highly acclaimed by the space community, it focuses on the role of space in supporting the UN Sustainable Development Goals in Africa, but covers an even more extensive array of relevant and timely topics addressing all facets of African development. It demonstrates that, while there have been significant achievements in recent years in terms of economic and social development, which have lifted many of Africa’s people out of poverty, there is still a great deal that needs to be done to fulfill the basic needs of Africa's citizens and afford them the dignity they deserve. To this end, space is already being employed in diverse fields of human endeavor to serve Africa’s goals for its future, but there is much room for further incorporation of space systems and data. Providing a comprehensive overview of the role space is playing in helping Africa achieve its developmental aspirations, the book will appeal to both students and professionals in fields such as space studies, international relations, governance, and social and rural development.

Value Network Orchestration of a Cognitive Radio Platform Springer

Cognitive Radio (CR) paradigm represents an innovative solution to mitigate the spectrum scarcity problem by enabling Dynamic Spectrum Access (DSA), defined in order to conciliate the existing conflicts between the ever-increasing spectrum demand growth and the currently inefficient

spectrum utilization. The basic idea of DSA is to provide proper solutions that allow sharing radio spectrum among several radio communication systems with sake of optimizing the overall spectrum utilization. This dissertation addressed the problem of modelling cognitive management frameworks that provide innovative strategies for spectrum management suitable to different scenarios and use cases in the context of DSA/CR Networks (CRNs). The first solution presented in this dissertation initially addressed the development of a framework that provides spectrum management strategies for Opportunistic Networks (ONs) defined as extended infrastructures created temporarily to serve specific regions following the policies dictated by the operator. The development of systems based on the CR paradigm to support the ONs is considered a key aspect to allow autonomous decisions and reconfiguration ability mechanisms because of the temporarily nature of these networks and the highly dynamic nature of the radio environment. Then, in order to expand the design of cognitive management frameworks providing spectrum management solutions that have applicability in a number of different scenarios and use cases, a cognitive management framework that exploits the Partially Observable Markov Decision Process (POMDP) concept has been proposed to combine the CR capabilities of radio environment awareness with a statistical characterization of the system dynamic. Finally, the framework based on POMDPs has been further extended with new functionalities able to characterize the environment dynamic through long-term predictions carried out exploiting the so-called belief vector. These frameworks as a whole aimed at demonstrating that a reliable characterization of the radio environment that combines awareness of its surrounding with a statistical evaluation of the system dynamics is able to guarantee an effcient utilization of the available spectrum resources. From a methodological point of view, the development and assessment of the proposed cognitive management frameworks and the corresponding spectrum management solutions involved analytical studies, system-level simulations and a real-time platform implementation. Overall, the research conducted in the context of this dissertation has revealed that proper cognitive management functionalities can be extremely beneficial to support spectrum management in a wide variety of scenarios and use cases.